UOP RUSSELL LLC
Tulsa, Oklahoma

JOB NO:	J-447	TAG NO:	T-501	DATE:	7/14/11
CLIENT:	UOP Russell	S.O./P.O. NO:		BY:	JRG
SUBJECT:	60 MMscfd Cryo Plant	SERVICE:	Demethanizer		

PRESSURE VESSELS

MECHANICAL DESIGN

Type (vertical, horizontal, tower)	Tower
Diameter: (inch)	60" / 42"
S/S Length (ft-inch)	98' - 0"
Skirt Length(ft-inch)	16' - 0"
Design Pressure (psig)	400
Design Temperature (°F)	200
MDMT (°F) @ Pressure (psig)	-200 @ 400
Corrosion Allowance (inch)	0
Radiography	RT-1
PWHT Req'd?	No
Wind / Seismic Code	ASCE 7-10 / ASCE 7-10
Wind Code	Cf=0.7, V=120 mph, Exp. C, Cat.III
Seismic Code	Site D, I=1.25, S_S=100% , S_1=40%
Insulation	Varies from 3.5" C (top) to 1.5" C (btm)
Fireproof	No
Code	ASME VIII, Div I
Code Stamp Req'd	Yes
Sandblast / Paint	SSPC-SP6 / TRCo Std ENG-36c (Note 4)
Ladder / Platform Clips Req'd?	No
Pipe Supports Req'd?	Yes

PROCESS DESIGN

Operating Pressure (psia)	
Operating Temperature (°F)	
Vapor Flow (Lb/Hr)	
Vapor Density (Lb/cf)	
Liquid Flow (Lb/Hr)	
Liquid Density (Lb/cf)	
Liquid Residence Time (Min)	> 5

MIST PAD

Req'd :	Yes	Diameter:	60"
Overall Thk:	8	Pad Thk:	6"
Removable:	No	Grid Matl:	304SS
Wire Diameter:	0.011	Mesh Matl:	316SS

MATERIAL SPECIFICATIONS

Shell	SA-	240-304
Head	SA-	240-304
Nozzle Necks	SA-	312 TP-304 WLD
Flanges	SA-	182 F-304
Couplings	SA-	182 F-304
Studs	SA-	193-B8
Nuts	SA-	194 Gr. 8
Skirt / Baseplate	SA-	240-304 / 516-70

NOZZLES

SERVICE	MK	QTY	SIZE	RATING	FACE & TYPE	NOZZLE APPURTENANCES
Reflux Inlet	A	1	4."	300	RF FLG	V-Baffle (Note 2)
Vapor Outlet	B	1	10."	300	RF FLG	
Top Feed	C	1	12."	300	RF FLG	V-Baffle (Note 2)
Bottom Feed	D	1	4."	300	RF FLG	V-Baffle (Note 2)
To E-205	E	1	8."	300	RF FLG	2 Ft Min. between E&F for Hydraulics
From E-205	F	1	8."	300	RF FLG	V-Baffle (Note 2)
To E-204 / E-207	G	1	8."	300	RF FLG	5 Ft Min. between G&H for Hydraulics
From E-204 / E-207	H	1	8."	300	RF FLG	V-Baffle (Note 2)
PSV	J	1	6."	300	RF FLG	Flush w/ 0.125" Radius Inside
Handholes	K	8	12."	300	RF FLG	
Bottoms Out	L	1	6."	300	RF FLG	Vortex Breaker
Equalization	M	1	6."	300	RF FLG	
Manway	N	4	20"	300	RF FLG	
TE / TI	P	1	1."	300	RF FLG	
TW	Q	4	1"	300	RF FLG	

INTERNALS AND APPURTENANCES

PACKING	Size (in.)	Type	Bed Height (ft.)
Top	2	Nutter	15
Upper	2	Nutter	10
Lower	2	Nutter	10
Bottom	1.5	Nutter	12

PLATFORMS	Quantity	Angle / Area
Access:		(deg)
Stepoff:		(deg)
Other:		(Sq. Ft)

	DOME	BOOT
Diameter (in):		
Length (in):		
with flanges		

TRAYS	Quantity	No. of Passes	Weldins by:

Platepack Length (inch):
Total Ladder Length (ft):
Qty Break Flg Pairs:
Qty of Hat Trays: Note 3

NOTES:
1) See scope of supply for oversizing mist pads.
2) Weld-ins and V-baffle designed and supllied by internals vendor. Vessel fabricator to install.
3) Vessel Fabricator to install (4) packing supports, (3) flash galleries, (4) distributors, and (3) hat trays. These internals will be supplied by Packing Vendor.
4) On CS surface ONLY, use TRCo Painting System 3 with a Top Coat.
5) Duplicate of PO 247-11

Weir Plate:	No
Wave Baffle:	No
Nat'l Board Req'd:	Yes
Charcoal Bed Height (ft):	
Qty Catalyst bed Supports:	

REVISION	A	0	1	▲ 2		
ENGINEER/DATE	JRG 7/14/11	JRG 7/14/11	BH 11/21/11	DAB 5/13/15		
ISSUED FOR	RFQ	Purchase	Revised	Revised		

UOP RUSSELL LLC
Tulsa, Oklahoma

JOB NO: J-447 TAG NO: T-501 DATE: 7/27/2011
CLIENT: UOP Russell BY: JRG
SUBJECT: 60 MMscfd Cryo Plant SERVICE: Demethanizer

Recovery Case

TOWER PACKING SPECIFICATION

LOADING AT TRAY NO: Theoretical (Top Tray is No. 1)	TT 1	TT 6	TT 10	TT 14
VAPOR				
Rate (lb/hr)	69,150	27,640	16,030	10,530
(ACFM)	1,086.0	452.2	220.3	124.8
Density (lb/cf)	1.061	1.019	1.213	1.405
Mol. Wt.	17.36	18.29	26.47	31.45
Viscosity (Cp)	0.0076	0.0080	0.0090	0.0090
LIQUID				
Rate (lb/hr)	18,490	26,300	76,280	70,780
(GPM @ F)	74.8	101.1	287.5	280.6
Density (lb/cf)	30.83	32.43	33.08	31.45
Mol. Wt.	24.60	29.48	34.99	37.07
Viscosity (Cp)	0.1191	0.1332	0.1326	0.1077
Surface Tension (Dynes/cm)	10.92	11.98	11.11	8.033
Temperature (F)	-154	-108	-51	19
Pressure (psia)	185	186.9	188.5	190
Operating Range %	30 to 110			
PERFORMANCE (5)				
Theoretical Stages	4	3	3	4
Tower I.D.	60"	42"	42"	42"
Packing Type	Nutter Rings	Nutter Rings	Nutter Rings	Nutter Rings
Packing Size	2	2	2	1.5
Bed Height	15' - 0"	10' - 0"	10' - 0"	12' - 0"
Jet Flood %	58.9	54.8	46.8	40.8
Loading (gpm/sf)	5.17	10.36	29.88	29.17
Packing DP (in.H2O/ft)	0.15	0.08	0.04	0.03

MECHANICAL DATA

Packing Materials	304SS	Packing Supplier	Sulzer Chemtech
Distributor Materials	304L	Distributor Supplier	Packing Supplier
Support Materials	304L	Support Supplier	Packing Supplier

NOTES

(1) Stage data attached.
(2) Packing vendor to provide packing, distributors, packing supports, weld-ins, and v-baffles.
(3) Two phase feeds on stage #1, #5, #8, and #11. Stream data attached.
(4) Recov C1 GSP-1.hsc
(5) Want to modify the internals to widen the operating range for our standard 60 MM Cryo Demethanizer. Need to fit within previous orders J-246/7. Sulzer Job 7117931. 5 Cases Total.

REVISION	A	0	▲ 1	
ENGINEER/DATE	JRG 7/27/11	JRG 08/03/11	DAB 05/13/15	
ISSUED FOR	RFQ	Purchase	Revised	

UOP RUSSELL LLC
Tulsa, Oklahoma

JOB NO: J-447 TAG NO: T-501 DATE: 7/27/2011
CLIENT: UOP Russell BY: JRG
SUBJECT: 60 MMscfd Cryo Plant SERVICE: Demethanizer

Recovery Case

TOWER PACKING SPECIFICATION

LOADING AT TRAY NO: Theoretical (Top Tray is No. 1)	TT 1	TT 6	TT 10	TT 14
VAPOR				
Rate (lb/hr)	87,440	16,430	17,890	9,554
(ACFM)	874.8	184.4	162.8	78.0
Density (lb/cf)	1.666	1.486	1.832	2.042
Mol. Wt.	16.81	17.81	28.15	32.09
Viscosity (Cp)	0.0076	0.0082	0.0097	0.0098
LIQUID				
Rate (lb/hr)	27,310	30,790	57,500	49,160
(GPM @ F)	131.5	123.0	219.3	197.7
Density (lb/cf)	25.89	31.20	32.70	31.00
Mol. Wt.	19.97	27.34	34.62	37.15
Viscosity (Cp)	0.0696	0.1135	0.1166	0.0985
Surface Tension (Dynes/cm)	6.525	10.31	9.661	6.672
Temperature (F)	-156	-113	-34	36
Pressure (psia)	260	261.9	263.5	265
Operating Range %	30 to 110			
PERFORMANCE (5)				
Theoretical Stages	4	3	3	4
Tower I.D.	60"	42"	42"	42"
Packing Type	Nutter Rings	Nutter Rings	Nutter Rings	Nutter Rings
Packing Size	2	2	2	1.5
Bed Height	15' - 0"	10' - 0"	10' - 0"	12' - 0"
Jet Flood %	68.3	36.2	39.9	30.1
Loading (gpm/sf)	7.92	12.63	22.79	20.55
Packing DP (in.H2O/ft)	0.25	0.02	0.03	0.01

MECHANICAL DATA

Packing Materials	304SS	Packing Supplier	Sulzer Chemtech
Distributor Materials	304L	Distributor Supplier	Packing Supplier
Support Materials	304L	Support Supplier	Packing Supplier

NOTES

(1) Stage data attached.
(2) Packing vendor to provide packing, distributors, packing supports, weld-ins, and v-baffles.
(3) Two phase feeds on stage #1, #5, #8, and #11. Stream data attached.
(4) Recov.120°F-ref.Rev1.hsc
(5) Want to modify the internals to widen the operating range for our standard 60 MM Cryo Demethanizer. Need to fit within previous orders J-246/7. Sulzer Job 7117931. 5 Cases Total.

REVISION	A	0	▲ 1	
ENGINEER/DATE	JRG 7/27/11	JRG 08/03/11	DAB 05/13/15	
ISSUED FOR	RFQ	Purchase	Revised	

UOP RUSSELL LLC
Tulsa, Oklahoma

JOB NO: J-447 TAG NO: T-501 DATE: 7/27/2011
CLIENT: UOP Russell BY: JRG
SUBJECT: 60 MMscfd Cryo Plant SERVICE: Demethanizer

Rejection Case

TOWER PACKING SPECIFICATION

LOADING AT TRAY NO: Theoretical (Top Tray is No. 1)	TT 2	TT 7	TT 10	TT 14
VAPOR				
Rate (lb/hr)	82,560	22,780	25,790	16,020
(ACFM)	1,163	314.0	260.5	156.8
Density (lb/cf)	1.183	1.209	1.650	1.703
Mol. Wt.	19.02	22.38	32.46	34.53
Viscosity (Cp)	0.0084	0.0092	0.0093	0.0095
LIQUID				
Rate (lb/hr)	15,380	26,340	71,350	61,580
(GPM @ F)	61.0	102.6	290.3	252.6
Density (lb/cf)	31.42	32.03	30.64	30.39
Mol. Wt.	29.41	34.35	37.83	39.59
Viscosity (Cp)	0.1173	0.1193	0.1002	0.0976
Surface Tension (Dynes/cm)	10.89	10.15	6.993	6.366
Temperature (F)	-89	-39	26	60
Pressure (psia)	215.4	217.3	218.5	220
Operating Range %	30 to 110			
PERFORMANCE (5)				
Theoretical Stages	4	3	3	4
Tower I.D.	60"	42"	42"	42"
Packing Type	Nutter Rings	Nutter Rings	Nutter Rings	Nutter Rings
Packing Size	2	2	2	1.5
Bed Height	15' - 0"	10' - 0"	10' - 0"	12' - 0"
Jet Flood %	60.4	45.3	58.4	46.4
Loading (gpm/sf)	3.51	10.66	30.18	26.26
Packing DP (in.H2O/ft)	0.17	0.06	0.12	0.06

MECHANICAL DATA

Packing Materials	304SS	Packing Supplier	Sulzer Chemtech
Distributor Materials	304L	Distributor Supplier	Packing Supplier
Support Materials	304L	Support Supplier	Packing Supplier

NOTES

(1) Stage data attached.
(2) Packing vendor to provide packing, distributors, packing supports, weld-ins, and v-baffles.
(3) Two phase feeds on stage #1, #5, #8, and #11. Stream data attached.
(4) Reject C1.hsc
(5) Want to modify the internals to widen the operating range for our standard 60 MM Cryo Demethanizer. Need to fit within previous orders J-246/7. Sulzer Job 7117931. 5 Cases Total.

REVISION	A	0	▲ 1	
ENGINEER/DATE	JRG 7/27/11	JRG 08/03/11	DAB 05/13/15	
ISSUED FOR	RFQ	Purchase	Revised	

UOP RUSSELL LLC
Tulsa, Oklahoma

JOB NO: J-447 TAG NO: T-501 DATE: 7/27/2011
CLIENT: UOP Russell BY: JRG
SUBJECT: 60 MMscfd Cryo Plant SERVICE: Demethanizer

Rejection Case

TOWER PACKING SPECIFICATION

LOADING AT TRAY NO: Theoretical (Top Tray is No. 1)	TT 1	TT 7	TT 10	TT 14
VAPOR				
Rate (lb/hr)	98,770	14,700	19,540	16,570
(ACFM)	1,201	146.9	164.1	128.4
Density (lb/cf)	1.371	1.667	1.984	2.151
Mol. Wt.	18.58	27.61	33.46	39.79
Viscosity (Cp)	0.0086	0.0097	0.0098	0.0103
LIQUID				
Rate (lb/hr)	11,550	22,050	40,320	37,360
(GPM @ F)	45.6	89.2	166.4	153.9
Density (lb/cf)	31.59	30.81	30.21	30.27
Mol. Wt.	29.13	36.91	40.14	44.62
Viscosity (Cp)	0.1202	0.1032	0.0963	0.0931
Surface Tension (Dynes/cm)	10.80	7.661	5.846	5.562
Temperature (F)	-98	11	54	120
Pressure (psia)	255.0	257.3	258.5	260
Operating Range %	30 to 110			
PERFORMANCE (5)				
Theoretical Stages	4	3	3	4
Tower I.D.	60"	42"	42"	42"
Packing Type	Nutter Rings	Nutter Rings	Nutter Rings	Nutter Rings
Packing Size	2	2	2	1.5
Bed Height	15' - 0"	10' - 0"	10' - 0"	12' - 0"
Jet Flood %	66.2	29.3	37.9	36
Loading (gpm/sf)	3.03	9.28	17.30	16.00
Packing DP (in.H2O/ft)	0.24	0.02	0.05	0.04

MECHANICAL DATA

Packing Materials	304SS	Packing Supplier	Sulzer Chemtech
Distributor Materials	304L	Distributor Supplier	Packing Supplier
Support Materials	304L	Support Supplier	Packing Supplier

NOTES

(1) Stage data attached.
(2) Packing vendor to provide packing, distributors, packing supports, weld-ins, and v-baffles.
(3) Two phase feeds on stage #1, #5, #8, and #11. Stream data attached.
(4) Reject.80°F.Rev1.hsc
(5) Want to modify the internals to widen the operating range for our standard 60 MM Cryo Demethanizer. Need to fit within previous orders J-246/7. Sulzer Job 7117931. 5 Cases Total.

REVISION	A	0	▲ 1	
ENGINEER/DATE	JRG 7/27/11	JRG 08/03/11	DAB 05/13/15	
ISSUED FOR	RFQ	Purchase	Revised	

UOP RUSSELL LLC
Tulsa, Oklahoma

JOB NO: J-447 TAG NO: T-501 DATE: 7/27/2011
CLIENT: UOP Russell BY: JRG
SUBJECT: 60 MMscfd Cryo Plant SERVICE: Demethanizer

Rejection Case

TOWER PACKING SPECIFICATION

LOADING AT TRAY NO: Theoretical (Top Tray is No. 1)	TT 2	TT 7	TT 10	TT 14
VAPOR				
Rate (lb/hr)	98,080	36,500	40,840	37,920
(ACFM)	1,423	434.4	404.1	321.3
Density (lb/cf)	1.149	1.400	1.684	1.967
Mol. Wt.	19.66	27.65	35.69	45.20
Viscosity (Cp)	0.0085	0.0092	0.0095	0.0099
LIQUID				
Rate (lb/hr)	18,920	35,870	65,680	62,760
(GPM @ F)	75.7	146.8	267.2	259.3
Density (lb/cf)	31.15	30.46	30.65	30.18
Mol. Wt.	30.19	34.98	40.33	47.44
Viscosity (Cp)	0.1143	0.1005	0.1003	0.0942
Surface Tension (Dynes/cm)	10.45	7.764	6.544	5.559
Temperature (F)	-74	-1	48	134
Pressure (psia)	210.4	212.3	213.5	215
Operating Range %	30 to 110			
PERFORMANCE (5)				
Theoretical Stages	4	3	3	4
Tower I.D.	60"	42"	42"	42"
Packing Type	Nutter Rings	Nutter Rings	Nutter Rings	Nutter Rings
Packing Size	2	2	2	1.5
Bed Height	15' - 0"	10' - 0"	10' - 0"	12' - 0"
Jet Flood %	70.4	68.2	75.1	75.1
Loading (gpm/sf)	3.75	15.26	27.77	26.95
Packing DP (in.H2O/ft)	0.24	0.18	0.32	0.35

MECHANICAL DATA

Packing Materials	304SS	Packing Supplier	Sulzer Chemtech
Distributor Materials	304L	Distributor Supplier	Packing Supplier
Support Materials	304L	Support Supplier	Packing Supplier

NOTES

(1) Stage data attached.
▲ (2) Packing vendor to provide packing, distributors, packing supports, weld-ins, and v-baffles.
(3) Two phase feeds on stage #1, #5, #8, and #11. Stream data attached.
(4) SC6 Rej HD-5.hsc
(5) Want to modify the internals to widen the operating range for our standard 60 MM Cryo Demethanizer. Need to fit within previous orders J-246/7. Sulzer Job 7117931. 5 Cases Total.

REVISION	A	0	▲ 1	
ENGINEER/DATE	JRG 7/27/11	JRG 08/03/11	DAB 05/13/15	
ISSUED FOR	RFQ	Purchase	Revised	

UOP RUSSELL, LLC
Tulsa, Oklahoma

FORM # MST-ELM

MIST ELIMINATOR SPECIFICATION

Job Number J-447

Vessel Tag T-501

Spec. No.: ME-501

Spec. By: JRG

Checked By:

Date: 7/14/2011

Mistpad Installed Diameter:	60	inches
Mesh Thickness:	6	inches
Mesh Material:	316SS	
Density Required:	12	lbs/cf
Wire Diameter:	0.011	inches
Grid Material:	304SS	
Grid Diameter:	58.5	inches
Mistpad Overall Thickness:	8	inches
Oversize mesh (on all sides):	0.375	inch
Manway I.D.:	17	inches
Number of Segments:	4	
Removeable (Yes / No):	No	

Note 1: Oversized diameter of Mist Extractor shall allow the vessel to be shipped horizontally with the

No. of segments	**Oversize (all sides of each sections)**
1 or 2	**1/2"**
3 or 4	**3/8"**
More than 4	**1/4"**

Note 2: Grid diameter shall be 1-1/2" less than the installed diameter shown above.

Note 3: OD of each grid section shall be banded.

REVISION	0								
ENGINEER/DATE	JRG	7/14/2011							
ISSUED FOR	Purchase								

13863 Industrial Road
Houston, Tx 77015

DATA BOOK

CUSTOMER: UOP Russell

P.O.# 4500739178

DESCRIPTION: Demethanizer Tower

TAG# T-501

DIMENSIONS: 42" I.D. x 60 " I.D. x 98'-0" SM/SM

SERIAL NO. 2132

Spitzer Industries, Inc.
Corporate Headquarters
11250 Tanner Road
Houston, Tx 77041
Tel: 713-482-2700
Fax: 713-482-2780

Spitzer Industries, Inc.
11433 Brittmoore Park Dr.
Houston, Tx 77041
Tel: 713-466-1518
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www.spitzerind.com

Spitzer HFD/ Curtis Kelly
13863 Industrial Road
Houston, Tx 77015
P.O. Box 96097
Houston, Tx 77213
Tel: 713-230-4200
Fax: 713-230-4250
www.spitzerind.com

Orizon Industries, Inc.
7007 FM 362
Brookshire, Tx 77423
Tel: 281-375-7700
Fax: 281-375-7979
www.orizonindustries.com

Curtis Kelly
A SPITZER COMPANY

13863 Industrial Road
Houston, Tx 77015

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Houston, Tx 77213
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www.spitzerind.com

Orizon Industries, Inc.
7007 FM 362
Brookshire, Tx 77423
Tel: 281-375-7700
Fax: 281-375-7979
www.orizonindustries.com

SECTION 1
ASME CODE DATA REPORT

2132
Serial No.
532
National Board No.

FORM U-1A MANUFACTURER'S DATA REPORT FOR PRESSURE VESSELS

(Alternative Form for Single Chamber, Completely Shop or Field Fabricated Vessels Only)
As Required by the Provisions of the ASME Boiler and Pressure Vessel Code Rules, Section VIII, Division 1

1. Manufactured and certified by **Curtis Kelly, Inc., A Subsidiary of Spitzer Industries, Inc., 13863 Industrial Road, Houston, Texas, 77015**
(Name and address of Manufacturer)

anufactured for **Thomas Russell, 7501 South Yale #210, Tulsa, Oklahoma, 74136**
(Name and address of Purchaser)

3. Location of Installation **Unknown**
(Name and address)

4. Type **Vertical** (Horizontal or vertical, tank) | **2132** (Manufacturer's serial number) | **N/A** (CRN) | **See Remarks** (Drawing number) | **532** (National Board number) | **2017** (Year built)

5. ASME Code, Section VIII, Division 1 | **2015/ N/A** [Edition and Addenda, if applicable (date)] | **N/A** (Code Case numbers) | **Low Temperature** (Special service per UG-120(d))

6. Shell: **SA-240-304** (Material spec. number, grade) | ***** (Nominal thickness) | **0"** (Corr. allow.) | **SEE REMARKS** (Inner diameter) | **98' 0"** [Length (overall)]

Body Flanges on Shells

No.	Type	ID	OD	Flange Thk	Min Hub Thk	Material	How Attached	Location	Bolting			
									Num & Size	Bolting Material	Washer (OD, ID, thk)	Washer Material
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

7. Seams: **1** [Long. (welded, dbl., sngl., lap, butt)] | **Full** [R.T.(spot or full)] | **100%** (Eff.,%) | **N/A** (H.T. temp) | **N/A** (Time, hr) | **1** [Girth. (welded, dbl., sngl., lap, butt)] | **Full** [R.T. (spot or full)] | **100%** (Eff., %) | **11** (No. of courses)

8. Heads: (a) Material **SA-240-304** (Spec. no., grade) (b) Material **SA-240-304** (Spec. no., grade)

	Location (Top, Bottom, Ends)	Minimum Thickness	Corrosion Allowance	Crown Radius	Knuckle Radius	Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to Pressure (Convex or Concave)
(a)	**TOP**	**.602"**	**0"**	**N/A**	**N/A**	**2:1**	**N/A**	**N/A**	**N/A**	**Concave**
(b)	**BOTTOM**	**.425"**	**0"**	**N/A**	**N/A**	**2:1**	**N/A**	**N/A**	**N/A**	**Concave**

Body Flanges on Heads

	Location	Type	ID	OD	Flange Thk	Min Hub Thk	Material	How Attached	Bolting			
									Num & Size	Bolting Material	Washer (OD, ID, thk)	Washer Material
(a)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A

MAWP **400 psi** (Internal) **N/A** (External) at max. temp. **200 °F** (Internal) **N/A** (External)

Min. design metal temp. **-200 °F** at **400 psi** . Hydro, pneu., or comb. test pressure **HYDRO at 520 psi** .

Proof test **N/A** .

10. Nozzles, inspection and safety valve openings:

Purpose (Inlet, Outlet, Drain, etc.)	No.	Diameter or Size	Type	Material		Nozzle Thickness		Reinforcement Material	Attachment Details		Location (Insp. Open.)
				Nozzle	Flange	Nom.	Corr.		Nozzle	Flange	
Reflux Inlet	1	**4" 300#**	**WN**	**SA-312TP304**	**SA182F304**	**.237"**	**0"**	**SA-240-304**	**UW16.1(e)**	**Welded**	**Shell**
Vapor Outlet	1	**10" 300#**	**WN**	**SA-312TP304**	**SA182F304**	**.365"**	**0"**	**SA-240-304**	**UW16.1(e)**	**Welded**	**Head**
Top Feed	1	**12" 300#**	**WN**	**SA-312TP304**	**SA182F304**	**.375"**	**0"**	**SA-240-304**	**UW16.1(e)**	**Welded**	**Shell**
Bottom Feed	1	**4" 300#**	**WN**	**SA-312TP304**	**SA182F304**	**.237"**	**0"**	**SA-240-304**	**UW16.1(e)**	**Welded**	**Shell**

Additional Nozzles - See Attached U-4...

11. Supports: Skirt **Yes** (Yes or no) Lugs **N/A** (Number) Legs **N/A** (Number) Other **N/A** (Describe) Attached **Welded to Head** (Where and how)

12. Remarks: Manufacturer's Partial Data Reports properly identified and signed by Commissioned Inspectors, have been furnished for the following items of the report:

60" ID x .750 Ellipsoidal Head, Fort Worth F & D Head Co., Serial# 193067-1, Cert# 10625.
(Name of part, item number, Manufacturer's name and identifying stamp)

No charpy impact testing per UHA-51.

* Shell# 1-7, .500" Thk / Shell Cone# 8, .750" Thk. / Shell# 9-11, .625" Thk.
4. 2132-2 Rev. 1 & 2132-3 Rev. 1
6. Shell# 1-7, 42" I.D. / Shell Cone # 8, 42" I.D. x 60" I.D. / Shell# 9-11, 60" I.D.
10. ** Pipe-2-SA312TP304, S/40S / Elbow-1-SA-403WP304, S/40S, 90 Deg LR
*** 1.125" Dia x 7.25" Lg. SA-193-B8 Studs w/ (2 ea.) SA-194-Gr.8 Heavy Hex Nuts
**** 1.25" Dia x 8.75" Lg. SA-193-B8 w/ (2 Ea.) SA-194-Gr.8 Heavy Hex Nuts

FORM U-1A (Back)

NB Number 532

CERTIFICATE OF SHOP/FIELD COMPLIANCE

We certify that the statements made in this report are correct and that all details of design, material, construction, and workmanship of this vessel conform to the ASME BOILER AND PRESSURE VESSEL CODE, Section VIII, Division 1. "U" Certificate of Authorization Number **34782** expires **October 13, 2019**.

Date **07/06/2017** Co. name **Curtis Kelly, Inc., A Subsidiary of Spitzer Industries, Inc.** (Manufacturer) Signed _____ (Representative)

CERTIFICATE OF SHOP/FIELD INSPECTION

Vessel constructed by **Curtis Kelly, Inc., A Subsidiary of Spitzer Industries, Inc.** at **13863 Industrial Road, Houston, Texas, 77015**

I, the undersigned, holding a valid commission issued by The National Board of Boiler and Pressure Vessel Inspectors and employed by OneCIS Insurance Company, of Lynn, MA

have inspected the component described in this Manufacturer's Data Report on July 6, 2017, and state that, to the best of my knowledge and belief, the Manufacturer has constructed this pressure vessel in accordance with ASME BOILER AND PRESSURE VESSEL CODE, Section VIII, Division 1. By signing this certificate neither the Inspector nor his/her employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his/her employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date 07/16/2017 Signed _____ (Authorized Inspector) Commissions 15477, TX2034, LA1651 [National Board (incl. endorsements)]

2725601 exe: v6.2.160 *Form and version: U1A-18*



2132
Serial No.
532
National Board No.

FORM U-4 MANUFACTURER'S DATA REPORT SUPPLEMENTARY SHEET

As Required by the Provisions of the ASME Boiler and Pressure Vessel Code Rules, Section VIII, Division 1

1. Manufactured and certified by **Curtis Kelly, Inc., A Subsidiary of Spitzer Industries, Inc., 13863 Industrial Road, Houston, Texas, 77015**
(Name and address of Manufacturer)

2. Manufactured for **Thomas Russell, 7501 South Yale #210, Tulsa, Oklahoma, 74136**
(Name and address of Purchaser)

3. Location of installation **Unknown**
(Name and address)

4. Type **Vertical** (Horizontal, vertical, or sphere) | **N/A** (Tank, separator, heat exch., etc.) | **2132** (Manufacturer's serial number)

N/A (CRN) | **See Remarks** (Drawing number) | **532** (National Board number) | **2017** (Year built)

Data Report Item Number | Remarks

Purpose (Inlet, Outlet, Drain, etc.)	No.	Diameter or Size	Type	Material		Nozzle Thickness		Reinforcement Material	Attachment Details		Location (Insp. Open.)
				Nozzle	Flange	Nom.	Corr.		Nozzle	Flange	
To E-205	1	8" 300#	WN	SA-312TP304	SA182F304	.322"	0"	SA-240-304	UW16.1(e)	Welded	Shell
From E-205	1	8" 300#	WN	SA-312TP304	SA182F304	.322"	0"	SA-240-304	UW16.1(e)	Welded	Shell
To E-204/E-207	1	8" 300#	WN	SA-312TP304	SA182F304	.322"	0"	SA-240-304	UW16.1(e)	Welded	Shell
From E-204/E-207	1	8" 300#	WN	SA-312TP304	SA182F304	.322"	0"	SA-240-304	UW16.1(e)	Welded	Shell
PSV	1	6" 300#	WN	SA-312TP304	SA182F304	.28"	0"	SA-240-304	UW16.1(e)	Welded	Shell
Handhole w/Cvr***	2	12" 300#	WN	SA-312TP304	SA182F304	.375"	0"	SA-240-304	UW16.1(e)	Welded	Shell
Handhole w/Cvr***	4	12" 300#	WN	SA-312TP304	SA182F304	.375"	0"	SA-240-304	UW16.1(e)	Welded	Shell
Handhole w/Cvr***	2	12" 300#	WN	SA-312TP304	SA182F304	.375"	0"	SA-240-304	UW16.1(e)	Welded	Shell
Bottoms Out	1	6" 300#	WN	**	SA182F304	.28"	0"	SA-240-304	UW16.1(e)	Welded	Head
Equalization	1	6" 300#	WN	SA-312TP304	SA182F304	.28"	0"	SA-240-304	UW16.1(e)	Welded	Shell
Manway w/Cvr****	4	20" 300#	WN	SA-312TP304	SA182F304	.375"	0"	SA-240-304	UW16.1(e)	Welded	Shell
TE/TI	1	1" 300#	LWN	SA182F304		.56"	0"	Integral	UW16.1(e)		Shell
TW	4	1" 300#	LWN	SA182F304		.56"	0"	Integral	UW16.1(e)		Shell

Certificate of Authorization: Type **"U"** No. **34782** Expires **October 13, 2019**

Date **07/06/2017** Name **Curtis Kelly, Inc., A Subsidiary of Spitzer Industries, Inc.** (Manufacturer) Signed _____ (Representative)

Date **07/16/2017** Name _____ (Authorized Inspector) Commissions: 15477, TX2034, LA1651 [National Board (incl. endorsements)]

FORM U-2A MANUFACTURER'S PARTIAL DATA REPORT (ALTERNATIVE FORM)

A Part of a Pressure Vessel Fabricated by One Manufacturer for Another Manufacturer

As Required by the Provisions of the ASME Boiler and Pressure Vessel Code Rules, Section VIII, Division 1

1. Manufactured and certified by: FORT WORTH F & D HEAD CO. 3040 E. PEDEN ROAD FORT WORTH, TEXAS 76179 (Name and address of Manufacturer)

2. Manufactured for: BUILT FOR STOCK (Name and address of Purchaser)

3. Location of installation: UNKNOWN (Name and address)

4. Type: 60" ID X .750 ELLIPSOIDAL HEAD (Description of vessel part (shell, two-piece head, tube bundle)) | 193067-1 (Manufacturer's serial No.) | XXX (CRN)

XXX (National Board Number) | 193067 (Drawing No.) | N/A (Drawing prepared by) | 2017 (Year built)

5. ASME Code, Section VIII, Div. 1: 2015 EDITION [Edition and Addenda (if applicable) date] | XXX (Code Case Number) | N/A (Special Service per UG-120(d))

6. Shell: (a) No. of course(s): (b) Overall length (ft & in.):

Course(s)			Material	Thickness		Long Joint (Cat. A)			Circum. Joint (Cat. A, B & C)			Heat Treatment	
No.	Diameter, in.	Length (ft. & in.)	Spec./Grade or Type	Nom.	Corr.	Type	Full, Spot, None	Eff.	Type	Full, Spot, None	Eff.	Temp.	Time

Body Flanges on Shells									Bolting			
No.	Type	ID	OD	Flange Thk	Min Hub Thk	Material	How Attached	Location	Num & Size	Bolting Material	Washer (OD,ID,th)	Washer Material

7. Heads: (a) SA240-304/304L (NO HT) (Mat'l Spec. No., Grade or Type) (H.T.-Time &Temp) (b) (Mat'l Spec. No., Grade or Type) (H.T.-Time & Temp)

	Location (Top, Bottom, Ends)	Thickness		Radius		Elliptical	Conical	Hemispherical	Flat	Side to Pressure		Category A		
		Min.	Corr.	Crown	Knuckle	Ratio	Apex Angle	Radius	Diameter	Convex	Concave	Type	Full, Spot, None	Eff.
(a)		.600				2:1						1	FULL	
(b)														

Body Flanges on Heads									Bolting			
	Location	Type	I.D.	O.D.	Flange Thk	Min Hub Thk	Material	How Attached	Num & Size	Bolting Material	Washer (OD,ID,th)	Washer Material
(a)												
(b)												

8. MAWP N/A (internal) N/A (external) psi at max. temp N/A (internal) N/A (external) °F Min. design metal temp. N/A °F at N/A psi

9. Impact test NONE (Indicate yes or no and the component(s) impact tested) at test temperature of N/A °F.

10. Hydro., pneu., or comb. test press. NONE Proof test N/A

11. Nozzles, inspection, and safety valve openings:

Purpose (Inlet, Outlet, Drain, etc.)	No.	Diameter or Size	Type	Material		Nozzle Thickness		Reinforcement Material	Attachment Details		Location (Insp, Open)
				Nozzle	Flange	Nom.	Corr.		Nozzle	Flange	

12. Identification of part(s).

Name of part	Quantity	Line No.	Mfr's. Identification No.	Mfr's. Drawing No.	CRN	National Board No.	Year Built

13. Supports: Skirt XXX (Yes or No) Lugs XXX (No.) Legs XXX (No.) Others N/A (Describe) Attached XXX (Where and How)

14. Remarks 1. NO DESIGN FUNCTION PERFORMED 2. NO PRESSURE TESTING PERFORMED

CERTIFICATE OF SHOP/FIELD COMPLIANCE

We certify that the statements made in this report are correct and that all details of material, construction, and workmanship of this pressure vessel part conform to the ASME BOILER AND PRESSURE VESSEL CODE Section VIII, Division 1. U Certificate of Authorization No. 10625 Expires 09/07/2017

Date 1/19/17 Name FORT WORTH F & D HEAD CO. (Manufacturer) Signed (Representative)

CERTIFICATE OF SHOP/FIELD INSPECTION

I, the undersigned, holding a valid commission issued by The National Board of Boiler and Pressure Vessel Inspectors and employed by OneCIS Insurance Company of Lynn, MA have inspected the pressure vessel part described in this Manufacturer's Data Report on JAN 19, 2017, and state that, to the best of my knowledge and belief, the Manufacturer has constructed this pressure vessel part in accordance with ASME BOILER AND PRESSURE VESSEL CODE, Section VIII, Division 1. By signing this certificate neither the Inspector nor his/her employer makes any warranty, expressed or implied, concerning the pressure vessel part described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his/her employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date 1-19-17 Signed (Authorized Inspector) Commissions NB# 9757 [National Board (including endorsements)]

07/14

SECTION 2
CERTIFICATE OF COMPLIANCE

Curtis Kelly
A SPITZER COMPANY

13863 Industrial Road
Houston, Tx 77015

CERTIFICATE OF COMPLIANCE

The below mentioned item has been manufactured, tested and inspected in accordance with your purchase order. All material meets the requirements of the applicable specifications.

Customer:	UOP Russell
S/O Number:	2132
Item Number:	T-501
Description:	Demethanizer Tower
Purchase Order#:	4500739178

I certify this to be true and correct.

August 10, 2017

Quality Control Manager
Curtis Kelly, Inc.

Date

Spitzer Industries, Inc.
Corporate Headquarters
11250 Tanner Road
Houston, Tx 77041
Tel: 713-482-2700
Fax: 713-482-2780

Spitzer Industries, Inc.
11433 Brittmoore Park Dr.
Houston, Tx 77041
Tel: 713-466-1518
Fax; 713-482-2700
www.spitzerind.com

Spitzer HFD/ Curtis Kelly
13863 Industrial Road
Houston, Tx 77015
P.O. Box 96097
Houston, Tx 77213
Tel: 713-230-4200
Fax: 713-230-4250
www.spitzerind.com

Orizon Industries, Inc.
7007 FM 362
Brookshire, Tx 77423
Tel: 281-375-7700
Fax: 281-375-7979
www.orizonindustries.com

SECTION 3
NAME PLATE FACSIMILE


532
Curtis Kelly
A KUTZER COMPANY
CERTIFIED BY CURTIS KELLY, INC. HOUSTON, TEXAS USA
ALLOW. WORK. PRESS. 400 P.S.I. AT 200 °F
ALLOW. WORK. PRESS. — — P.S.I. AT °F
DESIGN METAL TEMP. -200 °F AT 400 P.S.I.
AT NO. 2132 DATE 2017 WT. 70,644 LBS
TEST PRESS. P.S.I. 520 O.D. *
THK. ** HD. THK. *** ITEM NO. T-501
NO. 4500739178
* UPPER SECTION = 61.25" OD, LOWER SECTION = 43" OD
** UPPER SECTION .625", CONE = .75", LOWER SECTION = .5"
*** TOP HEAD = .602" MIN., BOTTOM HEAD = .425" MIN.
DEMETHANIZER

SECTION 4
ASME CODE TRAVELER /
MATERIAL TABULATION SHEET W/ MTR'S

Curtis Kelly A SPITZER COMPANY	**Pressure Vessel Material Tabulation**	Form Rev. 0 Rev. Date 06/04/12

Job. No.: 2132 Description/Type: Demethanizer, T-501 Dimensions: 42" I.D. x 60" I.D. x 98'-0" SM/SM

Component	Description	Specification/Heat No.:	Min. Thickness
Heads			
Top Head	60" I.D. 2:1	Spec.: SA-240-304 Heat #:ARPS	.602"
Bottom Head	42" I.D. 2:1	Spec.: SA-240-304 Heat #:W6X0	.425"
Shells			
Shell # 1	10'-0"	Spec.: SA-240-304 Heat #:862665 4AA	.500"
Shell # 2	10'-0"	Spec.: SA-240-304 Heat #:862665 4A	.500"
Shell # 3	10'-0"	Spec.: SA-240-304 Heat #:862665 3A	.500"
Shell # 4	10'-0"	Spec.: SA-240-304 Heat #:862665 3AA	.500"
Shell # 5	10'-0"	Spec.: SA-240-304 Heat #:862665 2A	.500"
Shell # 6	10'-0"	Spec.: SA-240-304 Heat #:862665 2AA	.500"
Shell # 7	7'-3"	Spec.: SA-240-304 Heat #:848032	.500"
Shell Cone # 8	3'-0"	Spec.: SA-240-304 Heat #:848525	.75"
Shell # 9	7'-9"	Spec.: SA-240-304 Heat #:849665	.625"
Shell # 10	10'-0"	Spec.: SA-240-304 Heat #:862665 1A	.625"
Shell # 11	10'-0"	Spec.: SA-240-304 Heat #:862665 1B	.625"
Nozzles			
Noz. MKD: A 4" 300#	Flange WN	Spec.: SA-182-F304 Heat #:5096	S/40S
	Pipe	Spec.: SA-312TP304 Heat #:36864	S/40S
	Repad	Spec.: SA-240-304 Heat #:X0T9	0.625

Curtis Kelly A SPITZER COMPANY	Pressure Vessel Material Tabulation	Form Rev. 0 Rev. Date 06/04/12

Job. No.: 2132 Description/Type: Demethanizer, T-501 Dimensions: 42" I.D. x 60" I.D. x 98'-0" SM/SM

Component	Description	Specification/Heat No.:	Min. Thickness
Nozzles			
Noz. MKD: B 10" 300#	Flange WN	Spec.: SA-182-F304 Heat #:98026	S/40S
	Pipe	Spec.: SA-312TP304 Heat #:R2R8	S/40S
	Repad	Spec.: SA-240-304 Heat #:X0T9	0.625
Noz. MKD: C 12" 300#	Flange WN	Spec.: SA-182-F304 Heat #:5629	S/40S
	Pipe	Spec.: SA-312TP304 Heat #:506796	S/40S
	Repad	Spec.: SA-240-304 Heat #:X0T9	0.625
Noz. MKD: D 4" 300#	Flange WN	Spec.: SA-182-F304 Heat #:5096	S/40S
	Pipe	Spec.: SA-312TP304 Heat #:36864	S/40S
	Repad	Spec.: SA-240-304 Heat #:506754	0.375
Noz. MKD: E 8" 300#	Flange WN	Spec.: SA-182-F304 Heat #:38790/1	S/40S
	Pipe	Spec.: SA-312TP304 Heat #:509972	S/40S
	Repad	Spec.: SA-240-304 Heat #:857975	0.500"
Noz. MKD: F 8" 300#	Flange WN	Spec.: SA-182-F304 Heat #:100765/1	S/40S
	Pipe	Spec.: SA-312TP304 Heat #:506115	S/40S
	Repad	Spec.: SA-240-304 Heat #:857975	0.500"
Noz. MKD: G 8" 300#	Flange WN	Spec.: SA-182-F304 Heat #:100765/1	S/40S
	Pipe	Spec.: SA-312TP304 Heat #:506115	S/40S
	Repad	Spec.: SA-240-304 Heat #:506754	0.375

Curtis Kelly A SPITZER COMPANY	Pressure Vessel Material Tabulation	Form Rev. 0 Rev. Date 06/04/12

Job. No.: 2132 Description/Type: Demethanizer, T-501 Dimensions: 42" I.D. x 60" I.D. x 98'-0" SM/SM

Component	Description	Specification/Heat No.:	Min. Thickness
Nozzles			
Noz. MKD: H 8" 300#	Flange WN	Spec.: SA-182-F304 Heat #:38790/1	S/40S
	Pipe	Spec.: SA-312TP304 Heat #:506115	S/40S
	Repad	Spec.: SA-240-304 Heat #:506754	0.375
Noz. MKD: J 6" 300#	Flange WN	Spec.: SA-182-F304 Heat #:5062	S/40S
	Pipe	Spec.: SA-312TP304 Heat #:510713	S/40S
	Repad	Spec.: SA-240-304 Heat #:506754	0.375
Noz. MKD: K1 12" 300#	Bld Flange	Spec.: SA-182-F304 Heat #:26484-1	
	Flange WN	Spec.: SA-182-F304 Heat #:5629	S/40S
	Pipe	Spec.: SA-312TP304 Heat #:506796	S/40S
	Repad	Spec.: SA-240-304 Heat #:X0T9	0.625
Noz. MKD: K2 12" 300#	Bld Flange	Spec.: SA-182-F304 Heat #:92877-2	
	Flange WN	Spec.: SA-182-F304 Heat #:5629	S/40S
	Pipe	Spec.: SA-312TP304 Heat #:506796	S/40S
	Repad	Spec.: SA-240-304 Heat #:857975	0.500"
Noz. MKD: K3 12" 300#	Bld Flange	Spec.: SA-182-F304 Heat #:92877-2	
	Flange WN	Spec.: SA-182-F304 Heat #:5629	S/40S
	Pipe	Spec.: SA-312TP304 Heat #:506796	S/40S
	Repad	Spec.: SA-240-304 Heat #:857975	0.500"

Curtis Kelly A SPITZER COMPANY	Pressure Vessel Material Tabulation	Form Rev. 0 Rev. Date 06/04/12

Job. No.: 2132 Description/Type: Demethanizer, T-501 Dimensions: 42" I.D. x 60" I.D. x 98'-0" SM/SM

Component	Description	Specification/Heat No.:	Min. Thickness
Nozzles			
Noz. MKD: K4 12" 300#	Bld Flange	Spec.: SA-182-F304	
		Heat #:92877-2	
	Flange WN	Spec.: SA-182-F304	S/40S
		Heat #:5629	
	Pipe	Spec.: SA-312TP304	S/40S
		Heat #:506796	
	Repad	Spec.: SA-240-304	0.375
		Heat #:506754	
Noz. MKD: K5 12" 300#	Bld Flange	Spec.: SA-182-F304	
		Heat #:27510-1	
	Flange WN	Spec.: SA-182-F304	S/40S
		Heat #:5629	
	Pipe	Spec.: SA-312TP304	S/40S
		Heat #:506796	
	Repad	Spec.: SA-240-304	0.625
		Heat #:X0T9	
Noz. MKD: K6 12" 300#	Bld Flange	Spec.: SA-182-F304	
		Heat #:26484-1	
	Flange WN	Spec.: SA-182-F304	S/40S
		Heat #:5629	
	Pipe	Spec.: SA-312TP304	S/40S
		Heat #:506796	
	Repad	Spec.: SA-240-304	0.500"
		Heat #:857975	
Noz. MKD: K7 12" 300#	Bld Flange	Spec.: SA-182-F304	
		Heat #:26484-1	
	Flange WN	Spec.: SA-182-F304	S/40S
		Heat #:5629	
	Pipe	Spec.: SA-312TP304	S/40S
		Heat #:506796	
	Repad	Spec.: SA-240-304	0.500"
		Heat #:857975	

Curtis Kelly A SPITZER COMPANY	Pressure Vessel Material Tabulation	Form Rev. 0 Rev. Date 06/04/12

Job. No.: 2132 Description/Type: Demethanizer, T-501 Dimensions: 42" I.D. x 60" I.D. x 98'-0" SM/SM

Component	Description	Specification/Heat No.:	Min. Thickness
Nozzles			
Noz. MKD: K8 12" 300#	Bld Flange	Spec.: SA-182-F304	
		Heat #:92877-1	
	Flange WN	Spec.: SA-182-F304	S/40S
		Heat #:5629	
	Pipe	Spec.: SA-312TP304	S/40S
		Heat #:506796	
	Repad	Spec.: SA-240-304	0.375
		Heat #:506754	
Noz. MKD: L 6" 300#	Flange WN	Spec.: SA-182-F304	S/40S
		Heat #: 5062	
	Pipe	Spec.: SA-312TP304	S/40S
		Heat #: 510713	
	Elbow 90°	Spec.: SA-403-WP304	S/40S
		Heat #: SE69768	
	Pipe	Spec.: SA-312TP304	S/40S
		Heat #:510713	
	Repad	Spec.: SA-240-304	0.5
		Heat #:857975	
Noz. MKD: M 6" 300#	Flange WN	Spec.: SA-182-F304	S/40S
		Heat #:5062	
	Pipe	Spec.: SA-312TP304	S/40S
		Heat #:510713	
	Repad	Spec.: SA-240-304	0.375
		Heat #:506754	
Noz. MKD: N1 20" 300#	Bld Flange	Spec.: SA-182-F304	
		Heat #:56666-2	
	Flange WN	Spec.: SA-182-F304	S/STD
		Heat #:33910	
	Pipe	Spec.: SA-240-304	S/STD
		Heat #:506324	
	Repad	Spec.: SA-240-304	0.625
		Heat #:X0T9	

Curtis Kelly A SPITZER COMPANY	Pressure Vessel Material Tabulation	Form Rev. 0 Rev. Date 06/04/12

Job. No.: 2132 Description/Type: Demethanizer, T-501 Dimensions: 42" I.D. x 60" I.D. x 98'-0" SM/SM

Component	Description	Specification/Heat No.:	Min. Thickness
Nozzles			
Noz. MKD: N2 20" 300#	Bld Flange	Spec.: SA-182-F304	
		Heat #:56613-2	
	Flange WN	Spec.: SA-182-F304	S/STD
		Heat #:33910	
	Pipe	Spec.: SA-240-304	S/STD
		Heat #:506324	
	Repad	Spec.: SA-240-304	0.75
		Heat #:E76249	
Noz. MKD: N3 20" 300#	Bld Flange	Spec.: SA-182-F304	
		Heat #:56613-2	
	Flange WN	Spec.: SA-182-F304	S/STD
		Heat #:33910	
	Pipe	Spec.: SA-240-304	S/STD
		Heat #:506324	
	Repad	Spec.: SA-240-304	0.5
		Heat #:857975	
Noz. MKD: N4 20" 300#	Bld Flange	Spec.: SA-182-F304	
		Heat #:544023	
	Flange WN	Spec.: SA-182-F304	S/STD
		Heat #:33910	
	Pipe	Spec.: SA-240-304	S/STD
		Heat #:506324	
	Repad	Spec.: SA-240-304	0.5
		Heat #:857975	
Noz. MKD: P 1" 300#	Flange LWN	Spec.: SA-182-F304	
		Heat #:M452	
Noz. MKD: Q1 1" 300#	Flange LWN	Spec.: SA-182-F304	
		Heat #:M452	
Noz. MKD: Q2 1" 300#	Flange LWN	Spec.: SA-182-F304	
		Heat #:AABAQ17	
Noz. MKD: Q3 1" 300#	Flange LWN	Spec.: SA-182-F304	
		Heat #:AABAQ17	
Noz. MKD: Q4 1" 300#	Flange LWN	Spec.: SA-182-F304	
		Heat #:AABAQ17	

FORT WORTH F & D HEAD CO
P.O. BOX 79700
FORT WORTH, TEXAS 76179-0700

COVER SHEET

A8C8-ARPS-2132-SA240-P-.7500 x 48 x 240

CUSTOMER	CUSTOMERS P.O. NUMBER	DATE
CURTIS KELLY INC	**2132005**	**1/19/18**

CODE LETTER	QTY.	SIZE-OD. OR ID.	THICKNESS	PLATE MFG.	HEAT NUMBER	SLAB NUMBER
ARPS BODY & SPLICE	**1**	**60"ID**	**3/4"NOM**	**NORTH AMERICAN**	**A8C8**	

COLD FORMED ☒

MATERIAL: **SA240-304/304L**

STYLE: **2:1 ELLIPTICAL**

SF: **2"**
BEVEL: **30 DEG**
DR: **54.27"**
MIN: **.6"**

OUTSIDE ☐ INSIDE BEVEL ☒

LAND ICR **10.36"**

WO# 193067

FORT WORTH F & D HEAD COMPANY CERTIFIES THAT HEADS MANUFACTURED FROM MATERIAL LISTED ON THIS REPORT COMPLY WITH ASME CODE SECTION II & SECTION VIII, DIVISION I. ALL HEADS COMPLY WITH UG-79 & UG-81 (a). NO SUBSEQUENT HEAT TREATMENT WAS PERFORMED.

po 2132-005

Roxanne L Taylor
FORT WORTH F & D HEAD CO.

Top Head

P-23142

NAS NORTH AMERICAN STAINLESS

METALLURGICAL TEST REPORT

6870 Highway 42 East
Ghent, KY 41045-9615
(502) 347-6000

Certificate: 693267 01 Mail To: Ship To:

Date: 12/09/2011 Page: 1

Customer: 0790 002

Steel: 304/304L

Finish: HRAP

Your Order: 31738 NAS Order: AN 0498673 08

Corrosion: ASTM A262/02aE;180Bend-OK

PRODUCT DESCRIPTION:

STAINLESS STEEL PLATE, HRAP; UNS 30400/30403
ASTM A240/11,A480/11,A666/10; ASME SA240/10,SA480/10,SA666/10
CHEM ONLY ON FOLLOWING ASTM: A276/10,A479/10a,A484/10,A312/09
CHEM ONLY ON FOLLOWING ASME: SA312/10,SA479/10
AMS5511H/5513J XMRK; MIL-S-5059D AMD3(X CRN MEAS); MIL-S-4043B
NACE MR0175/01, MR0103/07; QQS766D-A X MAG PERM
MIN. SOLUTION ANNEAL TEMP 1900F, WATER QUENCHED
ASTM A276 (Chemistry) ASTM A312 (Chemistry) NACE MR-01-75
EN 10204-3.1.B DIN 50049 AOD melt practice

REMARKS:

Mat'l is Free of Mercury Contamination. No weld repairs.
EN 10204:2004 3.1; QQS763F Cond A; RoHS Compliant
Material is Free of Radioactive Contamination
NAS Steel Making Process: EAF, AOD, & Cont. Casting
Product MFg.by a Quality Mgt.Sys. in Conf. w/ISO 9001
EN 10204 3.1

Product ID #	Coil #	Thickness	Width	Weight	--------Length--------	Mark	Pieces	COMMODITY CODE
07A8C8 GA	* 07A8C8 GA	.7500	48.0000	2,550	PLATE 240.00	S	1 -	ARPS

CHEMICAL ANALYSIS

CM(Country of Melt) ES(Spain) US(United States) ZA(South Africa) JP(Japan)

HEAT	CM	C	CR	CU	MN	MO	N	NI	P	S
A8C8	US	.0203	18.4090	.4525	1.7795	.3515	.0844	8.0070	.0398	.0010 - ARPS
		SI								
		.3385								

MECHANICAL PROPERTIES

Product ID #	Coil #	Loc	Dir	UTS KSI	.2% YS KSI	ELONG %-2"	Hard RB	A 262 Pr A	R of A %
07A8C8 GA	07A8C8 GA	P	T	86.94	37.91	68.00	82.00	OK	70.25 - ARPS

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 01-23-2017
THE SPITZER COMPANIES
Q.C. By JD.

Po 25392

NAS hereby certifies that the analysis on this certification is correct and the material meets the specifications stated.

Technical Dept. Mgr. ERIC HESS 12/09/2011

BOM #7 Formed HEAD

2132-005

BONDED INSPECTIONS
10817 Sanden Drive
Dallas, Texas 75238
972-276-0846 / 972-276-5048 Fax

REPORT NUMBER: 011817KP-G12

RADIOGRAPHIC EXAMINATION REPORT

CUSTOMER: FORT WORTH F&D HEAD COMPANY								JOB # / P.O. #:	DATE: 1/18/2017
ITEM DESCRIPTION: 193067								RADIOGRAPHER: MICHAEL TUDOR	APPROVED BY:
SERIAL #:	WELD #:	FILM:	ACC:	REJ:	DEF. CODE:	FILM DENSITY:	REMARKS:	LEVEL II: KEVIN POOR	LEVEL III:
-1		1-2	✓					BI. RT PROCEDURE: 1.0 REV. 17	
		2-3	✓					CODE:	ASME SECT. VIII DIVISION 1
		3-4	✓					100% OR RANDOM:	100%
		4-5	✓					ISOTOPE :	IR - 192
		5-6	✓					ISOTOPE PHYSICAL SIZE:	0.136"
		6-7	✓					X-RAY M.A.:	N/A
								X-RAY K.V.:	N/A
								X-RAY FOCAL SPOT SIZE:	N/A
								NO. OF EXPOSURES:	1
								NO. OF FILM PER HOLDER:	1
								BASE MATERIAL TYPE:	240-304
								DIAMETER:	60"
								THICKNESS:	0.750"
								WELD THICKNESS:	0.750"
								WELD REINFORCEMENT THICKNESS:	0"
								IQI TYPE:	B PACK
								IQI DESIGNATED HOLE OR WIRE:	# 8
								SHIM:	N/A
								EXPOSURE TIME:	8:15
								FILM SIZE:	4.5 X 17"
								MFR & FILM SPEED:	AGFA D7
								MIN. SOURCE TO OBJECT DISTANCE:	50"
								SOURCE SIDE OBJECT TO FILM DIST.:	0.750"
								SINGLE/ DOUBLE WALL EXPOSURE:	SINGLE
								SINGLE/ DOUBLE WALL VIEW:	SINGLE
								CHEMISTRY:	MANUAL 68*
								NUMBER OF TECHNICIANS:	2
								STANDBY TIME:	N/A
								REASON FOR STANDBY:	N/A
								TRAVEL TIME:	N/A
								START TIME:	N/A
								END TIME:	N/A

ADDITIONAL NOTES:

Discontinuity Terms and Abbreviations Codes

C.R= Crack	I.P= Incomplete Penetration
I.U= Internal Undercut	I.F= Incomplete Fusion
E.U= External Undercut	B.T= Burn Through
L.C= Low Crown	S.I= Slag Inclusion
S.B= Suck Back (Concave Root)	S.L= Slag Line
W.T= Wagon Tracks	P= Porosity

THIS DOCUMENT IS NOT A WARRANTY OR GUARANTY OF THE COMPONENTS, IT IS INTENDED TO PROVIDE INFORMATION AS TO THE CONDITION OF THE COMPONENT WHEN EXAMINED.

BONDED INSPECTIONS
10817 Sanden Drive
Dallas, TX 75238
972-276-0846 / 972-276-5048 FAX

REPORT NUMBER: 011817KP-G14

ULTRASONIC EXAMINATION REPORT

CUSTOMER:	FORT WORTH F&D HEAD CO.	CODE:	ASME SECT. VIII, DIVISION 1
DATE:	1/18/2017	MATERIAL TYPE:	STAINLESS STEEL
JOB# / P.O..#:	193067	MATERIAL THICKNESS:	0.750"
LOCATION:	FORT WORTH, TEXAS	SCANNING SURFACE(S):	1 SIDE
SPEC-BI:	1.0 REV. 12	SURFACE CONDITION:	<250 RMS
PROJECT:	WELD INSPECTION		

ID #	DESCRIPTION	ACC.	REJ.
	WO: 193067	✓	
	60" X 0.750" HEAD		
	ULTRASONIC INSPECTION PERFORMED		
	WITH SHEAR WAVE ON THE ABOVE		
	LISTED WELD TO LOCATE		
	POSSIBLE DEFECTS. WELD AREA		
	WAS SCANNED 100%.		
	NO RELEVANT INDICATIONS NOTED		
	UPON COMPLETION OF THIS INSPECTION.		

MACHINE AND CALIBRATION INFORMATION	
INSTRUMENT MODEL:	USM 35X
S/N:	11930a
CAL. DATE DUE:	5/7/2017
SOFTWARE VERSION:	N/A
DISPLAY TYPE:	A-SCAN
MAT VEL:	0.133
DELAY:	0.843"
DAMPENING:	HIGH
REJECT:	0
TRANS S/N:	N/A
TRANS SIZE:	0.500"
TRANS FREQ:	2.25 MHZ
ANGLE(S) USED:	45 & 60
COUPLANT USED:	ULTRAGEL
CABLE TYP. & LENGTH:	6' BNC TO MICRO
SPECIAL EQUIPMENT:	N/A
REFERENCE LEVEL (DB):	36 DB
SCANNING LEVEL (DB):	52 DB
CAL BLOCK TYPE & MAT:	ASME SDH / 0.750" THICK
REFERENCE BLOCK ID:	
REFERENCE BLOCK TYPE:	
D.A.C. OR T.C.G.	

REFLECTOR # AND SIZE:	TARGET SCR %:	SOUND PATH:

NOTES:

THIS DOCUMENT IS NOT A WARRANTY OR GUARANTY OF THE COMPONENTS. IT IS INTENDED TO PROVIDE INFORMATION AS TO THE CONDITION OF THE COMPONENT WHEN EXAMINED.

TRAVEL TIME:
START TIME:
END TIME:
STANDBY TIME:
REASON FOR STANDBY:

Glen Cooksy

GLEN COOKSY LEVEL II
LEVEL II

LEVEL III

FORM U-2A MANUFACTURER'S PARTIAL DATA REPORT (ALTERNATIVE FORM)
A Part of a Pressure Vessel Fabricated by One Manufacturer for Another Manufacturer
As Required by the Provisions of the ASME Boiler and Pressure Vessel Code Rules, Section VIII, Division 1

1. Manufactured and certified by: FORT WORTH F & D HEAD CO. 3040 E. PEDEN ROAD FORT WORTH, TEXAS 76179 (Name and address of Manufacturer)
2. Manufactured for: BUILT FOR STOCK (Name and address of Purchaser)
3. Location of installation: UNKNOWN (Name and address)
4. Type: 60" ID X .750 ELLIPSOIDAL HEAD (Description of vessel part (shell, two-piece head, tube bundle)) | 193067-1 (Manufacturer's serial No.) | XXX (CRN)
   XXX (National Board Number) | 193067 (Drawing No.) | N/A (Drawing prepared by) | 2017 (Year built)
5. ASME Code, Section VIII, Div. 1: 2015 EDITION [Edition and Addenda (if applicable) date] | XXX (Code Case Number) | N/A (Special Service per UG-120(d))
6. Shell: (a) No. of course(s): (b) Overall length (ft & in.):

Course(s)			Material	Thickness		Long Joint (Cat. A)			Circum. Joint (Cat. A, B & C)			Heat Treatment	
No.	Diameter, in.	Length (ft. & in.)	Spec./Grade or Type	Nom.	Corr.	Type	Full, Spot, None	Eff.	Type	Full, Spot, None	Eff.	Temp.	Time

Body Flanges on Shells									Bolting			
No.	Type	ID	OD	Flange Thk	Min Hub Thk	Material	How Attached	Location	Num & Size	Bolting Material	Washer (OD,ID,th)	Washer Material

7. Heads: (a) SA240-304/304L (NO HT) (Mat'l Spec. No., Grade or Type) (H.T.-Time &Temp) (b) (Mat'l Spec. No., Grade or Type) (H.T.-Time & Temp)

	Location (Top, Bottom, Ends)	Thickness		Radius		Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to Pressure		Category A		
		Min.	Corr.	Crown	Knuckle					Convex	Concave	Type	Full, Spot, None	Eff.
(a)		.600				2:1						1	FULL	
(b)														

Body Flanges on Heads									Bolting			
	Location	Type	I.D.	O.D.	Flange Thk	Min Hub Thk	Material	How Attached	Num & Size	Bolting Material	Washer (OD,ID,th)	Washer Material
(a)												
(b)												

8. MAWP N/A (internal) N/A (external) psi at max. temp N/A (internal) N/A (external) °F Min. design metal temp. N/A °F at N/A psi
9. Impact test NONE (Indicate yes or no and the component(s) impact tested) at test temperature of N/A °F.
10. Hydro., pneu., or comb. test press. NONE Proof test N/A
11. Nozzles, inspection, and safety valve openings:

Purpose (Inlet, Outlet, Drain, etc.)	No.	Diameter or Size	Type	Material		Nozzle Thickness		Reinforcement Material	Attachment Details		Location (Insp, Open)
				Nozzle	Flange	Nom.	Corr.		Nozzle	Flange	

12. Identification of part(s).

Name of part	Quantity	Line No.	Mfr's. Identification No.	Mfr's. Drawing No.	CRN	National Board No.	Year Built

13. Supports: Skirt XXX (Yes or No) Lugs XXX (No.) Legs XXX (No.) Others N/A (Describe) Attached XXX (Where and How)
14. Remarks 1. NO DESIGN FUNCTION PERFORMED 2. NO PRESSURE TESTING PERFORMED

CERTIFICATE OF SHOP/FIELD COMPLIANCE

We certify that the statements made in this report are correct and that all details of material, construction, and workmanship of this pressure vessel part conform to the ASME BOILER AND PRESSURE VESSEL CODE Section VIII, Division 1. U Certificate of Authorization No. 10625 Expires 09/07/2017

Date 1/19/17 Name FORT WORTH F & D HEAD CO. (Manufacturer) Signed (Representative)

CERTIFICATE OF SHOP/FIELD INSPECTION

I, the undersigned, holding a valid commission issued by The National Board of Boiler and Pressure Vessel Inspectors and employed by OneCIS Insurance Company of Lynn, MA have inspected the pressure vessel part described in this Manufacturer's Data Report on JAN 19, 2017, and state that, to the best of my knowledge and belief, the Manufacturer has constructed this pressure vessel part in accordance with ASME BOILER AND PRESSURE VESSEL CODE, Section VIII, Division 1. By signing this certificate neither the Inspector nor his/her employer makes any warranty, expressed or implied, concerning the pressure vessel part described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his/her employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date 1-19-17 Signed (Authorized Inspector) Commissions NB# 9757 [National Board (including endorsements)]

07/14

FORT WORTH F & D HEAD CO
P.O. BOX 79700
FORT WORTH, TEXAS 76179-0700

COVER SHEET

CUSTOMER		CUSTOMERS P.O. NUMBER		DATE		
CURTIS KELLY INC.		**2132005**		**11/22/16**		
CODE LETTER	QTY.	SIZE-OD. OR ID.	THICKNESS	PLATE MFG.	HEAT NUMBER	SLAB NUMBER
CFEU ✓	**1** ✓	**42"ID** ✓	**5/8"NOM**	**SSAB**	**W6X0** ✓	

COLD FORMED ☒

MATERIAL: **SA240-304/304L**

STYLE: **2:1 ELLIPTICAL**

SF: **2"**
BEVEL: **30 DEG**
DR: **37.99"**
MIN: **.42"**

OUTSIDE ☐ INSIDE BEVEL ☒

LAND ICR **7.25"**

WO# 193066

FORT WORTH F & D HEAD COMPANY CERTIFIES THAT HEADS MANUFACTURED FROM MATERIAL LISTED ON THIS REPORT COMPLY WITH ASME CODE SECTION II & SECTION VIII, DIVISION I. ALL HEADS COMPLY WITH UG-79 & UG-81 (a). NO SUBSEQUENT HEAT TREATMENT WAS PERFORMED.

Roxanne L Taylor
FORT WORTH F & D HEAD CO

po 2132-005

Bottom Head

W6X0-2132-SA240-P-.6250 x 60 x 240

P-30994

NORTH AMERICAN STAINLESS

METALLURGICAL TEST REPORT

6870 Highway 42 East
Ghent, KY 41045-9615
(502) 347-6000

1 OF 2

Certificate: 100920 03

Customer: 2830 023

Mail To:
ROLLED ALLOYS
6555 SOUTH 57TH WEST AVENUE
TULSA, OK 74131

Ship To:
ROLLED ALLOYS
6555 SOUTH 57TH WEST AVENUE
TULSA, OK 74131

Date: 10/03/2015 Page: 1

Steel: 304/304L

Finish: HRAP

Your Order: 0129005 NAS Order: AN 0673958 04 Corrosion: ASTM A262/14 A

PRODUCT DESCRIPTION:

STAINLESS STEEL PLATE, HRAP; UNS 30400/30403
ASTM A240/15a,A480/14b,A666/15;ASME SA240/13,SA480/13a,SA666/13
CHEM ONLY ON FOLLOWING ASTM: A276/13,A479/13a,A484/13a,A312/13
CHEM ONLY ON FOLLOWING ASME: SA312/13,SA479/13
AMS 5511H/5513J XRFK; MIL-S-5059D AMD3(X CRH REQS); MIL-S-4043B
NACE MR0175/ISO 15156-3:2009 A, MR0103/07;QQS766D-A X MRG PERM
MIN. SOLUTION ANNEAL TEMP 1900F, WATER QUENCHED

REMARKS:

Mat'l is Free of Mercury Contamination. No weld repairs.
EN 10204:2004 3.1; RoHS 1 & 2 Compliant
Material is Free of Radioactive Contamination
Steel Making Process: EAF, AOD, & Cont. Casting
Product Mfg.by a Quality Mgt.Sys. in Conf. w/ISO 9001
*Melted & Manufactured in the USA; Mat'l is DFARs Compliant

Product ID #	Coil #	Thickness	Width	Weight	---------Length--------	Mark	Pieces	COMMODITY CODE
01W6X0 DA	* 01W6X0 DA	.6250	60.0000	2,650	PLATE	240.00	4	1 - CFEU

Lab Accreditation Bureau, ISO/IEC 17025, Certificate# L2323

CHEMICAL ANALYSIS

CM(Country of Melt) ES(Spain) US(United States) ZA(South Africa) JP(Japan)

Chemical analysis per ASTM A751/08

HEAT	CM	C %	CO %	CR %	CU %	MN %	MO %	N %	NI %	P %
W6X0	US	.0161	.1400	18.0940	.4385	1.8335	.3390	.0863	8.0350	.0330 - CFEU

S %	SI %
.0010	.3370

Chemical & Physical Tests
Reviewed and Accepted
By KR Date 12-14-2016

THE SPITZER COMPANIES

MECHANICAL PROPERTIES

Product ID #	Coil #	Ht Dir	UTS KSI	20C .2% YS KSI	20C ELONG % %-2"	Hard RB	A 262 Pr A	R of A %
01W6X0 DA	01W6X0 DA	F T	85.10	38.20	61.90	82.00	OK	69.38 - CFEU

PMI VERIFIED BY:

Receiving Inspection
By: M Reynolds
Date: 10/9/15

PO 39130 Q.C. By J.D

HEAT # W6X0

TRACER # 0463518IR

NAS hereby certifies that the analysis on this certification is correct. Based upon th... ...ults and the accuracy of the test methods used, the material meets the specifications stated. These results relate only to the items tested and this report cannot be reproduced, except in its entirety, without the written approval of NAS.

Technical Dept. Mgr. Abhijeet Bhave 10/03/2015

PO 2132-005

Bom#6: Formed Head

outokumpu
high performance stainless steel

Outokumpu Stainless Plate, LLC

Certificate of Analysis and Tests

862665-4AA-2132-SA240-P-.5000 x 120 x 133

OUR ORDER 0293674 - 01 HEAT & PIECE 862665-4AA 12/07/16

SOLD TO: ROLLED ALLOYS
P O BOX 310
TEMPERANCE MI 48182

SHIP TO: ROLLED ALLOYS INC
9818 EAST HARDY ROAD
PH:713-691-4967
HOUSTON TX 77093

---------- YOUR ORDER & DATE ----------
0142629-HOU 11/01/16

---------- ITEM DESCRIPTION ----------
HEAT & PIECE 862665 - 4AA
WEIGHT 2410
FINISH 1
GRADE 304L / 304 UNS-S30403 / UNS-S30400
DIMENSIONS .500 X 120.000 X 133.518 EXACT

---------- SPECIFICATIONS ----------
*** MFG IN NEW CASTLE, IN, USA
AMS 5511H WITH EXCEPTIONS
ASTM A240-16 ASME SA240-15ED
ROLLED ALLOYS SPECS 304L/304
MEETS EU ELECTRICAL ROHS
DFAR 252.225-7009
ASTM A262-15 PRACTICE E
NO WELD REPAIRS

FROM SLABS IMPORTED FROM BRITAIN
AMS 5513J WITH EXCEPTIONS
ASTM A480-14B ASMESA480 15ED
NAFTA CTRY ORIGIN= SLAB CTRY
LIST HEAT/PCE/SIZE ON INVCE
ASTM A262-15 PRACTICE A
NO GRIPPER MARKS

PLATES & TEST PCS SOLUTION ANNEALED @ 1900 DEGREES FAHRENHEIT MINIMUM.
THEN WATER COOLED OR RAPIDLY COOLED BY AIR
FREE FROM MERCURY CONTAMINATION AT CURRENT DETECTION LIMITS
HOT ROLLED, ANNEALED & PICKLED (HRAP)

---------- MECHANICAL & OTHER TESTS ----------

HARDNESS HRBW	83
GRAIN SIZE	6
YIELD STRENGTH (PSI)	40010
TENSILE STRENGTH (PSI)	83570
BEND	OK
INTERGRANULAR CORROSION	OK
ELONGATION % IN 2"	54.2
REDUCTION OF AREA %	58.7

---------- CHEMICAL COMPOSITION ----------

CARBON	(C)	.020
MANGANESE	(MN)	1.57
PHOSPHORUS	(P)	.033
SULFUR	(S)	.001
SILICON	(SI)	.31
CHROMIUM	(CR)	18.05
NICKEL	(NI)	8.12
COBALT	(CO)	.16
COPPER	(CU)	.69
MOLY	(MO)	.35
NITROGEN	(N)	.07
COLUMBIUM	(CB)	.014
TITANIUM	(TI)	.003
ALUMINUM	(AL)	.006
TIN	(SN)	.011
TANTALUM	(TA)	.001
PB	(PB)	.001

ROLLED ALLOYS
Receiving Inspection
By:
Date:
HEAT # 862665
TRACER # 0496117US
0494235US

Chemical & Physical Tests
Reviewed and Accepted
By KR Date 01-25-2017
THE SPITZER COMPANIES

WE HEREBY CERTIFY THAT THE MATERIAL HEREIN HAS BEEN MADE, SUPPLIED, AND TESTED IN ACCORDANCE WITH THE LISTED SPECIFICATION(S) AND THAT THE RESULTS OF ALL TESTS AND INSPECTIONS ARE ACCEPTABLE.

JAMES DOUBMAN, QUALITY ASSURANCE MANAGER

CERTIFICATE IN CONFORMANCE WITH EN10204-95 3.1.B/EN10204-2004 3.1

Outokumpu Stainless Plate, LLC
549 West State Road 38
New Castle, Indiana 47362

po 2132008

Bom #4

Shell #1

1/1

outokumpu
high performance stainless steel

Outokumpu Stainless Plate, LLC

Certificate of Analysis and Tests

862665-4A-2132-SA240-P-.5000 x 120 x 133

OUR ORDER 0293674 - 01 HEAT & PIECE 862665-4A 12/07/16

SOLD TO: ROLLED ALLOYS
P O BOX 310
TEMPERANCE MI 48182

SHIP TO: ROLLED ALLOYS INC
9818 EAST HARDY ROAD
PH:713-691-4967
HOUSTON TX 77093

YOUR ORDER & DATE
0142629-HOU 11/01/16

ITEM DESCRIPTION			
HEAT & PIECE	862665 - 4A		
WEIGHT	2410		
FINISH	1		
GRADE	304L / 304		UNS-S30403 / UNS-S30400
DIMENSIONS	.500	X 120.000 X	133.518 EXACT

SPECIFICATIONS

*** MFG IN NEW CASTLE, IN, USA
AMS 5511H WITH EXCEPTIONS
ASTM A240-16 ASME SA240-15ED
ROLLED ALLOYS SPECS 304L/304
MEETS EU ELECTRICAL ROHS
DFAR 252.225-7009
ASTM A262-15 PRACTICE E
NO WELD REPAIRS

FROM SLABS IMPORTED FROM BRITAIN
AMS 5513J WITH EXCEPTIONS
ASTM A480-14B ASMESA480 15ED
NAFTA CTRY ORIGIN= SLAB CTRY
LIST HEAT/PCE/SIZE ON INVCE
ASTM A262-15 PRACTICE A
NO GRIPPER MARKS

PLATES & TEST PCS SOLUTION ANNEALED @ 1900 DEGREES FAHRENHEIT MINIMUM.
THEN WATER COOLED OR RAPIDLY COOLED BY AIR
FREE FROM MERCURY CONTAMINATION AT CURRENT DETECTION LIMITS
HOT ROLLED, ANNEALED & PICKLED (HRAP)

MECHANICAL & OTHER TESTS	
HARDNESS HRBW	83
GRAIN SIZE	6
YIELD STRENGTH (PSI)	40010
TENSILE STRENGTH (PSI)	83570
BEND	OK
INTERGRANULAR CORROSION	OK
ELONGATION % IN 2"	54.2
REDUCTION OF AREA %	58.7

CHEMICAL COMPOSITION		
CARBON	(C)	.020
MANGANESE	(MN)	1.57
PHOSPHORUS	(P)	.033
SULFUR	(S)	.001
SILICON	(SI)	.31
CHROMIUM	(CR)	18.05
NICKEL	(NI)	8.12
COBALT	(CO)	.16
COPPER	(CU)	.69
MOLY	(MO)	.35
NITROGEN	(N)	.07
COLUMBIUM	(CB)	.014
TITANIUM	(TI)	.003
ALUMINUM	(AL)	.006
TIN	(SN)	.011
TANTALUM	(TA)	.001
PB	(PB)	.001

ROLLED ALLOYS
Receiving Inspection
By:
Date: 12/12

HEAT # 862665

TRACER # 0496121US

0494234US

Chemical & Physical Tests
Reviewed and Accepted
By RA Date 01-25-2017
THE SPITZER COMPANIES

ROLLED ALLOYS
Receiving Inspection
By: AV
Date: 1/13/17

WE HEREBY CERTIFY THAT THE MATERIAL HEREIN HAS BEEN MADE, SUPPLIED, AND TESTED IN ACCORDANCE WITH THE LISTED SPECIFICATION(S) AND THAT THE RESULTS OF ALL TESTS AND INSPECTIONS ARE ACCEPTABLE.

James Doubman

JAMES DOUBMAN,QUALITY ASSURANCE MANAGER

CERTIFICATE IN CONFORMANCE WITH EN10204-95 3.1.B/EN10204-2004 3.1

Outokumpu Stainless Plate, LLC
549 West State Road 38
New Castle, Indiana 47362

po 2132-C08

Bon #4

Shell # 2

outokumpu
high performance stainless steel

Outokumpu Stainless Plate, LLC

Certificate of Analysis and Tests

862665-3A-2132-SA240-P-.5000 x 120 x 133

OUR ORDER 0293674 - 01 HEAT & PIECE 862665-3A 12/07/16

SOLD TO: ROLLED ALLOYS
P O BOX 310
TEMPERANCE MI 48182

SHIP TO: ROLLED ALLOYS INC
9818 EAST HARDY ROAD
PH:713-691-4967
HOUSTON TX 77093

---------- YOUR ORDER & DATE ----------

0142629-HOU 11/01/16

---------- ITEM DESCRIPTION ----------

HEAT & PIECE 862665 - 3A
WEIGHT 2410
FINISH 1
GRADE 304L / 304 UNS-S30403 / UNS-S30400
DIMENSIONS .500 X 120.000 X 133.518 EXACT

---------- SPECIFICATIONS ----------

*** MFG IN NEW CASTLE, IN, USA
AMS 5511H WITH EXCEPTIONS
ASTM A240-16 ASME SA240-15ED
ROLLED ALLOYS SPECS 304L/304
MEETS EU ELECTRICAL ROHS
DFAR 252.225-7009
ASTM A262-15 PRACTICE E
NO WELD REPAIRS

FROM SLABS IMPORTED FROM BRITAIN
AMS 5513J WITH EXCEPTIONS
ASTM A480-14B ASMESA480 15ED
NAFTA CTRY ORIGIN= SLAB CTRY
LIST HEAT/PCE/SIZE ON INVCE
ASTM A262-15 PRACTICE A
NO GRIPPER MARKS

PLATES & TEST PCS SOLUTION ANNEALED @ 1900 DEGREES FAHRENHEIT MINIMUM.
THEN WATER COOLED OR RAPIDLY COOLED BY AIR
FREE FROM MERCURY CONTAMINATION AT CURRENT DETECTION LIMITS
HOT ROLLED, ANNEALED & PICKLED (HRAP)

---------- MECHANICAL & OTHER TESTS ----------

HARDNESS HRBW	83
GRAIN SIZE	6
YIELD STRENGTH (PSI)	40010
TENSILE STRENGTH (PSI)	83570
BEND	OK
INTERGRANULAR CORROSION	OK
ELONGATION % IN 2"	54.2
REDUCTION OF AREA %	58.7

---------- CHEMICAL COMPOSITION ----------

CARBON	(C)	.020
MANGANESE	(MN)	1.57
PHOSPHORUS	(P)	.033
SULFUR	(S)	.001
SILICON	(SI)	.31
CHROMIUM	(CR)	18.05
NICKEL	(NI)	8.12
COBALT	(CO)	.16
COPPER	(CU)	.69
MOLY	(MO)	.35
NITROGEN	(N)	.07
COLUMBIUM	(CB)	.014
TITANIUM	(TI)	.003
ALUMINUM	(AL)	.006
TIN	(SN)	.011
TANTALUM	(TA)	.001
PB	(PB)	.001

ROLLED ALLOYS
Receiving Inspection
By:
Date: 12/13

HEAT # 862665

Chemical & Physical Te
Reviewed and Accepte
By RR Date 01-25-2017
THE SPITZER COMPANIES

TRACER # 0496124US
0494228US

WE HEREBY CERTIFY THAT THE MATERIAL HEREIN HAS BEEN MADE, SUPPLIED, AND TESTED IN ACCORDANCE WITH THE LISTED SPECIFICATION(S) AND THAT THE RESULTS OF ALL TESTS AND INSPECTIONS ARE ACCEPTABLE.

JAMES DOUBMAN, QUALITY ASSURANCE MANAGER

CERTIFICATE IN CONFORMANCE WITH EN10204-95 3.1.B/EN10204-2004 3.1

Outokumpu Stainless Plate, LLC
549 West State Road 38
New Castle, Indiana 47362

P.O. 2132-008 BOM # 4
Shell #3

outokumpu
high performance stainless steel

Outokumpu Stainless Plate, LLC

Certificate of Analysis and Tests

862665-3AA-2132-SA240-P-.5000 x 120 x 133

OUR ORDER 0293674 - 01 HEAT & PIECE 862665-3AA 12/07/16

SOLD TO: ROLLED ALLOYS
P O BOX 310
TEMPERANCE MI 48182

SHIP TO: ROLLED ALLOYS INC
9818 EAST HARDY ROAD
PH:713-691-4967
HOUSTON TX 77093

---------- YOUR ORDER & DATE ----------

0142629-HOU 11/01/16

---------- ITEM DESCRIPTION ----------

HEAT & PIECE 862665 - 3AA
WEIGHT 2410
FINISH 1
GRADE 304L / 304 UNS-S30403 / UNS-S30400
DIMENSIONS .500 X 120.000 X 133.518 EXACT

---------- SPECIFICATIONS ----------

*** MFG IN NEW CASTLE, IN, USA
AMS 5511H WITH EXCEPTIONS
ASTM A240-16 ASME SA240-15ED
ROLLED ALLOYS SPECS 304L/304
MEETS EU ELECTRICAL ROHS
DFAR 252.225-7009
ASTM A262-15 PRACTICE E
NO WELD REPAIRS

FROM SLABS IMPORTED FROM BRITAIN
AMS 5513J WITH EXCEPTIONS
ASTM A480-14B ASMESA480 15ED
NAFTA CTRY ORIGIN= SLAB CTRY
LIST HEAT/PCE/SIZE ON INVCE
ASTM A262-15 PRACTICE A
NO GRIPPER MARKS

PLATES & TEST PCS SOLUTION ANNEALED @ 1900 DEGREES FAHRENHEIT MINIMUM.
THEN WATER COOLED OR RAPIDLY COOLED BY AIR
FREE FROM MERCURY CONTAMINATION AT CURRENT DETECTION LIMITS
HOT ROLLED, ANNEALED & PICKLED (HRAP)

---------- MECHANICAL & OTHER TESTS ----------

HARDNESS HRBW	83
GRAIN SIZE	6
YIELD STRENGTH (PSI)	40010
TENSILE STRENGTH (PSI)	83570
BEND	OK
INTERGRANULAR CORROSION	OK
ELONGATION % IN 2"	54.2
REDUCTION OF AREA %	58.7

---------- CHEMICAL COMPOSITION ----------

CARBON	(C)	.020
MANGANESE	(MN)	1.57
PHOSPHORUS	(P)	.033
SULFUR	(S)	.001
SILICON	(SI)	.31
CHROMIUM	(CR)	18.05
NICKEL	(NI)	8.12
COBALT	(CO)	.16
COPPER	(CU)	.69
MOLY	(MO)	.35
NITROGEN	(N)	.07
COLUMBIUM	(CB)	.014
TITANIUM	(TI)	.003
ALUMINUM	(AL)	.006
TIN	(SN)	.011
TANTALUM	(TA)	.001
PB	(PB)	.001

ROLLED ALLOYS Receiving Inspection
By:
Date: 12/13

HEAT # 862665

TRACER # 0496123US
0494231US

Chemical & Physical Test
Reviewed and Accepted
By RR Date 01-25-2017
THE SPITZER COMPANIES

ROLLED ALLOYS Receiving Inspecti
By:
Date: 01/13/17

WE HEREBY CERTIFY THAT THE MATERIAL HEREIN HAS BEEN MADE, SUPPLIED, AND TESTED IN ACCORDANCE WITH THE LISTED SPECIFICATION(S) AND THAT THE RESULTS OF ALL TESTS AND INSPECTIONS ARE ACCEPTABLE.

JAMES DOUBMAN, QUALITY ASSURANCE MANAGER

CERTIFICATE IN CONFORMANCE WITH EN10204-95 3.1.B/EN10204-2004 3.1

Outokumpu Stainless Plate, LLC
549 West State Road 38
New Castle, Indiana 47362

po 2132-008

BOM # 4

Shell #4

outokumpu
high performance stainless steel

Outokumpu Stainless Plate, LLC

Certificate of Analysis and Tests

862665-2A-2132-SA240-P-.5000 x 120 x 133

OUR ORDER 0293674 - 01 HEAT & PIECE 862665-2A 12/07/16

SOLD TO: ROLLED ALLOYS
P O BOX 310
TEMPERANCE MI 48182

SHIP TO: ROLLED ALLOYS INC
9818 EAST HARDY ROAD
PH:713-691-4967
HOUSTON TX 77093

YOUR ORDER & DATE
0142629-HOU 11/01/16

ITEM DESCRIPTION			
HEAT & PIECE	862665 - 2A		
WEIGHT	2410		
FINISH	1		
GRADE	304L / 304		UNS-S30403 / UNS-S30400
DIMENSIONS	.500 X 120.000	X 133.518	EXACT

SPECIFICATIONS	
*** MFG IN NEW CASTLE, IN, USA	FROM SLABS IMPORTED FROM BRITAIN
AMS 5511H WITH EXCEPTIONS	AMS 5513J WITH EXCEPTIONS
ASTM A240-16 ASME SA240-15ED	ASTM A480-14B ASMESA480 15ED
ROLLED ALLOYS SPECS 304L/304	NAFTA CTRY ORIGIN= SLAB CTRY
MEETS EU ELECTRICAL ROHS	LIST HEAT/PCE/SIZE ON INVCE
DFAR 252.225-7009	ASTM A262-15 PRACTICE A
ASTM A262-15 PRACTICE E	NO GRIPPER MARKS
NO WELD REPAIRS	

PLATES & TEST PCS SOLUTION ANNEALED @ 1900 DEGREES FAHRENHEIT MINIMUM.
THEN WATER COOLED OR RAPIDLY COOLED BY AIR
FREE FROM MERCURY CONTAMINATION AT CURRENT DETECTION LIMITS
HOT ROLLED, ANNEALED & PICKLED (HRAP)

MECHANICAL & OTHER TESTS	
HARDNESS HRBW	83
GRAIN SIZE	6
YIELD STRENGTH (PSI)	40010
TENSILE STRENGTH (PSI)	83570
BEND	OK
INTERGRANULAR CORROSION	OK
ELONGATION % IN 2"	54.2
REDUCTION OF AREA %	58.7

CHEMICAL COMPOSITION		
CARBON	(C)	.020
MANGANESE	(MN)	1.57
PHOSPHORUS	(P)	.033
SULFUR	(S)	.001
SILICON	(SI)	.31
CHROMIUM	(CR)	18.05
NICKEL	(NI)	8.12
COBALT	(CO)	.16
COPPER	(CU)	.69
MOLY	(MO)	.35
NITROGEN	(N)	.07
COLUMBIUM	(CB)	.014
TITANIUM	(TI)	.003
ALUMINUM	(AL)	.006
TIN	(SN)	.011
TANTALUM	(TA)	.001
PB	(PB)	.001

ROLLED ALLOYS
Receiving Inspection
By: [signature]
Date: 12/13

HEAT # 862665

Chemical & Physical Tested
Reviewed and Accepted
By RR Date 01-25-2017
THE SPITZER COMPANIES

TRACER # 0496119US
0494224US

ROLLED ALLOYS
Receiving Inspectio
By: [signature]
Date: 12/13/17

WE HEREBY CERTIFY THAT THE MATERIAL HEREIN HAS BEEN MADE, SUPPLIED, AND TESTED IN ACCORDANCE WITH THE LISTED SPECIFICATION(S) AND THAT THE RESULTS OF ALL TESTS AND INSPECTIONS ARE ACCEPTABLE.

James Doubman

JAMES DOUBMAN,QUALITY ASSURANCE MANAGER

CERTIFICATE IN CONFORMANCE WITH EN10204-95 3.1.B/EN10204-2004 3.1

Outokumpu Stainless Plate, LLC
549 West State Road 38
New Castle, Indiana 47362

po 2132-008

Ban #4
Shell #5

1/1

outokumpu
high performance stainless steel

Outokumpu Stainless Plate, LLC

Certificate of Analysis and Tests

862665-2AA-2132-SA240-P-.5000 x 120 x 133

OUR ORDER 0293674 - 01 HEAT & PIECE 862665-2AA 12/07/16

SOLD TO: ROLLED ALLOYS
P O BOX 310
TEMPERANCE MI 48182

SHIP TO: ROLLED ALLOYS INC
9818 EAST HARDY ROAD
PH:713-691-4967
HOUSTON TX 77093

YOUR ORDER & DATE
0142629-HOU 11/01/16

ITEM DESCRIPTION			
HEAT & PIECE	862665 - 2AA		
WEIGHT	2410		
FINISH	1		
GRADE	304L / 304	UNS-S30403 / UNS-S30400	
DIMENSIONS	.500 X 120.000	X 133.518	EXACT

SPECIFICATIONS

*** MFG IN NEW CASTLE, IN, USA
AMS 5511H WITH EXCEPTIONS
ASTM A240-16 ASME SA240-15ED
ROLLED ALLOYS SPECS 304L/304
MEETS EU ELECTRICAL ROHS
DFAR 252.225-7009
ASTM A262-15 PRACTICE E
NO WELD REPAIRS

FROM SLABS IMPORTED FROM BRITAIN
AMS 5513J WITH EXCEPTIONS
ASTM A480-14B ASMESA480 15ED
NAFTA CTRY ORIGIN= SLAB CTRY
LIST HEAT/PCE/SIZE ON INVCE
ASTM A262-15 PRACTICE A
NO GRIPPER MARKS

PLATES & TEST PCS SOLUTION ANNEALED @ 1900 DEGREES FAHRENHEIT MINIMUM.
THEN WATER COOLED OR RAPIDLY COOLED BY AIR
FREE FROM MERCURY CONTAMINATION AT CURRENT DETECTION LIMITS
HOT ROLLED, ANNEALED & PICKLED (HRAP)

MECHANICAL & OTHER TESTS

HARDNESS HRBW	83
GRAIN SIZE	6
YIELD STRENGTH (PSI)	40010
TENSILE STRENGTH (PSI)	83570
BEND	OK
INTERGRANULAR CORROSION	OK
ELONGATION % IN 2"	54.2
REDUCTION OF AREA %	58.7

CHEMICAL COMPOSITION

CARBON	(C)	.020
MANGANESE	(MN)	1.57
PHOSPHORUS	(P)	.033
SULFUR	(S)	.001
SILICON	(SI)	.31
CHROMIUM	(CR)	18.05
NICKEL	(NI)	8.12
COBALT	(CO)	.16
COPPER	(CU)	.69
MOLY	(MO)	.35
NITROGEN	(N)	.07
COLUMBIUM	(CB)	.014
TITANIUM	(TI)	.003
ALUMINUM	(AL)	.006
TIN	(SN)	.011
TANTALUM	(TA)	.001
PB	(PB)	.001

ROLLED ALLOYS
Receiving Inspection
By:
Date: 12/13

HEAT # 862665

TRACER # 0496122US

0494226US

Chemical & Physical Test
Reviewed and Accepted
By RR Date 01-25-2017
THE SPITZER COMPANIES

WE HEREBY CERTIFY THAT THE MATERIAL HEREIN HAS BEEN MADE, SUPPLIED, AND TESTED IN ACCORDANCE WITH THE LISTED SPECIFICATION(S) AND THAT THE RESULTS OF ALL TESTS AND INSPECTIONS ARE ACCEPTABLE.

James Doubman

JAMES DOUBMAN, QUALITY ASSURANCE MANAGER

CERTIFICATE IN CONFORMANCE WITH EN10204-95 3.1.B/EN10204-2004 3.1

Outokumpu Stainless Plate, LLC
549 West State Road 38
New Castle, Indiana 47362

po 2132-008

Bonney
Shell #6

848032-2132-SA240-P-.5000 x 96 x 206 (SHELL)

ATI
Flat Rolled Products

500 Green Street
Washington, PA 15301

Certificate of Test

Stephen Wolff - Director, Corporate Quality Assurance

Mill Information		Customer Information	
Cert Number	0154928-00	Name	ROLLED ALLOYS INC
Sales Order	50-086-067	PO	0139948-TUL
Cert Date	Aug-10-2016	PO Date	Aug-05-2016

Sold to: ROLLED ALLOYS INC
PO BOX 310
TEMPERANCE, MI 48182

Ship to: ROLLED ALLOYS LP
6555 SOUTH 57TH W AVE
TULSA, OK 74131

Material Information

"ATI 304/304L" STAINLESS STEEL
PMP HOT ROLLED PLATE ANNEALED PICKLED COMMERCIAL CUT EDGE

ASTM-A-240-16	ASME-SA-240 ED 2015
ASTM-A-666-15	AMS 5513J
AMS 5511H R2013	UNS S30403
UNS S30400	ASTM-A-262-14 PRA E/SCREEN PRA A
NACE MR0175/ISO 15156-3:2015	DIN EN 10204:2005 3.1 CERTIFICATE

Piece Information

	Gauge	Width	Length					Total Wt
Pcs	(in)	(in)	(in)	Heat #	Piece ID	Section Id	Lot #	(lbs)
Item: 001	Cust-Id: 0003864 Cust-Job:			Govt-Contract-#: ScheduleB:			Govt-DO-Rating:	
1	.5000	96.0000	206.0000	848032	CD51191	---	454813	2975

Chemistry Testing

Element (wt %)	Requirements Min	Requirements Max	Final Heat Analysis 848032	Loc
C	---	.030	.021	BN
MN	---	2.00	1.49	BN
P	---	.040	.033	BN
S	---	.030	< .001	BN
SI	---	.75	.30	BN
CR	18.00	19.50	18.27	BN
NI	8.00	10.50	8.11	BN
MO	---	.75	.38	BN
CU	---	.75	.44	BN
N	---	.10	.08	BN

Chemical & Physical Tests
Reviewed and Accepted
By KR Date 01-25-2017
THE SPITZER COMPANIES

HEAT # 848032
TRACER # 0496784US
0486350US

Receiving Inspection
By: R. Cymbols
Date: 8/16/16

po 2132-008

Receiving Inspection
By: AJ
Date: 01/25/17
Bom #-3 - Shell Can #7

ALC720 08/10/2016 13:16:27

848032-2132-SA240-P-.5000 x 96 x 206 (SHELL)

ATI
Flat Rolled Products

500 Green Street
Washington, PA 15301

Certificate of Test

Stephen Wolff - Director, Corporate Quality Assurance

Mill Information		Customer Information	
Cert Number	0154928-00	Name	ROLLED ALLOYS INC
Sales Order	50-086-067	PO	0139948-TUL
Cert Date	Aug-10-2016	PO Date	Aug-05-2016

Chemistry Testing

ATI Flat Rolled Products performs chemical analysis by following techniques
for testing locations TC,BN,MI, & LO:
C, S by combustion/infrared; N, O, H by inert fusion/thermal conductivity;
Mn, P, Si, Cr, Ni, Mo, Cu, Cb, Co, V, by WDXRF; Pb, Bi, Ag by GFAA;
B by OES; Al and Ti (>=0.10%) by WDXRF, otherwise by OES.

848032 - Material was produced by EF melting with AOD refining.

Mechanical Testing

		LOT 454813	
Condition:		ANNEALED	
Direction:		TRANSVERSE	
Temperature:		ROOM TEMP	
Spec:			
Test Limit	Units	Result	Loc
YIELD 0.2%	psi	42700.	TC
TENSILE	psi	86200.	TC
ELONGATION	%	65.	TC
RED OF AREA	%	80.	TC
HARDNESS	---	167. HBW	TC

Bend test passed per periodic test requirement.

Mechanical Property Requirements

Condition:		ANNEALED	
Direction:		TRANSVERSE	
Temperature:		ROOM TEMP	
Spec:			
Test Limit	Units	Min	Max
YIELD 0.2%	psi	30000.	---
TENSILE	psi	75000.	100000.
ELONGATION	%	40.	---
RED OF AREA	%	---	---
HARDNESS	---	---	201. HBW

HEAT # 848032
TRACER # 0496784US

0486350

ALC720 08/10/2016 13:16:27

848032-2132-SA240-P-.5000 x 96 x 206 (SHELL)

ATI Flat Rolled Products

500 Green Street
Washington, PA 15301

Certificate of Test

Stephen Wolff - Director, Corporate Quality Assurance

Mill Information		Customer Information	
Cert Number	0154928-00	Name	ROLLED ALLOYS INC
Sales Order	50-086-067	PO	0139948-TUL
Cert Date	Aug-10-2016	PO Date	Aug-05-2016

Corrosion Testing

Test ID	Result Name	Test Result	Wt Loss	Units	Visual Exam	Pit Depth	Units	Bend	Loc	Requirements
LOT 454813	A-262 E/SCR A	DUAL	---	---	---	---	---	---	TC	---

Metallography - General

Test ID	Result Name	Condition	Test Result	Loc	Requirements
454813	GRAIN SIZE	ANNEALED	5.	TC	---

Certification Statements

Material does not have a continuous carbide network.

Material was solution annealed at 1900F (1038C) minimum for a time commensurate with thickness and rapidly cooled with air or water.

ATI Flat Rolled Products does not use mercury in the testing or production of its products.

Material is of USA melt and manufacture.

No welds/weld repairs performed.

Knowingly and willfully recording any false, fictitious or fraudulent statement or entry on this document may be punished as a felony under Federal Statutes, including Federal Law, Title 18, Chapter 47.

DIN EN 10204:2005 - ATI Flat Rolled Products is approved as a manufacturer according to Pressure Equipment Directive PED 2014/68/EU.

EN 10204:2005 3.1 Certificate.

General Statements

TESTING WAS PERFORMED AT THE FOLLOWING LOCATIONS
BN = ATI FLAT ROLLED PRODUCTS; 100 River Road; Brackenridge, PA 15014
TC = ATI FLAT ROLLED PRODUCTS; 1300 Pacific Avenue; Natrona Heights, PA 15065
WARNING: Processing that makes fumes, dust, or solutions may cause lung disease. Please see Safety Data Sheet for further information which has been supplied to your Purchasing Department. For an additional copy, please refer to our website at:
www.atimetals.com/business/ATIFlatRolledProducts/Tools/Pages/Safety-and-MSDS.aspx

For access to online Certifications of Test, please register at MyATI.ATIMetals.com

This Certified Material Test Report is a true representation of the data on file. The reported results conform to the sales contract and specification(s) as set forth in ATI Flat Rolled Products order acknowledgement. This Certificate of Test may not be reproduced except in full without the written authorization of the company.

ATI Flat Rolled Products website contains listing of material produced, general technical and contact information, and current quality and company accreditations including but not limited to ISO-9001, AS-9100, Nadcap, and ISO/IEC 17025. Please visit us at www.atimetals.com

TR#

0496784US

TRACER # 0486350

ALC720 08/10/2016 13:16:27

848525-2132-SA240-P-.7500 x 79 x 266 (SHELL)

ATI Flat Rolled Products

Certificate of Test

Stephen Wolff - Director, Corporate Quality Assurance

500 Green Street
Washington, PA 15301

Mill Information		Customer Information	
Cert Number	0154022-00	Name	ROLLED ALLOYS INC
Sales Order	50-066-028	PO	0138165-HOU
Cert Date	Jul-21-2016	PO Date	Jun-01-2016

Sold to: ROLLED ALLOYS INC
PO BOX 310
TEMPERANCE, MI 48182

Ship to: ROLLED ALLOYS INC.
9818 E. HARDY ROAD
HOUSTON, TX 77093

Material Information

"ATI 304/304L" STAINLESS STEEL
PMP HOT ROLLED PLATE ANNEALED PICKLED COMMERCIAL CUT EDGE

ASTM-A-240-15B	ASME-SA-240 ED 2015
ASTM-A-666-15	AMS 5513J
AMS 5511H R2013	UNS S30403
UNS S30400	ASTM-A-262-14 PRA E/SCREEN PRA A
NACE MR0175/ISO 15156-3:2015	DIN EN 10204:2005 3.1 CERTIFICATE

Piece Information

	Gauge	Width	Length					Total Wt
Pcs	(in)	(in)	(in)	Heat #	Piece ID	Section Id	Lot #	(lbs)
Item: 004	Cust-Id: 0003873 Cust-Job:			Govt-Contract-#: ScheduleB:			Govt-DO-Rating:	
1	.7500	79.0000	266.2500	848525	CD59705	---	456842	4692

Chemistry Testing

Element (wt %)	Requirements Min	Requirements Max	Final Heat Analysis 848525	Loc
C	---	.030	.021	BN
MN	---	2.00	1.42	BN
P	---	.040	.034	BN
S	---	.030	< .001	BN
SI	---	.75	.38	BN
CR	18.00	19.50	18.29	BN
NI	8.00	10.50	8.12	BN
MO	---	.75	.34	BN
CU	---	.75	.35	BN
N	---	.10	.08	BN

HEAT # 848525/848972
TRACER # 0496125US
0484758US

ROLLED ALLOYS QUALITY CONTROL
Receiving Inspection
By:
Date: 7/25/16

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 01-25-2017
THE SPITZER COMPANIES

Po 2132-008

ROLLED ALLOYS
Receiving Inspection
By: RR
Date: 01/13/17

Bom #5 – Shell Cone #8

ALC720 07/21/2016 15:27:52

848525-2132-SA240-P-.7500 x 79 x 266 (SHELL)

ATI Flat Rolled Products

500 Green Street
Washington, PA 15301

Certificate of Test

Stephen Wolff - Director, Corporate Quality Assurance

Mill Information		Customer Information	
Cert Number	0154022-00	Name	ROLLED ALLOYS INC
Sales Order	50-066-028	PO	0138165-HOU
Cert. Date	Jul-21-2016	PO Date	Jun-01-2016

Chemistry Testing

ATI Flat Rolled Products performs chemical analysis by following techniques
for testing locations TC,BN,MI, & LO:
C, S by combustion/infrared; N, O, H by inert fusion/thermal conductivity;
Mn, P, Si, Cr, Ni, Mo, Cu, Cb, Co, V, by WDXRF; Pb, Bi, Ag by GFAA;
B by OES; Al and Ti (>=0.10%) by WDXRF, otherwise by OES.

848525 - Material was produced by EF melting with AOD refining.

Mechanical Testing

		LOT 456842	
Condition:		ANNEALED	
Direction:		TRANSVERSE	
Temperature:		ROOM TEMP	
Spec:			
Test Limit	Units	Result	Loc
YIELD 0.2%	psi	39500.	TC
TENSILE	psi	84800.	TC
ELONGATION	%	63.	TC
RED OF AREA	%	81.	TC
HARDNESS	---	174. HBW	TC

When hardness is measured using the Brinell scale, the indentation measuring device is Type A.

Mechanical Property Requirements

Condition:		ANNEALED	
Direction:		TRANSVERSE	
Temperature:		ROOM TEMP	
Spec:			
Test Limit	Units	Min	Max
YIELD 0.2%	psi	30000.	---
TENSILE	psi	75000.	100000.
ELONGATION	%	40.	---
RED OF AREA	%	---	---
HARDNESS	---	---	201. HBW

HEAT # 848525

0484758US

TR# ✓

0496125 ws

ALC720 07/21/2016 15:27:52

ATI Flat Rolled Products

500 Green Street
Washington, PA 15301

Certificate of Test

Stephen Wolff - Director, Corporate Quality Assurance

Mill Information		Customer Information	
Cert Number	0154022-00	Name	ROLLED ALLOYS INC
Sales Order	50-066-028	PO	0138165-HOU
Cert Date	Jul-21-2016	PO Date	Jun-01-2016

Corrosion Testing

Test ID	Result Name	Test Result	Wt Loss	Units	Visual Exam	Pit Depth	Units	Bend	Loc	Requirements
LOT 456842	A-262 E/SCR A	DUAL	---	---	---	---	---	---	TC	---

Metallography - General

Test ID	Result Name	Condition	Test Result	Loc	Requirements
456842	GRAIN SIZE	ANNEALED	5.	TC	---

Metallographic magnification: 100X; Etchant used OXALIC ACID

Certification Statements

Material does not have a continuous carbide network.

Material was solution annealed at 1900F (1038C) minimum for a time commensurate with thickness and rapidly cooled with air or water.

ATI Flat Rolled Products does not use mercury in the testing or production of its products.

Material is of USA melt and manufacture.

No welds/weld repairs performed.

Knowingly and willfully recording any false, fictitious or fraudulent statement or entry on this document may be punished as a felony under Federal Statutes, including Federal Law, Title 18, Chapter 47.

DIN EN 10204:2005 - ATI Flat Rolled Products is approved as a manufacturer according to Pressure Equipment Directive PED 2014/68/EU.

EN 10204:2005 3.1 Certificate.

General Statements

TESTING WAS PERFORMED AT THE FOLLOWING LOCATIONS
BN = ATI FLAT ROLLED PRODUCTS; 100 River Road; Brackenridge, PA 15014
TC = ATI FLAT ROLLED PRODUCTS; 1300 Pacific Avenue; Natrona Heights, PA 15065
WARNING: Processing that makes fumes, dust, or solutions may cause lung disease. Please see Safety Data Sheet for further information which has been supplied to your Purchasing Department. For an additional copy, please refer to our website at:
www.atimetals.com/business/ATIFlatRolledProducts/Tools/Pages/Safety-and-MSDS.aspx

For access to online Certifications of Test, please register at MyATI.ATIMetals.com

This Certified Material Test Report is a true representation of the data on file. The reported results conform to the sales contract and specification(s) as set forth in ATI Flat Rolled Products order acknowledgement. This Certificate of Test may not be reproduced except in full without the written authorization of the company.

ATI Flat Rolled Products website contains listing of material produced, general technical and contact information, and current quality and company accreditations including but not limited to ISO-9001, AS-9100, Nadcap, and ISO/IEC 17025. Please visit us at www.atimetals.com

TR# ✓

04847584US

ALC720 07/21/2016 15:27:52

04961251US

849665-2132-SA240-P-.6250 x 96 x 240 (SHELL)

ATI
Flat Rolled Products

500 Green Street
Washington, PA 15301

Certificate of Test

Stephen Wolff - Director, Corporate Quality Assurance

Mill Information		Customer Information	
Cert Number	0158633-00	Name	ROLLED ALLOYS INC
Sales Order	50-106-099	PO	0142027-HOU
Cert Date	Nov-20-2016	PO Date	Oct-13-2016

Sold to: ROLLED ALLOYS INC
PO BOX 310
TEMPERANCE, MI 48182

Ship to: ROLLED ALLOYS INC.
9818 E. HARDY ROAD
HOUSTON, TX 77093

Material Information

"ATI 304/304L" STAINLESS STEEL
PMP HOT ROLLED PLATE ANNEALED PICKLED COMMERCIAL CUT EDGE

ASTM-A-240-16	ASME-SA-240 ED 2015
ASTM-A-666-15	AMS 5513J
AMS 5511H R2013	UNS S30403
UNS S30400	ASTM-A-262-14 PRA E/SCREEN PRA A
NACE MR0175/ISO 15156-3:2015	DIN EN 10204:2005 3.1 CERTIFICATE

Piece Information

	Gauge	Width	Length					Total Wt
Pcs	(in)	(in)	(in)	Heat #	Piece ID	Section Id	Lot #	(lbs)
Item: 003 Cust-Id: 0003864 Cust-Job:					Govt-Contract-#: ScheduleB:		Govt-DO-Rating:	
1	.5000	96.0000	240.0000	849843	CD77590 TR	04935690US	460473	3466
1	.5000	96.0000	240.0000	849843	CD77591 TR	04935700US	460473	3466
1	.5000	96.0000	240.0000	849843	CD77592 TR	04935710US	460473	3466
Item: 004 Cust-Id: 0003870 Cust-Job:					Govt-Contract-#: ScheduleB:		Govt-DO-Rating:	
1	.6250	96.0000	240.0000	849665	CD77596 TR	04935720US	460498	4293

Chemistry Testing

Element (wt %)	Requirements Min	Requirements Max	Final Heat Analysis 849665	Loc	Final Heat Analysis 849843	Loc
C	---	.030	.020	BN	.023	BN
MN	---	2.00	1.48	BN	1.48	BN
P	---	.040	.034	BN	.034	BN
S	---	.030	< .001	BN	< .001	BN
SI	---	.75	.30	BN	.29	BN
CR	18.00	19.50	18.11	BN	18.23	BN
NI	8.00	10.50	8.11	BN	8.14	BN
MO	---	.75	.48	BN	.50	BN
CU	---	.75	.48	BN	.46	BN

CD77596

HEAT # 849665
TRACER # 0496780US

Receiving Inspection
By: RJ
Date: 01/23/17

po 2132-008

Bom#2
Shell Can #9

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 01-25-2017
THE SPITZER COMPANIES

ALC720 11/23/2016 12:51:45

849665-2132-SA240-P-.6250 x 96 x 240 (SHELL)

ATI Flat Rolled Products

500 Green Street
Washington, PA 15301

Certificate of Test

Stephen Wolff - Director, Corporate Quality Assurance

Mill Information		Customer Information	
Cert Number	0158633-00	Name	ROLLED ALLOYS INC
Sales Order	50-106-099	PO	0142027-HOU
Cert Date	Nov-20-2016	PO Date	Oct-13-2016

Chemistry Testing

Element (wt %)	Requirements		Final Heat Analysis		Final Heat Analysis	
	Min	Max	849665	Loc	849843	Loc
N	---	.10	.08	BN	.08	BN

ATI Flat Rolled Products performs chemical analysis by following techniques for testing locations TC,BN,MI, & LO:
C, S by combustion/infrared; N, O, H by inert fusion/thermal conductivity; Mn, P, Si, Cr, Ni, Mo, Cu, Cb, Co, V, by WDXRF; Pb, Bi, Ag by GFAA; B by OES; Al and Ti (>=0.10%) by WDXRF, otherwise by OES.

849665 - Material was produced by EF melting with AOD refining.
849843 - Material was produced by EF melting with AOD refining.

Mechanical Testing

		LOT 460498		LOT 460473	
Condition:		ANNEALED		ANNEALED	
Direction:		TRANSVERSE		TRANSVERSE	
Temperature:		ROOM TEMP		ROOM TEMP	
Spec:					
Test Limit	Units	Result	Loc	Result	Loc
YIELD 0.2%	psi	41100.	TC	41800.	TC
TENSILE	psi	85500.	TC	85900.	TC
ELONGATION	%	62.	TC	67.	TC
RED OF AREA	%	80.	TC	76.	TC
HARDNESS	---	170. HBW	TC	170. HBW	TC

When hardness is measured using the Brinell scale, the indentation measuring device is Type A.

Bend test passed per periodic test requirement.

Mechanical Property Requirements

Condition:		ANNEALED	
Direction:		TRANSVERSE	
Temperature:		ROOM TEMP	
Spec:			
Test Limit	Units	Min	Max
YIELD 0.2%	psi	30000.	---

ALG720 11/23/2016 12:51:45

849665-2132-SA240-P-.6250 x 96 x 240 (SHELL)

ATI Flat Rolled Products

500 Green Street
Washington, PA 15301

Certificate of Test

Stephen Wolff - Director, Corporate Quality Assurance

Mill Information		Customer Information	
Cert Number	0158633-00	Name	ROLLED ALLOYS INC
Sales Order	50-106-099	PO	0142027-HOU
Cert Date	Nov-20-2016	PO Date	Oct-13-2016

Mechanical Property Requirements

Condition:	ANNEALED
Direction:	TRANSVERSE
Temperature:	ROOM TEMP
Spec:	

Test Limit	Units	Min	Max
TENSILE	psi	75000.	100000.
ELONGATION	%	40.	---
RED OF AREA	%	---	---
HARDNESS	--	---	201. HBW

Corrosion Testing

Test ID	Result Name	Test Result	Wt Loss	Units	Visual Exam	Pit Depth	Units	Bend	Loc	Requirements
LOT 460498	A-262 E/SCR A	STEP	---	---	---	---	---	---	TC	---
LOT 460473	A-262 E/SCR A	DUAL	---	---	---	---	---	---	TC	---

Metallography - General

Test ID	Result Name	Condition	Test Result	Loc	Requirements
460498	GRAIN SIZE	ANNEALED	5.	TC	---
460473	GRAIN SIZE	ANNEALED	7.	TC	---

Metallographic magnification: 100X; Etchant used OXALIC ACID

Certification Statements

Material does not have a continuous carbide network.

Material was solution annealed at 1900F (1038C) minimum for a time commensurate with thickness and rapidly cooled with air or water.

ATI Flat Rolled Products does not use mercury in the testing or production of its products.

Material is of USA melt and manufacture.

No welds/weld repairs performed.

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DIN EN 10204:2005 - ATI Flat Rolled Products is approved as a manufacturer according to Pressure Equipment Directive PED 2014/68/EU.

ALC720 11/23/2016 12:51:45

849665-2132-SA240-P-.6250 x 96 x 240 (SHELL)

ATI
Flat Rolled Products

500 Green Street
Washington, PA 15301

Certificate of Test

Stephen Wolff - Director, Corporate Quality Assurance

Mill Information		Customer Information	
Cert Number	0158633-00	Name	ROLLED ALLOYS INC
Sales Order	50-106-099	PO	0142027-HOU
Cert Date	Nov-20-2016	PO Date	Oct-13-2016

Certified Statements

EN 10204:2005 3.1 Certificate.

General Statements

TESTING WAS PERFORMED AT THE FOLLOWING LOCATIONS
BN = ATI FLAT ROLLED PRODUCTS; 100 River Road; Brackenridge, PA 15014
TC = ATI FLAT ROLLED PRODUCTS; 1300 Pacific Avenue; Natrona Heights, PA 15065
WARNING: Processing that makes fumes, dust, or solutions may cause lung disease. Please see Safety Data Sheet for further information which has been supplied to your Purchasing Department. For an additional copy, please refer to our website at:
www.atimetals.com/business/ATIFlatRolledProducts/Tools/Pages/Safety-and-MSDS.aspx

For access to online Certifications of Test, please register at MyATI.ATIMetals.com

This Certified Material Test Report is a true representation of the data on file. The reported results conform to the sales contract and specification(s) as set forth in ATI Flat Rolled Products order acknowledgement. This Certificate of Test may not be reproduced except in full without the written authorization of the company.

ATI Flat Rolled Products website contains listing of material produced, general technical and contact information, and current quality and company accreditations including but not limited to ISO-9001, AS-9100, Nadcap, and ISO/IEC 17025. Please visit us at www.atimetals.com

ALC720 11/23/2016 12:51:45

outokumpu
high performance stainless steel

Outokumpu Stainless Plate, LLC

Certificate of Analysis and Tests

862665-1A-2132-SA240-P-.6250 x 120 x 190

OUR ORDER 0293674 - 02 HEAT & PIECE 862665-1A 12/07/16

SOLD TO: ROLLED ALLOYS
P O BOX 310
TEMPERANCE MI 48182

SHIP TO: ROLLED ALLOYS INC
9818 EAST HARDY ROAD
PH:713-691-4967
HOUSTON TX 77093

---------- YOUR ORDER & DATE ----------

0142629-HOU 11/01/16

---------- ITEM DESCRIPTION ----------

HEAT & PIECE 862665 - 1A
WEIGHT 4259
FINISH 1
GRADE 304L / 304 UNS-S30403 / UNS-S30400
DIMENSIONS .625 X 120.000 X 190.500 EXACT

---------- SPECIFICATIONS ----------

*** MFG IN NEW CASTLE, IN, USA
AMS 5511H WITH EXCEPTIONS
ASTM A240-16 ASME SA240-15ED
ROLLED ALLOYS SPECS 304L/304
MEETS EU ELECTRICAL ROHS
DFAR 252.225-7009
ASTM A262-15 PRACTICE E
NO WELD REPAIRS

FROM SLABS IMPORTED FROM BRITAIN
AMS 5513J WITH EXCEPTIONS
ASTM A480-14B ASMESA480 15ED
NAFTA CTRY ORIGIN= SLAB CTRY
LIST HEAT/PCE/SIZE ON INVCE
ASTM A262-15 PRACTICE A
NO GRIPPER MARKS

PLATES & TEST PCS SOLUTION ANNEALED @ 1900 DEGREES FAHRENHEIT MINIMUM.
THEN WATER COOLED OR RAPIDLY COOLED BY AIR
FREE FROM MERCURY CONTAMINATION AT CURRENT DETECTION LIMITS
HOT ROLLED, ANNEALED & PICKLED (HRAP)

---------- MECHANICAL & OTHER TESTS ----------

HARDNESS HRBW	80
GRAIN SIZE	6
YIELD STRENGTH (PSI)	39343
TENSILE STRENGTH (PSI)	82770
BEND	OK
INTERGRANULAR CORROSION	OK
ELONGATION % IN 2"	53.9
REDUCTION OF AREA %	57.1

---------- CHEMICAL COMPOSITION ----------

CARBON	(C)	.020
MANGANESE	(MN)	1.57
PHOSPHORUS	(P)	.033
SULFUR	(S)	.001
SILICON	(SI)	.31
CHROMIUM	(CR)	18.05
NICKEL	(NI)	8.12
COBALT	(CO)	.16
COPPER	(CU)	.69
MOLY	(MO)	.35
NITROGEN	(N)	.07
COLUMBIUM	(CB)	.014
TITANIUM	(TI)	.003
ALUMINUM	(AL)	.006
TIN	(SN)	.011
TANTALUM	(TA)	.001
PB	(PB)	.001

ROLLED ALLOYS Receiving Inspection
By:
Date: 12/13

HEAT # 862665

TRACER # 0496782US

0494236US

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 01-25-2017
THE SPITZER COMPANIES

WE HEREBY CERTIFY THAT THE MATERIAL HEREIN HAS BEEN MADE, SUPPLIED, AND TESTED IN ACCORDANCE WITH THE LISTED SPECIFICATION(S) AND THAT THE RESULTS OF ALL TESTS AND INSPECTIONS ARE ACCEPTABLE.

ROLLED ALLOYS Receiving Inspec
By:
Date: 01/23/17

James Doubman

JAMES DOUBMAN,QUALITY ASSURANCE MANAGER

CERTIFICATE IN CONFORMANCE WITH EN10204-95 3.1.B/EN10204-2004 3.1

Outokumpu Stainless Plate, LLC
549 West State Road 38
New Castle, Indiana 47362 po 2132-008

Bom#1
Shell #10

1/1

outokumpu
high performance stainless steel

Outokumpu Stainless Plate, LLC

Certificate of Analysis and Tests

862665-1B-2132-SA240-P-.6250 x 120 x 190

OUR ORDER 0293674 - 02 HEAT & PIECE 862665-1B 12/07/16

SOLD TO: ROLLED ALLOYS
P O BOX 310
TEMPERANCE MI 48182

SHIP TO: ROLLED ALLOYS INC
9818 EAST HARDY ROAD
PH:713-691-4967
HOUSTON TX 77093

---------- YOUR ORDER & DATE ----------
0142629-HOU 11/01/16

---------- ITEM DESCRIPTION ----------
HEAT & PIECE 862665 - 1B
WEIGHT 4259
FINISH 1
GRADE 304L / 304 UNS-S30403 / UNS-S30400
DIMENSIONS .625 X 120.000 X 190.500 EXACT

---------- SPECIFICATIONS ----------
*** MEG IN NEW CASTLE, IN, USA
AMS 5511H WITH EXCEPTIONS
ASTM A240-16 ASME SA240-15ED
ROLLED ALLOYS SPECS 304L/304
MEETS EU ELECTRICAL ROHS
DFAR 252.225-7009
ASTM A262-15 PRACTICE E
NO WELD REPAIRS

FROM SLABS IMPORTED FROM BRITAIN
AMS 5513J WITH EXCEPTIONS
ASTM A480-14B ASMESA480 15ED
NAFTA CTRY ORIGIN= SLAB CTRY
LIST HEAT/PCE/SIZE ON INVCE
ASTM A262-15 PRACTICE A
NO GRIPPER MARKS

PLATES & TEST PCS SOLUTION ANNEALED @ 1900 DEGREES FAHRENHEIT MINIMUM.
THEN WATER COOLED OR RAPIDLY COOLED BY AIR
FREE FROM MERCURY CONTAMINATION AT CURRENT DETECTION LIMITS
HOT ROLLED, ANNEALED & PICKLED (HRAP)

---------- MECHANICAL & OTHER TESTS ----------

HARDNESS HRBW	80
GRAIN SIZE	6
YIELD STRENGTH (PSI)	39343
TENSILE STRENGTH (PSI)	82770
BEND	OK
INTERGRANULAR CORROSION	OK
ELONGATION % IN 2"	53.9
REDUCTION OF AREA %	57.1

---------- CHEMICAL COMPOSITION ----------

CARBON	(C)	.020
MANGANESE	(MN)	1.57
PHOSPHORUS	(P)	.033
SULFUR	(S)	.001
SILICON	(SI)	.31
CHROMIUM	(CR)	18.05
NICKEL	(NI)	8.12
COBALT	(CO)	.16
COPPER	(CU)	.69
MOLY	(MO)	.35
NITROGEN	(N)	.07
COLUMBIUM	(CB)	.014
TITANIUM	(TI)	.003
ALUMINUM	(AL)	.006
TIN	(SN)	.011
TANTALUM	(TA)	.001
PB	(PB)	.001

ROLLED ALLOYS
Receiving Inspection
By: Mur E
Date: 12/13

HEAT # 862665

TRACER # 0496781US
0494237US

Chemical & Physical Tests Reviewed and Accepted
By RR Date 01-25-2017
THE SPITZER COMPANIES

WE HEREBY CERTIFY THAT THE MATERIAL HEREIN HAS BEEN MADE, SUPPLIED, AND TESTED IN ACCORDANCE WITH THE LISTED SPECIFICATION(S) AND THAT THE RESULTS OF ALL TESTS AND INSPECTIONS ARE ACCEPTABLE.

ROLLED ALLOYS
Receiving Inspect
By: OJ
Date: 01/23/17

James Doubman

JAMES DOUBMAN, QUALITY ASSURANCE MANAGER

CERTIFICATE IN CONFORMANCE WITH EN10204-95 3.1.B/EN10204-2004 3.1

Outokumpu Stainless Plate, LLC
549 West State Road 38
New Castle, Indiana 47362

po 2132-008

Bom#1

Shell #11

1/1

5096-2132-SA182-L-4

TEXAS METAL WORKS®
an AFGlobal Company

Material Test Report

Heat Code: 5096

ISO 9001:2008 Certified

Texas Metal Works
An AFGlobal Company
13770 Industrial Rd. Houston, TX 77015
Sales: (713) 868-4421 Fax: (713) 455-8366

RSD SUPPLY INC RSD0001	PO: 5473500	Sales Order: 156867	Line: 1
13225 FM 529	Item Code: 0301400101-FAV4F	Qty Shipped: 2	
SUITE N	Item Desc: FLG 04.00 0300 WN RF 40S 304/304L SAN TMW		
HOUSTON, TX 77041	Supplier Heat: 5096		
Spec: ASTM A 182/A 182M (16)/ASME SA 182/SA 182M (15) Section II Part A, F304/F304L			

Element	(%wt)	Ladle	Product	EPCRA	CAS#	Element	(%wt)	Ladle	Product	EPCRA	CAS#
C	Carbon	0.019				Si	Silicon	0.38			
Mn	Manganese	1.62		✓	7439-96-5	Ni	Nickel	8.06		✓	7440-02-0
P	Phosphorous	0.035				Cr	Chromium	18.15		✓	7440-47-3
S	Sulphur	0.023				N	Nitrogen	0.07			

Mechanical Testing		Heat Treat	
Test Lab	SUPPLIER	Solution Annealed (F)	1922
Test Bar Size	SACRIFICIAL PIECE	S.A. Cooling Type	WATER
HBW	160 - 170		
Elg (%)	56.2	**Other**	
RA (%)	69.5	AOD/VOD	Y
Tensile Specimen Size (in)	.500	EF	Y
Tensile (ksi)	83		
Yield (ksi)	42		
Gauge Length (in)	2		

Compliant with hardness max of 22 HRC (237 BHN) per NACE MR0175/ISO 15156-3:2009 and NACE MR0103-2012.

* No Weld repair performed.
* Ladle Chemical Analysis results are reported from the raw material suppliers MTR.
* Tensile taken from a round specimen. Measurement of elongation after fracture.
* Yield strength was determined using the .2% offset method, unless otherwise specified.
* All material supplied under this order is certified to be free of mercury contamination and no mercury bearing equipment was used in manufacturing, fabrication or testing.
* When reported on MTR: Tensile Testing Per ASTM E8; Brinell Hardness Per ASTM E10; Charpy Testing Per ASTM E23
* AF Global manufactures materials according to a certified Quality Management System conforming to ISO 9001:2008 and PED 2014/68/EU, Annex 1, Section 4.3

Unless otherwise noted on PO, Dimensions of all standard pipe flanges and flange fittings (NPS 1/2 to NPS 24) per ASME B16.5-2013 , large diameter steel flanges (NPS 26 to 60) per ASME B16.47-2011, Orifice flanges per ASME B16.36-2015, Steel pipeline flanges (NPS 1/2 to 60) per MSS SP-44.

The recording of false, fictitious, or fraudulent statement or entries on this document may be punishable as a felony under federal statute.

EPCRA Supplier Notification: This product may contain one or more toxic chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-to-Know Act (Title III of the Superfund Amendments and Reauthorization Act of 1986) and 40 C.F.R. Part 372. Potentially reportable chemicals are indicated with a checkmark in the "EPCRA" column and a Chemical Abstract Services (CAS) registry number is provided for each such chemical in addition to the percent by weight of the chemical present in this product. It is your responsibility alone to determine whether your facility is required to submit a Toxic Release Inventory Report under EPCRA Section 313.

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 11-28-2016
THE SPITZER COMPANIES

Certification No.: 1264523
Certification Date: 11/22/2016
Issued By: Nancy Loos

Rina Sane - Metallurgical Lab Manager

This report is issued in compliance with the requirements of EN10204 3.1 / ISO 10474 3.1.b

Bom #15, Noz A, Noz D

Po 2132-014

outokumpu
high performance stainless steel

36864-2132-SA312-S-4

****
* CERTIFICATION *
****

Page: 1

08/27/14
HEAT 36864 ORDER 0028718/011 BO0023774

SHIP TO:
MULTALLOY CO.
12781 Pennridge Drive
314-770-0273
Bridgeton MO 63044

---------- YOUR ORDER & DATE ----------
295054 8/27/14 CUST# MULCOM01

---------- ITEM DESCRIPTION ----------
4" SCH40S TP304/TP304L A312
Country of Melt : FIN
Country of Mfg. : USA

---------- SPECIFICATIONS ----------
ASTM A312-13B/ASME SA312-13 WELDED
Certificate in conformance with EN10204-95 3.1.B / EN10204-2004 3.1

---------- MECHANICAL & OTHER TESTS ----------

Tensile strength,KSI (MPa)	88.2	(608)
Yield strength,KSI (MPa)	53.1	(366)
Elongation % in 2	50.0	
Flatten	OK	
Eddy Test		OK
Bend Test		
NACE MR0175/ISO 15156:09	NACE MR0103-12	
HRB-86		

---------- CHEMICAL COMPOSITION ----------

Carbon	(C)	.024	Manganese	(Mn)	1.510
Phosphorus	(P)	.032	Sulphur	(S)	.001
Silicon	(Si)	.390	Chromium	(Cr)	18.200
Nickel	(Ni)	8.100	Moly	(Mo)	.290
Nitrogen	(N)	.045			

CAUTION: Processing that produces fumes and dust may cause respiratory disease: Especially alloys containing Chromium and Nickel.

CERTIFICATION: We certify that the analysis figures are correct as contained in the records of the company and that the material is free of known mercury, asbestos, and low melting alloy contamination. No weld repair unless otherwise noted.

HEAT TREATMENT & PICKLING: Solution annealed at a range 1900F-2000F and water quenched to below 800F within 3 minutes. Descaled, pickled, and passivated.

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes.

We hereby certify that the chemical analysis and/or test results shown in this report are correct as contained in the records of the company.

Quality Representative

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 11-29-2016
THE SPITZER COMPANIES

Martha James

Outokumpu Stainless Pipe, Inc.
ADDRESS
241 W Clarke Street
Wildwood, Florida 34785-9601
TELEPHONE
(352) 748-1313
TELEFAX
Administration. (352) 748-2751
Purchasing. (352) 748-6576
Production Control (352) 748-0533
Quality Assurance. (352) 748-0533

po 2132-012

BOM#18

Nozzle A+D

1/1

X0T9-2132-SA240-P-.6250 x 48 x 96

NAS NORTH AMERICAN STAINLESS

METALLURGICAL TEST REPORT

6870 Highway 42 East
Ghent, KY 41045-9615
(502) 347-6000

Certificate: 114138 01

Customer: 0095 138

Mail To:
RYERSON, INC.
4075 BLUE RIDGE INDUSTRIAL PKWY.
NORCROSS, GA 30071

Ship To:
RYERSON, INC.
4075 BLUE RIDGE INDUSTRIAL PKWY.
NORCROSS, GA 30071

Date: 11/13/2015 Page: 1

Steel: 304/304L

Finish: HRAP

Your Order: M0141050

NAS Order: AN 0681310 01

Corrosion: ASTM A262/14 A 180Bend-OK

PRODUCT DESCRIPTION:

STAINLESS STEEL PLATE, HRAP; UNS 30400/30403
ASTM A240/15a,A480/14b,A666/15;ASME SA240/13,SA480/13a,SA666/13
CHEM ONLY ON FOLLOWING ASTM: A276/13,A479/13a,A484/13a,A312/13
CHEM ONLY ON FOLLOWING ASME: SA312/13,SA479/13
AMS 5511H/5513J XMRK; MIL-S-5059D AMD3(X CRN MEAS); MIL-S-4043B
NACE MR0175/ISO 15156-3:2009 A, MR0103/07;QQS766D-A X MAG PERM
MIN. SOLUTION ANNEAL TEMP 1900F, WATER QUENCHED

REMARKS:

Mat'l is Free of Mercury Contamination. No weld repairs.
EN 10204:2004 3.1; RoHS 1 & 2 Compliant
Material is Free of Radioactive Contamination
Steel Making Process: EAF, AOD, & Cont. Casting
Product Mfg.by a Quality Mgt.Sys. in Conf. w/ISO 9001
Melted & Manufactured in the USA; Mat'l is DFARs Compliant

Skid #	Prod #	Thickness	Width	Weight	--------Length--------	Mark	Pieces	PART NUMBER
PF9269	* 03X0T9	.6250	48.0000	4,240	PLATE 96.000		5	49809

CHEMICAL ANALYSIS

Lab Accreditation Bureau, ISO/IEC 17025, Certificate# L2323

CM(Country of Melt) ES(Spain) US(United States) ZA(South Africa) JP(Japan)

Chemical analysis per ASTM A751/08

HEAT	CM	C %	CR %	CU %	MN %	MO %	N %	NI %	P %	S %
X0T9	US	.0173	18.3270	.3895	1.7310	.3475	.0852	8.0215	.0315	.0010

SI %
.3410

MECHANICAL PROPERTIES

Skid #	Prod #	Loc	Id Or	UTS KSI	20C .2% YS KSI	20C ELONG % %-2"	Hard RB	A 262 Pr A Pr A	R of A %
PF9269	03X0T9	F	T	85.32	37.41	63.95	79.00	OK	72.27

Chemical & Physical Tests
Reviewed and Accepted
By BL Date 12-5-2016
THE SPITZER COMPANIES

Nozzle A, B, C, K1, K5, N1

NAS hereby certifies that the analysis on this certification is correct. Based upon the results and the accuracy of the test methods used, the material meets the specifications stated. These results relate only to the items tested and this report cannot be reproduced, except in its entirety, without the written approval of NAS.

Technical Dept. Mgr. Abhijeet Bhave 11/13/2015

Po 2132-015

Cust: GULF COAST STEEL, IN ORD#: 01-05047-05 Date: 12112015 Time: 065112 To: ATLEVJS(Page 1 of 1

98026-2132-SA182-L-10

TEXAS METAL WORKS®
an AFGlobal Company

Material Test Report

Heat Code: 98026

ISO 9001:2008 Certified

Texas Metal Works
An AFGlobal Company
13770 Industrial Rd. Houston, TX 77015
Sales: (713) 868-4421 Fax: (713) 455-8366

RSD SUPPLY INC RSD0001	PO: 5473500	Sales Order: 156867	Line: 5
13225 FM 529	Item Code: 0301910101-FAV4F	Qty Shipped: 1	
SUITE N	Item Desc: FLG 10.00 0300 WN RF 40S 304/304L SAN TMW		
HOUSTON, TX 77041	Supplier Heat: 98026		
Spec: ASTM A 182/A 182M (16)/ASME SA 182/SA 182M (15) Section II Part A, F304/F304L			

Element	(%wt)	Ladle	Product	EPCRA	CAS#	Element	(%wt)	Ladle	Product	EPCRA	CAS#
C	Carbon	0.022				Si	Silicon	0.32			
Mn	Manganese	1.14		✓	7439-96-5	Ni	Nickel	8.05		✓	7440-02-0
P	Phosphorous	0.034				Cr	Chromium	18.18		✓	7440-47-3
S	Sulphur	0.020				N	Nitrogen	0.08			

Mechanical Testing		Heat Treat	
Test Lab	SUPPLIER	Solution Annealed (F)	1922
Test Bar Size	SACRIFICIAL PIECE	S.A. Cooling Type	WATER
HBW	154 - 154		
Elg (%)	59.2	Other	
RA (%)	71.3	AOD/VOD	AOD
Tensile Specimen Size (in)	.500	EF	Y
Tensile (ksi)	84		
Yield (ksi)	41		
Gauge Length (in)	2		

Compliant with hardness max of 22 HRC (237 BHN) per NACE MR0175/ISO 15156-3:2009 and NACE MR0103-2012.

* No Weld repair performed.
* Ladle Chemical Analysis results are reported from the raw material suppliers MTR.
* Tensile taken from a round specimen. Measurement of elongation after fracture.
* Yield strength was determined using the .2% offset method, unless otherwise specified.
* All material supplied under this order is certified to be free of mercury contamination and no mercury bearing equipment was used in manufacturing, fabrication or testing.
* When reported on MTR: Tensile Testing Per ASTM E8; Brinell Hardness Per ASTM E10; Charpy Testing Per ASTM E23
* AF Global manufactures materials according to a certified Quality Management System conforming to ISO 9001:2008 and PED 2014/68/EU, Annex 1, Section 4.3

Unless otherwise noted on PO, Dimensions of all standard pipe flanges and flange fittings (NPS 1/2 to NPS 24) per ASME B16.5-2013 , large diameter steel flanges (NPS 26 to 60) per ASME B16.47-2011, Orifice flanges per ASME B16.36-2015, Steel pipeline flanges (NPS 1/2 to 60) per MSS SP-44.

The recording of false, fictitious, or fraudulent statement or entries on this document may be punishable as a felony under federal statute.

EPCRA Supplier Notification: This product may contain one or more toxic chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-to-Know Act (Title III of the Superfund Amendments and Reauthorization Act of 1986) and 40 C.F.R. Part 372. Potentially reportable chemicals are indicated with a checkmark in the "EPCRA" column and a Chemical Abstract Services (CAS) registry number is provided for each such chemical in addition to the percent by weight of the chemical present in this product. It is your responsibility alone to determine whether your facility is required to submit a Toxic Release Inventory Report under EPCRA Section 313.

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 11-28-2016
THE SPITZER COMPANIES

Certification No.: 1264525
Certification Date: 11/22/2016
Issued By: Nancy Loos

Rina Sane - Metallurgical Lab Manager

This report is issued in compliance with the requirements of EN10204 3.1 / ISO 10474 3.1.b

BOM #17 - N62 B

PO 2132-014

1/1

BRISTOL METALS, LLC

MILL TEST REPORT

RM ID NUMBER
132151

SALES ORDER / RLS
011575 / 4

CERT ID / REV
00114702 / 01

SOLD TO

SOUTHWEST STAINLESS
8505 MONROE BLVD
HOUSTON, TX 77061
USA

R2R8-2132-SA312-S-10

CUSTOMER P.O. 33376200 | CUSTOMER PART | HEAT NO. R2R8

DESCRIPTION:310004003120100,
10" WELDED PIPE SCHED 40S TP304/TP304L (UNS# S30400/S30403) A312

CERTIFICATION REQUIREMENTS

ENGINEERING
ASTM A312-13b ASME SA312-13

HYDRO PRESSURE
1,000 PSI

HEAT TREAT
Annealed at1900 Deg F. and water quenched to below 800 Deg. F. in less than 3 minutes.

Chemical

C	Cr	Mn	Ni	N	P	Si	S
.0171	18.1125	1.749	8.0175	.0824	.0325	.237	.0106

Mechanical

TEST	UNITS	RESULTS
Tensile PSI	PSI	88900
Yield PSI	PSI	50410
Elong %		51.86

Hardness

RB88

TEST	RESULT
TG Bend	Pass

This report shall not be altered or reproduced, except in full, without the prior written approval of Bristol Metals LLC.
This test report represents the actual attributes of the items furnished and all items were manufactured, sampled, inspected, and tested in full compliance with applicable specifications and your purchase order.
Certification is in accordance with EN10204:2004 type 3.1.
Chemical content is % by weight. Mechanical test results are in English units (inches and pounds).
No weld repairs have been performed on the base material.
Hardness in accordance with NACE MR0175/ISO 15156-3:2009 and MR0103-2012 and material is free of cold work to enhance mechanical properties.
Pipe is Pickled and Passivated in accordance with ASTM A380.
Bristol Metals has a Quality Management System in place that is in compliance with ISO 9001:2008.
Bristol Metals does not add mercury during any manufacturing process.
→ NAFTA country of origin: USA. Pipe/Tube Manufactured in the USA.
• Raw Material Melt Source USA
FAR BAA - Complies, DFARS BAA - Complies, FAR TAA - Complies

Bom#21

Rick Duncan – Director of Technical Sales / Compliance

QF-575 atc302a (v1.1)

Page Chemical & Physical Tests Reviewed and Accepted By RR Date 11-29-2016 THE SPITZER COMPANIES

Date Printed 12/04/2014

po 2132-02

5629-2132-SA182-L-12

TEXAS METAL WORKS® an AFGlobal Company

Material Test Report

Heat Code: 5629

ISO 9001:2008 Certified

Texas Metal Works
An AFGlobal Company
13770 Industrial Rd. Houston, TX 77015
Sales: (713) 868-4421 Fax: (713) 455-8366

RSD SUPPLY INC RSD0001	PO: 5473500	Sales Order: 156867	Line: 3
13225 FM 529	Item Code: 0301912101-FAV4F	Qty Shipped: 9	
SUITE N	Item Desc: FLG 12.00 0300 WN RF 40S 304/304L SAN TMW		
HOUSTON, TX 77041		Supplier Heat: 5629	

Spec: ASTM A 182/A 182M (16)/ASME SA 182/SA 182M (15) Section II Part A, F304/F304L

Element	(%wt)	Ladle	Product	EPCRA	CAS#	Element	(%wt)	Ladle	Product	EPCRA	CAS#
C	Carbon	0.022 ✓				Si	Silicon	0.34 ✓			
Mn	Manganese	1.70 ✓		✓	7439-96-5	Ni	Nickel	8.04 ✓		✓	7440-02-0
P	Phosphorous	0.039 ✓				Cr	Chromium	18.25 ✓		✓	7440-47-3
S	Sulphur	0.023 ✓				N	Nitrogen	0.08 ✓			

Mechanical Testing		Heat Treat	
Test Lab	SUPPLIER	Solution Annealed (F)	1922 ✓
Test Bar Size	SACRIFICIAL PIECE	S.A. Cooling Type	WATER
HBW	163 - 173		
Elg (%)	60.0 ✓	**Other**	
RA (%)	69.9 ✓	AOD/VOD	AOD
Tensile Specimen Size (in)	.500	EF	Y
Tensile (ksi)	81.7 ✓		
Yield (ksi)	38.5 ✓		
Gauge Length (in)	2		

Compliant with hardness max of 22 HRC (237 BHN) per NACE MR0175/ISO 15156-3:2009 and NACE MR0103-2012.

* No Weld repair performed.
* Ladle Chemical Analysis results are reported from the raw material suppliers MTR.
* Tensile taken from a round specimen. Measurement of elongation after fracture.
* Yield strength was determined using the .2% offset method, unless otherwise specified.
* All material supplied under this order is certified to be free of mercury contamination and no mercury bearing equipment was used in manufacturing, fabrication or testing.
* When reported on MTR: Tensile Testing Per ASTM E8; Brinell Hardness Per ASTM E10; Charpy Testing Per ASTM E23
* AF Global manufactures materials according to a certified Quality Management System conforming to ISO 9001:2008 and PED 2014/68/EU, Annex 1, Section 4.3

Unless otherwise noted on PO, Dimensions of all standard pipe flanges and flange fittings (NPS 1/2 to NPS 24) per ASME B16.5-2013 , large diameter steel flanges (NPS 26 to 60) per ASME B16.47-2011, Orifice flanges per ASME B16.36-2015, Steel pipeline flanges (NPS 1/2 to 60) per MSS SP-44.

The recording of false, fictitious, or fraudulent statement or entries on this document may be punishable as a felony under federal statute.

EPCRA Supplier Notification: This product may contain one or more toxic chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-to-Know Act (Title III of the Superfund Amendments and Reauthorization Act of 1986) and 40 C.F.R. Part 372. Potentially reportable chemicals are indicated with a checkmark in the "EPCRA" column and a Chemical Abstract Services (CAS) registry number is provided for each such chemical in addition to the percent by weight of the chemical present in this product. It is your responsibility alone to determine whether your facility is required to submit a Toxic Release Inventory Report under EPCRA Section 313.

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 11-28-2016
THE SPITZER COMPANIES

Certification No.: 1264526
Certification Date: 11/22/2016
Issued By: Nancy Loos

Rina Sane - Metallurgical Lab Manager

This report is issued in compliance with the requirements of EN10204 3.1 / ISO 10474 3.1.b

PO 2132-014

Boul #14 - Noz K3, K4, K5, K6, K7, K8, Noz K1, K2
Boul #12 - Noz C

outokumpu
high performance stainless steel

506796-2132-SA312-S-12

CERTIFICATION

Page: 1

07/25/16
HEAT 506796 ORDER 0030889/001 BO0025488

SHIP TO:
SOUTHWEST STAINLESS HOUSTON
8505 Monroe road
800-231-8268
Houston TX 77061

YOUR ORDER & DATE
486402-00 7/25/16 CUST# SOUSTA02

ITEM DESCRIPTION
12" SCH40S TP304/TP304L A312
Country of Melt : USA
Country of Mfg. : USA

SPECIFICATIONS

ASTM A312-16/ASME SA312-15
QUALITY SYSTEM CERTIFIED TO:
PED 97/23/EC ANNEX 1, § 4.3
BY TUV SUD INDUSTRIE SERVICE
GMBH, NOTIFIED BODY 0036
TOLERANCE: ASTM A999
LONGITUDINAL WELDED
RANDOM LENGTHS
PLAIN ENDS
DESCALED, PICKLED, AND
PASSIVATED: ASTM A380
WELDED
MECHANICAL TESTING: ASTM A370
YIELD STRENGTH:0.2% OFFSET
COLD FINISHED
ELECTRIC FUSION WELDED (EFW)
IM EINVERNEHMEN MIT DEM TUV
SUD INDUSTRIE SERVICE GMBH
WIRD AUF EINE GEGENZEICHNUNG
LAUT SCHREIBEN VOM 05.AUGUST
2008 DURCH TUV SUD INDUSTRIE
SERVICE GMBH VERZICHTET
Certificate in conformance with EN10204-95 3.1.B / EN10204-2004 3.1

MECHANICAL & OTHER TESTS

Tensile strength,KSI (MPa)		93.1 (642)
Yield strength,KSI (MPa)		53.7 (370)
Elongation % in 2		50.0
Guided Bend Face	OK	
Bend Test		
Hydrotest PSI (MPa)		900 (6.21)
NACE MR0175/ISO 15156:15	NACE MR0103-15	
HRB-88		

CHEMICAL COMPOSITION

Carbon	(C)	.025	Manganese	(Mn)	1.760
Phosphorus	(P)	.029	Sulphur	(S)	.009
Silicon	(Si)	.540	Chromium	(Cr)	18.070
Nickel	(Ni)	8.020	Moly	(Mo)	.350
Nitrogen	(N)	.071			

-- Continued --

Chemical & Physical Tests
Reviewed and Accepted
By RK Date 1-29-2016
THE SPITZER COMPANIES

Martha James
Martha James

Outokumpu Stainless Pipe, Inc.
ADDRESS
241 W Clarke Street
Wildwood Florida 34785-9601
TELEPHONE
(352) 748-1313
TELEFAX
Administration (352) 748-2751
Purchasing (352) 748-6575
Production Control (352) 748-0533
Quality Assurance (352) 748-0533

po 2132-012

BOM #22

No2 C, K1, K2, K3, K4,
K5, K6, K7, K8

1/2

outokumpu
high performance stainless steel

506796-2132-SA312-S-12

****
* CERTIFICATION *
****

07/25/16
HEAT 506796 ORDER 0030859/00_ BO0025488

SHIP TO:
SOUTHWEST STAINLESS HOUSTON
8505 Monroe road
800-231-8268
HOUSTON TX 77061

CAUTION: Processing that produces fumes and dust may cause respiratory disease: Especially alloys containing Chromium and Nickel.

CERTIFICATION: We certify that the analysis figures are correct as contained in the records of the company and that the material is free of known mercury, asbestos, and low melting alloy contamination. No weld repair unless otherwise noted.

HEAT TREATMENT & PICKLING: Solution annealed at a range 1900F-2000F and water quenched to below 800F within 3 minutes. Descaled, pickled, and passivated.

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes.

We hereby certify that the chemical analysis and/or test results shown in this report are correct as contained in the records of the company.

Quality Representative

Martha James

Outokumpu Stainless Pipe, Inc.
ADDRESS
241 W Clarke Street
Wildwood, Florida 34785-9601
TELEPHONE
(352) 748-1313
TELEFAX
Administration, (352) 748-2751
Purchasing, (352) 748-6576
Production Control (352) 748-0533
Quality Assurance (352) 748-0533

po 2132-012

2/2

506754-2132-SA240-P-0.3717 x 61.5

Manufacturer / Fabricante / Hersteller

outokumpu

Type of document / Tipo de documento / Art der Prüfbescheinigung

INSPECTION CERTIFICATE

CERTIFICADO DE INSPECCION

ABNAHMEPRÜFZEUGNIS

according to / de acuerdo con / nach

EN 10204-3.1

Document number / Nº de certificado / Bescheinigungsnr.: 0000182979 /

Page / Pagina / Seite: 1 / 1

1 Steel Drive; P.O. Box 13000; Calvert, AL 36513-1300

USA

Customer/Ship to / Cliente / Besteller/Empfänger

Customer's order number / Nº de Pedido Cliente / Kundenbestellnr.: 27115-0301

Manufacturer's works order no. / Nº de Pedido Manufactura / Werksauftragsnr.: 901197990 / 001

Delivery note no. / Nº de Entrega / Lieferantsnr.: 85367232 / 010

Product / Producto / Erzeugnis: COIL/BOBINA/BAND

Terms of delivery / Condiciones de entrega / Lieferbedingungen: ASTM A240/240M, ASME SA-240 Sec.II Part A Ed. 2015; ASTM A480/480M, ASME SA-480 Sec.II Part A Ed. 2015

Steel grade and quality / Acero / Stahlsorte und Gütequalität: TYPE 304L/304

Customer's material no. / Nº de material del cliente / Kundenmaterial-Nr.	Product dimensions (Thickness / Width / Length) / Dimensiones (Espesor / Ancho / Largo) / Maße des Erzeugnisses (Dicke / Breite / Länge)	Steelmaking procedure / Proceso de manufactura / Herstellart	Finish / Acabado / Ausführung
	9.44 mm x 1,563.00 mm 0.3717 inch x 61.5354 inch	AOD	IIa / 1D / No.1

Packing-No. / Nº de Empaque / Paket-Nr.	Heat pieces / Piezas / Stückzahl	Actual weight / Peso actual / Ist-Gewicht	Coil No. / Bobina Nº / Band-Nr.	Heat No. / Colada Nº / Schmelzen-Nr.	Sample Id. / Nº de muestra / Proben-Id.	Sample Id. / Nº de muestra / Proben-Id.
6478508	1	28,208 lb / 12,795 kg	760242	506754	1000314436	1000314436
Sum / Suma / Summe	1	28,208 lb / 12,795 kg				

Heat / Colada / Schmelze	Country of Melt / País de colada / Erschmelzungsland	Chemical composition / Composición Química / Chemische Zusammensetzung									
		% C	% Si	% Mn	% P	% S	% Cr	% Mo	% Ni	% N	% Cu
506754	USA	0.024	0.37	1.29	0.027	0.0020	18.33	0.32	8.04	0.074	0.46

Sample Position / Localización de la muestra / Probenlage: TRANSVERSE

Inspection lot / Lote de inspección / Prüflos	YS0.2% PSI / MPa	TS PSI / MPa	El. A2" %	HRB		
1000314435	49,601 / 342	92,530 / 638	59.5	82		
1000314436	50,016 / 349	93,401 / 644	67.1	82		

Dimensions-surface / Dimensiones-Superficie / Maße-Oberfläche: OK

Test of identity (spectrum analysis) / Control de identidad (análisis espectográfico) / Verwechslungsprüfung (Spektralanalyse): OK

Heat Treatment: Solution annealed 1920°F Min / Air cooled

No welding or weld repairs were performed on this material

No intentional additions of Mercury compounds were made or used

Free of radioactive contamination

EU RoHS Directive 2011/65/EU Compliant

Country of Heat as per ISO 3166-1

Originator of the document / Originador del documento / Aussteller der Bescheinigung:

Outokumpu Stainless USA, LLC
An ISO 9001: 2008 certified company
EU PED 97/23/EC, Anex I, 4.3 certified

Certificate is generated automatically / Certificado es generado automáticamente / Das Zeugnis wurde elektronisch erstellt

The information provided is a true copy of data on file / Los valores mostrados corresponden a los datos archivados / Die genannten Werte entsprechen den gespeicherten Daten

Andrew Fawcett
Phone: +1 251 829 3402

Name of expert / Nombre del experto / Name des Sachverständigen

Date of issue and validation / Fecha de emisión y validación / Datum Ausstellung / Bestätigung: 05/03/2016

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Chemical & Physical Tests
Reviewed and Accepted
By RF Date 12-5-2016
THE SPITZER COMPANIES

po 2132-015

Nozzle D, G, H, J, K4, K8, M

38790-1-2132-SA182-L-8

BEBITZ

Bereich Flansche / Flange Division

Flanschenwerk Bebitz GmbH-Lebendorfer Str.1-06420 Bebitz/GERMANY (A01) Tel. +49 34691 40 0-Fax +49 3469140 329-Email: flanges@bebitz.de
Bebitz Flanges Works Pvt. Ltd.-Survey No. 140/2, Saravali Boisar - Taluka Palghar - Thane 401501 Maharashtra, INDIA - Email: quality@bebitz.in
Bebitz U.S.A., INC. 100 Quentin Roosevelt BLVD-Garden City, NY11530/USA Tel. +1-516-2808380-Fax +1-516-2808382-Email: bebitzusa@bebitz.de

Abnahmeprüfzeugnis 3.1 / Inspection certificate 3.1 / Certificat de reception 3.1

nach (A02) / acc. DIN EN 10204 : 2005 Nr. (A03) / No. 16-05185 **Datum (Z02) / Date** 05.04.2016

Zeichen des Herstellers (A04) / Manufacturer's brand: [B]

Stempel des Abnehmers (Z03) / Stamp of the testing engineer: TKO B

Überprüft als Hersteller nach AD-Merkblatt W0 / TRD100 und VdTÜV Werkstoffblätter 350/3, 354, 399. / Approved as manufacturer acc. AD-Merkblatt W0 / TRD100 and VdTÜV Material Sheets 350/3, 354, 399.
Zertifiziert nach DGR 97/23/EG durch TÜV CERT Zertifizierungsst. für Druckgeräte der TÜV NORD GmbH Co KG, Benannte Stelle Nr. 0045. / Certified acc. to PED 97/23/EC, certifying body for pressure equipment TÜV NORD GmbH Co KG, registration no. 0045.

Besteller (A06) / Customer: TEXAS PIPE & SUPPLY Co.
2330 Holmes Road
HOUSTON, TX 77051

Bestell-Nr (A07) / Order-No. 156332-00
Auftrag (A08) / Order 3522721
Lieferschein / Delivery No. 3630789
Position (B07.1) / Item 42FB

Stck (B08) / Quantity	Bezeichnung (B01; B09 - B11) / Product	Schmelze/Prüflos (B07) / Heat no./Test no.
4	8 inch Welding Neck Flange 300 lbs S40s raised face	38790/1

Material (B02; B05): F 304/F 304L - ASTM A182M-15 / ASME SA-182M
solution annealed > 1040 °C and quenched in water

Anford. (B03) Requirements: ASME B 16.5-2013
NACE MR0175-2011 / MR0103-2010 - DIN EN ISO 15156-2:2009
2015 ASME Boiler & Pressure Vessel Code - Section II Part A
PMI-tested 100%, IC-test acc. to DIN EN ISO 3651-2 Test A / ASTM A262 practice E

Schmelzenanalyse (C71 - C92) / Ladle analysis — **Erschmelzung (C70) / Melting process** E+AOD

C	Si	Mn	P	S	Cr	Ni	Ti	Mo	Nb	V	N	Cu	Al	PREN
0,017	0,35	1,21	0,036	0,023	18,30	8,09					0,085			19,66

$$CEV = C + \frac{Mn}{6} + \frac{V + Mo + Cr}{5} + \frac{Ni + Cu}{15} \qquad PREN = Cr + 3{,}3 \times Mo + 16 \times N$$

Mechanische Prüfungen / Mechanical tests

Probenlage (C02): T / Position of Specimen: T
Zugversuch / Tensile Test - ASTM A 370

Temp (C03) °C	Streckgrenze (C11) / Yield 0,2% MPa (N/mm²)	Streckgrenze (C11) / Yield 1,0% MPa (N/mm²)	Zugfestigkeit (C12) Tensile MPa (N/mm²)	Dehnung (C13) Elongation %		Einschnürg. Red. of area %
20	min 205 max		515	30,0 $5d_0$	$4d_0$	50
20	307	341	570	60,2	75,3	71

Kerbschlagbiegeversuch / Impact test DIN EN ISO 148-1 (V-Kerb / V-notch)

Temp. (C03) °C	Einzelwerte (C42) Single values J			MW (C43) Average J
20				
20	180	178	188	182,0

Härte (C32) Hardness ISO 6506-1 HBW 2,5/187,5: 159

Country of Origin: Germany

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 01-16-2017
THE SPITZER COMPANIES

Am Material wurden keine Reparaturschweißungen vorgenommen. / No welding repair on the material.
Material ist nicht radioaktiv oder mit Quecksilber kontaminiert. / Material is free from radioactive or mercury contamination.
Sicht- und Maßprüfungen ohne Beanstandungen. (D01) / Visual and dimensional examinations without objections.
Die Anforderungen der Bestellung sind erfüllt. / The product meets the requirements of the order specifications.
Die Angaben in Klammern entsprechen den Vorgaben der DIN EN 10168 / Data in parentheses refer to DIN EN 10168.
APZ ist mit EDV erstellt und ohne Unterschrift gültig. / MTR was electronically generated and is valid without a signature.

R. Sparing
Abnahmebeauftragter des Herstellers (Z02) / Inspection Representative of the Manufacturer

po 2132-027

Nozzle E, H

1/1

509972-2132-SA312-S-8

390 Bristol Metals Rd.
Bristol, TN 37620

MILL TEST REPORT

RM ID NUMBER
51981
SALES ORDER / RLS
20160227801
CERT ID / REV
7030

SOLD TO:
SOUTHWEST STAINLESS
8505 MONROE BLVD
HOUSTON, TX 77061

CUSTOMER P.O.	CUSTOMER PART	HEAT NO
48310100		509972

DESCRIPTION: 33008000403043I2010
8" WELDED PIPE SCHED 40S TP304/TP304L (UNS# S30400/S30403) A312

CERTIFICATION REQUIREMENTS

ENGINEERING
ASTM A312-16 ASME SA312-15

HYDRO PRESSURE
1100 PSI

HEAT TREAT
Annealed at 1900 - 2000 Deg F. and water quenched to below 800 Deg. F. in less than 3 minutes.

Chemical		Mechanical	
Test	Result	Test	Result
Carbon	025	Tensile	92966
Manganese	1.78	Yield	51631
Phosphorus	.029	Elongation	58
Sulfur	.01	Hardness RB	82
Silicon	.55		
Nickel	8.03	Tension	Pass
Chromium	18.11	TG Face Bend	Pass
Molybdenum	.39		
Nitrogen	.065		
Country of Origin	USA		

This report shall not be altered or reproduced, except in full, without the prior written approval of Bristol Metals LLC. This test report represents the actual attributes of the items furnished and all items were manufactured, sampled, inspected, and tested in full compliance with applicable specifications and your purchase order.
Certification is in accordance with EN10204:2004 type 3.1
Chemical content is % by weight. Mechanical test results are in English units (inches and pounds).
No weld repairs have been performed on the base material.
Hardness in accordance with NACE MR0175/ISO 15156-3:2009 and MR0103-2012 and material is free of cold work to enhance mechanical properties.
Pipe is Pickled and Passivated in accordance with ASTM A380.
Bristol Metals has a Quality Management System in place that is in compliance with ISO 9001:2008.
In compliance with Pressure Equipment Directive (PED) 97/23/EC as Category 1 material unless otherwise stated.
Bristol Metals does not add mercury or radioactive materials during any manufacturing process.
→ NAFTA country of origin: USA. Pipe/Tube Manufactured in the USA. Raw Material Melt Source: USA
FAR BAA - Complies, DFARS BAA -Complies, FAR TAA – Complies.
Pipe/Tube has been double welded using an EFW process.
QF-576

Date Printed: 10/21/2016

Jan R. Barnett

Quality Assurance Manager

Chemical & Physical Tests
Reviewed and Accepted
By RK Date 11-29-2016
THE SPITZER COMPANIES

Bom#20

po 2132-012

Nozzle E

1/1

857975-2A-2132-SA240-P-.5000 x 120 x 246

848172 01

outokumpu

Outokumpu Stainless Plate, LLC

Certificate of Analysis and Tests

****
* RE-CERTIFICATION *
****

OUR ORDER 0286231 - 01

HEAT & PIECE 857975-2A 03/27/14

SOLD TO: CONSOLIDATED POWER SUPPLY
3556 MARY TAYLOR ROAD
BIRMINGHAM AL 35235

SHIP TO: CONSOLIDATED POWER SUPPLY
3556 MARY TAYLOR ROAD
205-655-5515
BIRMINGHAM AL 35235

YOUR ORDER	DATE
Z65-41987	1/23/14

ITEM DESCRIPTION

HEAT & PIECE 857975-2A PARENT HEAT B140080 Lot No. 9399
WEIGHT 4441
FINISH 1
GRADE 304L / 304 UNS-S30403 / UNS-S30400
DIMENSIONS .500 X 120.000 X 246.000 EXACT

	SPECIFICATIONS
*** MFG IN NEW CASTLE, IN, USA	FROM SLABS IMPORTED FROM BRITAIN
ASTM A240-13C ASMESA240-13ED	ASTM A480-13 ASMESA480 13ED
COUPONS REQUIRED	OSI QA MAN ED 2 R 2 02/22/12
REQUIRES PRODUCT ANALYSIS	NO GRIPPER MARKS
NO WELD REPAIRS	
ASTM A262-13 PRACTICE A	ASTM A262-13 PRACTICE E

PLATES & TEST PCS SOLUTION ANNEALED @ 1900 DEGREES FAHRENHEIT MINIMUM.
THEN WATER COOLED OR RAPIDLY COOLED BY AIR
FREE FROM MERCURY CONTAMINATION AT CURRENT DETECTION LIMITS
HOT ROLLED, ANNEALED & PICKLED (HRAP)

CB&I POWER
JUN 27 2014
083

MECHANICAL & OTHER TESTS

HARDNESS HRBW	87
GRAIN SIZE	6
YIELD STRENGTH (PSI)	39246
TENSILE STRENGTH (PSI)	88020
BEND	OK
INTERGRANULAR CORROSION	OK
ELONGATION % IN 2"	57.9
REDUCTION OF AREA %	63.5

CHEMICAL COMPOSITION ----- PRODUCT ANALYSIS

CARBON	(C)	.021	(C)	.018
MANGANESE	(MN)	1.76	(MN)	1.72
PHOSPHORUS	(P)	.029	(P)	.029
SULFUR	(S)	.003	(S)	.001
SILICON	(SI)	.30	(SI)	.35
CHROMIUM	(CR)	18.21	(CR)	18.21
NICKEL	(NI)	8.11	(NI)	8.58
COBALT	(CO)	.34	(CO)	.32
COPPER	(CU)	.32	(CU)	.33
MOLY	(MO)	.34	(MO)	.31
NITROGEN	(N)	.07	(N)	.09
COLUMBIUM	(CB)	.021	(CB)	.018
TITANIUM	(TI)	.004	(TI)	.003
ALUMINUM	(AL)	.005	(AL)	.002
TIN	(SN)	.008	(SN)	.006
TANTALUM	(TA)	.001	(TA)	
PB	(PB)	.001		

CPS
QA REVIEW
Approved
Date 3/27/14

WE HEREBY CERTIFY THAT THE MATERIAL HEREIN HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE LISTED SPECIFICATION(S) AND THAT THE RESULTS OF ALL TESTS ARE ACCEPTABLE.

JAMES DOUSMAN, QUALITY ASSURANCE MANAGER

CERTIFICATE IN CONFORMANCE WITH EN10204 95 3.1.B/EN10204-2004 3.1

Outokumpu Stainless Plate, LLC
P.O. Box 370
New Castle, Indiana 47362

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 12-5-2016
THE SPITZER COMPANIES

HT# 857975
po 2132-015

1/2" x 120" x 240"

Nozzle E, F, K2, K3, K6, K7, L, N3, N4

1/1

100765-1-2132-SA182-L-8

BEBITZ

Bereich Flansche / Flange Division

Flanschenwerk Bebitz GmbH-Lebendorfer Str.1-06420 Bebitz/GERMANY (A01) Tel. +49 34691 40 0-Fax +49 3469140 329-Email: flanges@bebitz.de
Bebitz Flanges Works Pvt. Ltd.-Survey No. 140/2, Saravali Bolsar - Taluka Palghar - Thane 401501 Maharashtra, INDIA - Email: quality@bebitz.in
Bebitz U.S.A., INC. 100 Quentin Roosevelt BLVD-Garden City, NY11530/USA Tel. +1-516-2808380-Fax +1-516-2808382-Email: bebitzusa@bebitz.de

Abnahmeprüfzeugnis 3.1 / Inspection certificate 3.1 / Certificat de reception 3.1

nach (A02) / acc. DIN EN 10204 : 2005 Nr. (A03) / No. 16-05186 **Datum (Z02) / Date** 05.04.2016

Zeichen des Herstellers (A04) / Manufacturer's brand: [B]

Stempel des Abnehmers (Z03) / Stamp of the testing engineer: TKO B

Überprüft als Hersteller nach AD-Merkblatt W0 / TRD100 und VdTÜV Werkstoffblätter 350/3, 354, 399. / Approved as manufacturer acc. AD-Merkblatt W0 / TRD100 and VdTÜV Material Sheets 350/3, 354, 399.
Zertifiziert nach DGR 97/23/EG durch TÜV CERT Zertifzierungsst. für Druckgeräte der TÜV NORD GmbH Co KG, Benannte Stelle Nr. 0045. / Certified acc. to PED 97/23/EC, certifying body for pressure equipment TÜV NORD GmbH Co KG, registration no. 0045.

Besteller (A06) / Customer TEXAS PIPE & SUPPLY Co.
2330 Holmes Road
HOUSTON, TX 77051

Bestell-Nr (A07) / Order-No. 156332-00
Auftrag (A08) / Order 3522721
Lieferschein / Delivery No. 3630789
Position (B07.1) / Item 42FB

Stck (B08) / Quantity	Bezeichnung (B01; B09 - B11) / Product	Schmelze/Prüflos (B07) / Heat no./Test no.
16	8 inch Welding Neck Flange 300 lbs S40s raised face	100765/1

Material (B02; B05) F 304/F 304L - ASTM A182M-15 / ASME SA-182M
solution annealed > 1040 °C and quenched in water

Anford. (B03) Requirements
ASME B 16.5-2013
NACE MR0175-2011 / MR0103-2010 - DIN EN ISO 15156-2:2009
2015 ASME Boiler & Pressure Vessel Code - Section II Part A
PMI-tested 100%, IC-test acc. to DIN EN ISO 3651-2 Test A / ASTM A262 practice E

Schmelzenanalyse (C71 - C92) / Ladle analysis **Erschmelzung (C70) / Melting process** E+AOD

C	Si	Mn	P	S	Cr	Ni	Ti	Mo	Nb	V	N	Cu	Al	PREN
0,025	0,39	1,08	0,036	0,024	18,36	8,10		0,38			0,075			20,81

$$CEV = C + \frac{Mn}{6} + \frac{V + Mo + Cr}{5} + \frac{Ni + Cu}{15} \qquad PREN = Cr + 3{,}3 \times Mo + 16 \times N$$

Mechanische Prüfungen / Mechanical tests

Probenlage (C02): T / Position of Specimen: T
Zugversuch / Tensile Test - ASTM A 370

Temp (C03) °C	Streckgrenze (C11) / Yield 0,2% MPa (N/mm²)	1,0% MPa (N/mm²)	Zugfestigkeit (C12) Tensile MPa (N/mm²)	Dehnung (C13) Elongation %		Einschnürg. Red. of area %
20	min 205		515	30,0		50
	max			$5d_0$	$4d_0$	
20	301	349	574	58,4	73,0	67

Kerbschlagbiegeversuch / Impact test DIN EN ISO 148-1 (V-Kerb / V-notch)

Temp. (C03) °C	Einzelwerte (C42) Single values J			MW (C43) Average J
20				
20	170	174	166	170,0

Härte (C32) Hardness ISO 6506-1 HBW 2,5/187,5: 164

Country of Melting: India - Country of Origin: Germany

Chemical & Physical Tests
Reviewed and Accepted
By KK Date 11-28-2016
THE SPITZER COMPANIES

Am Material wurden keine Reparaturschweißungen vorgenommen. / No welding repair on the material.
Material ist nicht radioaktiv oder mit Quecksilber kontaminiert. / Material is free from radioactive or mercury contamination.
Sicht- und Maßprüfungen ohne Beanstandungen. (D01) / Visual and dimensional examinations without objections.
Die Anforderungen der Bestellung sind erfüllt. / The product meets the requirements of the order specifications.
Die Angaben in Klammern entsprechen den Vorgaben der DIN EN 10168 / Data in parentheses refer to DIN EN 10168.
APZ ist mit EDV erstellt und ohne Unterschrift gültig. / MTR was electronically generated and is valid without a signature.

R. Sparing
Abnahmebeauftragter des Herstellers (Z02) / Inspection Representative of the Manufacturer

PO 2132-014

Boxes 11, Noz. F, Noz. G

outokumpu
high performance stainless steel

506115-2132-SA312-S-8

ODF 85 C 0002 v11

****
* CERTIFICATION *
****

01/08/16
HEAT 506115 ORDER 0030330/004 B00024957

OUPW 9888-3

SHIP TO:
TA CHEN INTERNATIONAL
8499 - 107th Street
800-580-1070
Pleasant Prairie WI 53158

---------- YOUR ORDER & DATE ----------
L55206 1/08/16 CUST# TACHEN01

---------- ITEM DESCRIPTION ----------
8" SCH40S TP304/TP304L A312
Country of Melt : USA
Country of Mfg. : USA

---------- SPECIFICATIONS ----------
ASTM A312-15A/ASME SA312-15
QUALITY SYSTEM CERTIFIED TO:
PED 97/23/EC ANNEX 1, § 4.3
BY TUV SUD INDUSTRIE SERVICE
GMBH, NOTIFIED BODY 0036
TOLERANCE: ASTM A999
LONGITUDINAL WELDED
RANDOM LENGTHS
PLAIN ENDS
DESCALED, PICKLED, AND
PASSIVATED: ASTM A380
WELDED
MECHANICAL TESTING: ASTM A370
YIELD STRENGTH:0.2% OFFSET
COLD FINISHED
ELECTRIC FUSION WELDED (EFW)
IM EINVERNEHMEN MIT DEM TUV
SUD INDUSTRIE SERVICE GMBH
WIRD AUF EINE GEGENZEICHNUNG
LAUT SCHREIBEN VOM 05.AUGUST
2008 DURCH TUV SUD INDUSTRIE
SERVICE GMBH VERZICHTET
Certificate in conformance with EN10204-95 3.1.B / EN10204-2004 3.1

---------- MECHANICAL & OTHER TESTS ----------

Tensile strength,KSI (MPa)		84.8 (585)
Yield strength,KSI (MPa)		48.5 (334)
Elongation % in 2		50.0
Guided Bend Face	OK	
Bend Test		
Hydrotest PSI (MPa)		1200 (8.27)
NACE MR0175/ISO 15156:09	NACE MR0103-12	
HRB-89		

---------- CHEMICAL COMPOSITION ----------

Carbon	(C)	.024	Manganese	(Mn)	1.790
Phosphorus	(P)	.027	Sulphur	(S)	.012
Silicon	(Si)	.540	Chromium	(Cr)	18.000
Nickel	(Ni)	8.030	Moly	(Mo)	.350
Nitrogen	(N)	.074			

-- Continued --

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 11-29-2016
THE SPITZER COMPANIES

Martha James
Martha James

Outokumpu Stainless Pipe, Inc.
ADDRESS
241 W Clarke Street
Wildwood, Florida 34785-9501
TELEPHONE
(352) 748-1313
TELEFAX
Administration: (352) 748-2751
Purchasing: (352) 748-5576
Production Control: (352) 748-0533
Quality Assurance: (352) 748-0533

Bom#20

po 2132-012

Nozzle F, G, H

1/2

506115-2132-SA312-S-8

OUPW 9888-4

outokumpu
high performance stainless steel

****
* CERTIFICATION *
****

01/08/16
HEAT 506115 ORDER 0030330/004 BO0024957

SHIP TO:
TA CHEN INTERNATIONAL
8499 - 107th Street
800-580-1070
LONG BEACH CA 53158

CAUTION: Processing that produces fumes and dust may cause respiratory disease: Especially alloys containing Chromium and Nickel.

CERTIFICATION: We certify that the analysis figures are correct as contained in the records of the company and that the material is free of known mercury, asbestos, and low melting alloy contamination. No weld repair unless otherwise noted.

HEAT TREATMENT & PICKLING: Solution annealed at a range 1900F-2000F and water quenched to below 800F within 3 minutes. Descaled, pickled, and passivated.

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes.

We hereby certify that the chemical analysis and/or test results shown in this report are correct as contained in the records of the company.

Quality Representative

Martha James
Martha James

Outokumpu Stainless Pipe, Inc.
ADDRESS
241 W Clarke Street
Wildwood, Florida 34785-9501
TELEPHONE
(352) 748-1313
TELEFAX
Administration: (352) 748-2761
Purchasing: (352) 748-8576
Production Control: (352) 748-0533
Quality Assurance: (352) 748-0533

po 2132-012

2/2

5062-2132-SA182-L-6

TEXAS METAL WORKS®
an AFGlobal Company

Material Test Report

Heat Code: 5062

ISO 9001:2008 Certified

Texas Metal Works
An AFGlobal Company
13770 Industrial Rd. Houston, TX 77015
Sales: (713) 868-4421 Fax: (713) 455-8366

RSD SUPPLY INC RSD0001	PO: 5473500	Sales Order: 156867	Line: 4
13225 FM 529	Item Code: 0301600101-FAV4F	Qty Shipped: 3	
SUITE N	Item Desc: FLG 06.00 0300 WN RF 40S 304/304L SAN TMW		
HOUSTON, TX 77041	Supplier Heat: 5062		

Spec: ASTM A 182/A 182M (16)/ASME SA 182/SA 182M (15) Section II Part A, F304/F304L

Element	(%wt)	Ladle	Product	EPCRA	CAS#	Element	(%wt)	Ladle	Product	EPCRA	CAS#
C	Carbon	0.022				Si	Silicon	0.41			
Mn	Manganese	1.81		✓	7439-96-5	Ni	Nickel	8.05		✓	7440-02-0
P	Phosphorous	0.038				Cr	Chromium	18.32		✓	7440-47-3
S	Sulphur	0.010				N	Nitrogen	0.07			

Mechanical Testing		Heat Treat	
Test Lab	SUPPLIER	Solution Annealed (F)	1922
Test Bar Size	SACRIFICIAL PIECE	S.A. Cooling Type	WATER
HBW	155 - 165		
Elg (%)	57	**Other**	
RA (%)	72.3	AOD/VOD	AOD
Tensile Specimen Size (in)	.500	EF	Y
Tensile (ksi)	81		
Yield (ksi)	36		
Gauge Length (in)	2		

Compliant with hardness max of 22 HRC (237 BHN) per NACE MR0175/ISO 15156-3:2009 and NACE MR0103-2012.

* No Weld repair performed.
* Ladle Chemical Analysis results are reported from the raw material suppliers MTR.
* Tensile taken from a round specimen. Measurement of elongation after fracture.
* Yield strength was determined using the .2% offset method, unless otherwise specified.
* All material supplied under this order is certified to be free of mercury contamination and no mercury bearing equipment was used in manufacturing, fabrication or testing.
* When reported on MTR: Tensile Testing Per ASTM E8; Brinell Hardness Per ASTM E10; Charpy Testing Per ASTM E23
* AF Global manufactures materials according to a certified Quality Management System conforming to ISO 9001:2008 and PED 2014/68/EU, Annex 1, Section 4.3

Unless otherwise noted on PO, Dimensions of all standard pipe flanges and flange fittings (NPS 1/2 to NPS 24) per ASME B16.5-2013 , large diameter steel flanges (NPS 26 to 60) per ASME B16.47-2011, Orifice flanges per ASME B16.36-2015, Steel pipeline flanges (NPS 1/2 to 60) per MSS SP-44.

The recording of false, fictitious, or fraudulent statement or entries on this document may be punishable as a felony under federal statute.

EPCRA Supplier Notification: This product may contain one or more toxic chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-to-Know Act (Title III of the Superfund Amendments and Reauthorization Act of 1986) and 40 C.F.R. Part 372. Potentially reportable chemicals are indicated with a checkmark in the "EPCRA" column and a Chemical Abstract Services (CAS) registry number is provided for each such chemical in addition to the percent by weight of the chemical present in this product. It is your responsibility alone to determine whether your facility is required to submit a Toxic Release Inventory Report under EPCRA Section 313.

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 11-28-2016
THE SPITZER COMPANIES

Certification No.: 1264524
Certification Date: 11/22/2016
Issued By: Nancy Loos

Rina Sane - Metallurgical Lab Manager

This report is issued in compliance with the requirements of EN10204 3.1 / ISO 10474 3.1.b

BOM #10 - No2J, No2L, No2M

PO 2132-014

1/1

outokumpu
high performance stainless steel

510713-2132-SA312-S-6

CERTIFICATION

11/17/16
HEAT 510713 ORDER 0030791/004 BO0025802

SHIP TO:
SOUTHWEST STAINLESS TULSA
3742 South Maybelle Ave.

TULSA OK 74107

YOUR ORDER & DATE

481011-00 11/17/16 CUST# STATUB01

ITEM DESCRIPTION

6" SCH40S TP304/TP304L A312-TE

Country of Melt : USA
Country of Mfg. : USA

SPECIFICATIONS

ASTM A312-16A/ASME SA312-15
QUALITY SYSTEM CERTIFIED TO:
PED 97/23/EC ANNEX 1, § 4.3
BY TUV SUD INDUSTRIE SERVICE
GMBH, NOTIFIED BODY 0036
TOLERANCE: ASTM A999
LONGITUDINAL WELDED
RANDOM LENGTHS
PLAIN ENDS
DESCALED, PICKLED, AND
PASSIVATED: ASTM A380
Certificate in conformance with EN10204-95 3.1.B / EN10204-2004 3.1

WELDED
MECHANICAL TESTING: ASTM A370
YIELD STRENGTH:0.2% OFFSET
COLD FINISHED
ELECTRIC FUSION WELDED (EFW)
IM EINVERNEHMEN MIT DEM TUV
SUD INDUSTRIE SERVICE GMBH
WIRD AUF EINE GEGENZEICHNUNG
LAUT SCHREIBEN VOM 05.AUGUST
2008 DURCH TUV SUD INDUSTRIE
SERVICE GMBH VERZICHTET

MECHANICAL & OTHER TESTS

Tensile strength,KSI (MPa)		91.2 (629)
Yield strength,KSI (MPa)		51.9 (358)
Elongation % in 2		50.0
Guided Bend Face	OK	
Bend Test		
Hydrotest PSI (MPa)		1300 (8.96)
NACE MR0175/ISO 15156:15	NACE MR0103-15	
HRB-83		

CHEMICAL COMPOSITION

Carbon	(C)	.025	Manganese	(Mn)	1.780
Phosphorus	(P)	.027	Sulphur	(S)	.011
Silicon	(Si)	.620	Chromium	(Cr)	18.250
Nickel	(Ni)	8.020	Moly	(Mo)	.270
Nitrogen	(N)	.065			

-- Continued --

Chemical & Physical Tests
Reviewed and Accepted
By RK Date 11-29-2016
THE SPITZER COMPANIES

Martha James
Martha James

Outokumpu Stainless Pipe, Inc.
ADDRESS
241 W Clarke Street
Wildwood, Florida 34785-9601
TELEPHONE
(352) 748-1313
TELEFAX
Administration: (352) 748-2751
Purchasing: (352) 748-6578
Production Control (352) 748-0533
Quality Assurance (352) 748-0533

Beam #19

2132-012

Nozzle J, L, M

1/2

outokumpu
high performance stainless steel

510713-2132-SA312-S-6

****
* CERTIFICATION *
****

11/17/16
HEAT 510713 ORDER 0030791/004 BO0025802

SHIP TO:
SOUTHWEST STAINLESS TULSA
3742 South Maybelle Ave.

TULSA OK 74107

CAUTION: Processing that produces fumes and dust may cause respiratory disease: Especially alloys containing Chromium and Nickel.

CERTIFICATION: We certify that the analysis figures are correct as contained in the records of the company and that the material is free of known mercury, asbestos, and low melting alloy contamination. No weld repair unless otherwise noted.

HEAT TREATMENT & PICKLING: Solution annealed at a range 1900F-2000F and water quenched to below 800F within 3 minutes. Descaled, pickled, and passivated.

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes.

We hereby certify that the chemical analysis and/or test results shown in this report are correct as contained in the records of the company.

Quality Representative

Martha James

Martha James

Outokumpu Stainless Pipe, inc.
ADDRESS
241 W Clarke Street
Wildwood, Florida 34785-9601
TELEPHONE
(352) 748-1213
TELEFAX
Administration (352) 748-2751
Purchasing (352) 748-6576
Production Control (352) 748-0533
Quality Assurance (352) 748-0533

po 2132-012

4/2

BEBITZ

Bereich Flansche / Flange Division

Flanschenwerk Bebitz GmbH-Lebendorfer Str.1-06420 Bebitz/GERMANY (A01) Tel. +49 34691 40 0-Fax +49 3469140 329-Email: flanges@bebitz.de
Bebitz Flanges Works Pvt. Ltd.-Survey No. 140/2, Saravali Boisar - Taluka Palghar - Thane 401501 Maharashtra, INDIA - Email: quality@bebitz.in
Bebitz U.S.A., INC. 100 Quentin Roosevelt BLVD-Garden City, NY11530/USA Tel. +1-516-2808380-Fax +1-516-2808382-Email: bebitzusa@bebitz.de

Abnahmeprüfzeugnis 3.1 / Inspection certificate 3.1 / Certificat de reception 3.1

nach (A02) / acc. DIN EN 10204 : 2005 Nr. (A03) / No. 13-35968 **Datum (Z02) / Date** 18.11.2013

Zeichen des Herstellers (A04) / Manufacturer's brand: [B]

Stempel des Abnehmers (Z03) / Stamp of the testing engineer: TKO B

Überprüft als Hersteller nach AD-Merkblatt W0 / TRD100 und VdTÜV Werkstoffblätter 350/3, 354, 399. / Approved as manufacturer acc. AD-Merkblatt W0 / TRD100 and VdTÜV Material Sheets 350/3, 354, 399.
Zertifiziert nach DGR 97/23/EG durch TÜV CERT Zertifzierungsst. für Druckgeräte der TÜV NORD GmbH Co KG, Benannte Stelle Nr. 0045. / Certified acc. to PED 97/23/EC, certifying body for pressure equipment TÜV NORD GmbH Co KG, registration no. 0045.

Besteller (A06) Customer
TEXAS PIPE & SUPPLY Co.
2330 Holmes Road
HOUSTON, TX 77051

Bestell-Nr (A07) / Order-No. 132165-00
Auftrag (A08) / Order 3321834
Lieferschein / Delivery No. 3337220
Position (B07.1) / Item 51FB

Stck (B08) / Quantity	Bezeichnung (B01; B09 - B11) / Product	Schmelze/Prüflos (B07) / Heat no./Test no.
3	12 inch Blind Flange 300 lbs raised face	26484/1

Material (B02; B05) F 304/F 304L - ASTM A 182M-13 / ASME SA-182M
austenitis. > 1040 °C and quenched in water

Anford. (B03) Require-ments
ASME B 16.5-2009
NACE MR0175-2011 / MR0103-2010 - DIN EN ISO 15156-2:2009
2011a ASME Boiler & Pressure Vessel Code - Section II Part A
PMI-tested 100%, IC-test acc. to DIN EN ISO 3651-2 Test A / ASTM A 262 practice E

Schmelzenanalyse (C71 - C92) / Ladle analysis **Erschmelzung (C70) / Melting process** E

C	Si	Mn	P	S	Cr	Ni	Ti	Mo	Nb	V	N	Cu	Al	PREN
0,025	0,40	1,71	0,038	0,022	18,19	8,04					0,080			19,47

$CEV = C + \frac{Mn}{6} + \frac{V + Mo + Cr}{5} + \frac{Ni + Cu}{15}$ $\quad PREN = Cr + 3{,}3 \times Mo + 16 \times N$

Mechanische Prüfungen / Mechanical tests

Probenlage (C02): T / Position of Specimen: T Zugversuch / Tensile Test - ASTM A 370						Kerbschlagbiegeversuch / Impact test DIN EN ISO 148-1 (V-Kerb / V-notch)				Härte (C32) Hardness ISO 6506-1
Temp (C03) ° C	Streckgrenze (C11) / Yield 0,2% MPa (N/mm²)	1,0% MPa (N/mm²)	Zugfestigkeit (C12) Tensile MPa (N/mm²)	Dehnung (C13) Elongation %	Einschnürg. Red. of area %	Temp. (C03) ° C	Einzelwerte (C42) Single values J		MW (C43) Average J	HBW 2,5/187,5
20	min 205 max		515	30,0 $5d_0$ $4d_0$	50	20				
20	287	313	569	60,2 75,3	73	20	180	170 174	174,7	159

Country of Melting: India - Country of Origin: Germany

Nozzle K1, K6, K7

Chemical & Physical Tests
Reviewed and Accepted
By KR Date 02-24-2017
THE SPITZER COMPANIES

PO 2132-013 26484-1-2132-SA182-L-12

Besichtigung und Ausmessung ohne Beanstandungen. (D01) / Results of inspection and dimension without objections.
Die gestellten Anforderungen sind erfüllt. (Z01) / The product meets the requirements.

APZ wurde mit EDV erstellt und ist ohne Unterschrift gültig. /
This MTR was electronically generated and is valid without a signature.

R. Sparing,
Abnahmebeauftragter des Herstellers (Z02)
Inspection Representative of the Manufacturer

Angaben in Klammern entsprechen den Vorgaben der DIN EN 10168 /
Data in parentheses refer to EN 10168.

BEBITZ

Bereich Flansche / Flange Division

Flanschenwerk Bebitz GmbH-Lebendorfer Str.1-06420 Bebitz/GERMANY (A01) Tel. +49 34691 40 0-Fax +49 3469140 329-Email: flanges@bebitz.de
Bebitz Flanges Works Pvt. Ltd.-Survey No. 140/2, Saravali Boisar - Taluka Palghar - Thane 401501 Maharashtra, INDIA - Email: quality@bebitz.in
Bebitz U.S.A., INC. 100 Quentin Roosevelt BLVD-Garden City, NY11530/USA Tel. +1-516-2808380-Fax +1-516-2808382-Email: bebitzusa@bebitz.de

Abnahmeprüfzeugnis 3.1 / Inspection certificate 3.1 / Certificat de reception 3.1

nach (A02) / acc. DIN EN 10204 : 2005 Nr. (A03) / No. 14-22592 **Datum (Z02) / Date** 08.07.2014

Zeichen des Herstellers (A04) / Manufacturer's brand: [B]

Stempel des Abnehmers (Z03) / Stamp of the testing engineer: TKO B

Überprüft als Hersteller nach AD-Merkblatt W0 / TRD100 und VdTÜV Werkstoffblätter 350/3, 354, 399. / Approved as manufacturer acc. AD-Merkblatt W0 / TRD100 and VdTÜV Material Sheets 350/3, 354, 399.
Zertifiziert nach DGR 97/23/EG durch TÜV CERT Zertifizierungsst. für Druckgeräte der TÜV NORD GmbH Co KG, Benannte Stelle Nr. 0045. / Certified acc. to PED 97/23/EC, certifying body for pressure equipment TÜV NORD GmbH Co KG, registration no. 0045.

Besteller (A06) Customer
TEXAS PIPE & SUPPLY Co.
2330 Holmes Road
HOUSTON, TX 77051

Bestell-Nr (A07) / Order-No. 137962-00
Auftrag (A08) / Order 3420752
Lieferschein / Delivery No. 3434228
Position (B07.1) / Item 42U

Stck (B08) Quantity	Bezeichnung (B01; B09 - B11) Product	Schmelze/Prüflos (B07) Heat no./Test no.
4	12 inch Blind Flange 300 lbs raised face	92877/2

Material (B02; B05) F 304/F 304L - ASTM A 182M-13 / ASME SA-182M
solution annealed > 1040 °C and quenched in water

Anford. (B03) Require-ments
ASME B 16.5-2009
NACE MR0175-2011 / MR0103-2010 - DIN EN ISO 15156-2:2009
2013 ASME Boiler & Pressure Vessel Code - Section II Part A
PMI-tested 100%, IC-test acc. to DIN EN ISO 3651-2 Test A / ASTM A 262 practice E

Schmelzenanalyse (C71 - C92) / Ladle analysis **Erschmelzung (C70) / Melting process** E+AOD

C	Si	Mn	P	S	Cr	Ni	Ti	Mo	Nb	V	N	Cu	Al	PREN
0,020	0,49	1,88	0,038	0,021	18,23	8,77		0,20			0,093			20,38

$$CEV = C + \frac{Mn}{6} + \frac{V + Mo + Cr}{5} + \frac{Ni + Cu}{15} \qquad PREN = Cr + 3{,}3 \times Mo + 16 \times N$$

Mechanische Prüfungen / Mechanical tests

Probenlage (C02): T / Position of Specimen: T
Zugversuch / Tensile Test - ASTM A 370

Temp (C03) ° C	Streckgrenze (C11) / Yield 0,2% MPa (N/mm²)	1,0% MPa (N/mm²)	Zugfestigkeit (C12) Tensile MPa (N/mm²)	Dehnung (C13) Elongation %		Einschnürg. Red. of area %
20	min 205 max		515	30,0 $5d_0$	$4d_0$	50
20	314	342	570	59,3	74,1	73

Kerbschlagbiegeversuch / Impact test DIN EN ISO 148-1 (V-Kerb / V-notch)

Temp. (C03) ° C	Einzelwerte (C42) Single values J			MW (C43) Average J
20				
20	157	179	163	166,3

Härte (C32) Hardness ISO 6506-1 HBW 2,5/187,5

164

Country of Melting: India - Country of Origin: Germany

92877-2-2132-SA182-L-12

Besichtigung und Ausmessung ohne Beanstandungen. (D01) / Results of inspection and dimension without objections.
Die gestellten Anforderungen sind erfüllt. (Z01) / The product meets the requirements.

R. Sparing,
Abnahmebeauftragter des Herstellers (Z02)
Inspection Representative of the Manufacturer

APZ wurde mit EDV erstellt und ist ohne Unterschrift gültig. /
This MTR was electronically generated and is valid without a signature.
Angaben in Klammern entsprechen den Vorgaben der DIN EN 10168 /
Data in parentheses refer to EN 10168.

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 02-24-2017
THE SPITZER COMPANIES

Nozzle K2, K3, K4,
po 2132-013 K8

1/1

BEBITZ

Bereich Flansche / Flange Division

Flanschenwerk Bebitz GmbH-Lebendorfer Str.1-06420 Bebitz/GERMANY (A01) Tel. +49 34691 40 0-Fax +49 3469140 329-Email: flanges@bebitz.de
Bebitz Flanges Works Pvt. Ltd.-Survey No. 140/2, Saravali Boisar - Taluka Palghar - Thane 401501 Maharashtra, INDIA - Email: quality@bebitz.in
Bebitz U.S.A., INC. 100 Quentin Roosevelt BLVD-Garden City, NY11530/USA Tel. +1-516-2808380-Fax +1-516-2808382-Email: bebitzusa@bebitz.de

Abnahmeprüfzeugnis 3.1 / Inspection certificate 3.1 / Certificat de reception 3.1

nach (A02) / acc. DIN EN 10204 : 2005 Nr. (A03) / No. 14-11237 **Datum (Z02) / Date** 27.03.2014

Zeichen des Herstellers (A04) / Manufacturer's brand: [B]

Stempel des Abnehmers (Z03) / Stamp of the testing engineer: TKO B

Überprüft als Hersteller nach AD-Merkblatt W0 / TRD100 und VdTÜV Werkstoffblätter 350/3, 354, 399. / Approved as manufacturer acc. AD-Merkblatt W0 / TRD100 and VdTÜV Material Sheets 350/3, 354, 399.
Zertifiziert nach DGR 97/23/EG durch TÜV CERT Zertifizierungsst. für Druckgeräte der TÜV NORD GmbH Co KG, Benannte Stelle Nr. 0045. / Certified acc. to PED 97/23/EC, certifying body for pressure equipment TÜV NORD GmbH Co KG, registration no. 0045.

Besteller (A06) Customer
TEXAS PIPE & SUPPLY Co.
2330 Holmes Road
HOUSTON, TX 77051

Bestell-Nr (A07) / Order-No. 137962-00
Auftrag (A08) / Order 3420752
Lieferschein / Delivery No. 3432044
Position (B07.1) / Item 42U

Stck (B08) Quantity	Bezeichnung (B01; B09 - B11) Product	Schmelze/Prüflos (B07) Heat no./Test no.
1	12 inch Blind Flange 300 lbs raised face	27510/1

Material (B02; B05) F 304/F 304L - ASTM A 182M-13 / ASME SA-182M
austenitis. > 1040 °C and quenched in water

Anford. (B03) Require-ments
ASME B 16.5-2009
NACE MR0175-2011 / MR0103-2010 - DIN EN ISO 15156-2:2009
2011a ASME Boiler & Pressure Vessel Code - Section II Part A
PMI-tested 100%, IC-test acc. to DIN EN ISO 3651-2 Test A / ASTM A 262 practice E

Schmelzenanalyse (C71 - C92) / Ladle analysis **Erschmelzung (C70) / Melting process** E

C	Si	Mn	P	S	Cr	Ni	Ti	Mo	Nb	V	N	Cu	Al	PREN
0,018	0,38	1,80	0,034	0,025	18,08	8,08					0,093			19,57

$$CEV = C + \frac{Mn}{6} + \frac{V + Mo + Cr}{5} + \frac{Ni + Cu}{15} \qquad PREN = Cr + 3{,}3 \times Mo + 16 \times N$$

Mechanische Prüfungen / Mechanical tests

Probenlage (C02): T / Position of Specimen: T Zugversuch / Tensile Test - ASTM A 370						Kerbschlagbiegeversuch / Impact test DIN EN ISO 148-1 (V-Kerb / V-notch)				Härte (C32) Hardness ISO 6506-1
Temp (C03) °C	Streckgrenze (C11) / Yield 0,2% MPa (N/mm²)	1,0% MPa (N/mm²)	Zugfestigkeit (C12) Tensile MPa (N/mm²)	Dehnung (C13) Elongation %	Einschnürg. Red. of area %	Temp. (C03) °C	Einzelwerte (C42) Single values J		MW (C43) Average J	HBW 2,5/187,5
20	min 205 max		515	30,0 5d₀ 4d₀	50	20				
20	278	305	569	59,5 74,4	72	20	160	148 154	154,0	157

Country of Melting: India - Country of Origin: Germany

27510-1-2132-SA182-L-12

Besichtigung und Ausmessung ohne Beanstandungen. (D01) / Results of inspection and dimension without objections.
Die gestellten Anforderungen sind erfüllt. (Z01) / The product meets the requirements.

R. Sparing,
Abnahmebeauftragter des Herstellers (Z02)
Inspection Representative of the Manufacturer

APZ wurde mit EDV erstellt und ist ohne Unterschrift gültig. /
This MTR was electronically generated and is valid without a signature.
Angaben in Klammern entsprechen den Vorgaben der DIN EN 10168 /
Data in parentheses refer to EN 10168.

Nozzle K5

po 2132-013

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 02-24-2017
THE SPITZER COMPANIES

SE69768-2132-SA403 F-6 ELBOW

MATERIAL TEST & INSPECTION CERTIFICATE

SUNGKWANG BEND CO., LTD.(SKB)
26, Noksansandan 262-ro, Gangseo-Gu, Busan, Korea
TEL : 82-051-3300-450
FAX : 82-051-3300-335
http://www.skbend.com

CUSTOMER: TEAM ALLOYS
PROJECT NAME: N/A

According to
DIN 50049 3.1 / EN 10204 3.1 / ISO 10474 3.1

PURCHASE ORDER NO.	2772-BB	SPEC. FOR MATERIAL	ASTM/ASME A/SA403WP304/304L-W 12/13ED	CERTIFICATE NO.	QCLH2013123976
PJT NO.	N/A	SPEC. FOR INSPECTION	ASME B16.9	DATE OF ISSUE	2013.12.18
STARTING MATERIAL	E.F.W PIPE	SKB NO.	2013080915	VISUAL & DIMENSION	SATISFACTORY

NO.	SEQ/LINE/ITEM NO	DESCRIPTION					QTY	HEAT NO.	MFG ID NO.	POR/CODE/TAG NO
156		90D ELBOW(L)	S40S	6"	B.W WELD	SUS	100	SE69768	SE69768	
170		45D ELBOW(L)	S40S	6"	B.W WELD	SUS	24	SE69768	SE69768	

CHEMICAL COMPOSITION(%) (L : LADLE, P : PRODUCT)

STD. / HEAT NO.	SPEC.	C	Si	Mn	P	S	Ni	Cr	Mo	Cu	V	Nb	N	Al	B	Zr	Fe	Ti	C.E
	MIN						8.00	18.00											
	MAX	0.030	1.00	2.00	0.045	0.030	11.00	20.00											
SE69768	L	0.024	0.35	1.46	0.030	0.002	8.05	18.09											
	P																		
	L																		
	P																		

TENSILE TEST

SPEC.	Y.S 0.2% offset KSI	T.S KSI	EL. %	R.A %
MIN	30.0	75.0	28.0	
MAX				
	44.4	89.6	56.0	

IMPACT TEST / HEAT NO.	TEST TEMP.	SIZE OF SPECIMEN(mm)		ABSORBED ENERGY STD. / VALUE			AVE.	LATERAL EXPANSION STD. / VALUE			AVE.	PERCENT SHEAR STD. / VALUE			AVE.
SE69768			B/M												
			HAZ												
			W/M												
			B/M												
			HAZ												
			W/M												

HARDNESS HRC	
MIN	
MAX	22.0
HB	152

HEAT TREATMENT: SOLUTION TREATED. 1060℃, 20Min., "Water"

PMI	ACCEPT	N.D.E	N/A
FLATTENING TEST	N/A	*MEMO	
BENDING TEST	N/A		
HYDROSTATIC TEST	N/A		
CORROSION TEST	N/A		
GRAIN SIZE TEST	N/A		
HIC TEST	N/A		

MATERIAL MEETS THE REQUIREMENTS OF NACE MR0103 & 0175 /ISO15156

WE CERTIFY THIS MATERIAL HAS BEEN MANUFACTURED AND EXAMINED IN ACCORDANCE WITH ALL REQUIREMENTS OF THE SPECIFICATION AND THE RESULTS OF ALL EXAMINATION ARE ACCEPTABLE.

QM DIV. SENIOR MANAGING DIRECTOR

□ REVIEWED BY
□ WITNESSED BY : _____

SKE-8903

*본 검사증명서에 명기된 규격용외 사용시 안전상 문제가 발생할 수 있으며, 검사증명서 위 변조시 사문서 위조(형법231조)로 불이익을 당하실 수 있습니다.

PO 2132-011

Chemical & Physical Te...
Reviewed and Accepte...
By RK Date 11-30-2016
THE SPITZER COMPAN...

1/1

56666-2-2132-SA182-L-20

BEBITZ

Bereich Flansche / Flange Division

Flanschenwerk Bebitz GmbH-Lebendorfer Str.1-06420 Bebitz/GERMANY (A01) Tel. +49 34691 40 0-Fax +49 3469140 329-Email: flanges@bebitz.de
Bebitz Flanges Works Pvt. Ltd.-Survey No. 140/2, Saravali Boisar - Taluka Palghar - Thane 401501 Maharashtra, INDIA - Email: quality@bebitz.in
Bebitz U.S.A., INC. 100 Quentin Rooseveit BLVD-Garden City, NY11530/USA Tel. +1-516-2808380-Fax +1-516-2808382-Email: bebitzusa@bebitz.de

Abnahmeprüfzeugnis 3.1 / Inspection certificate 3.1 / Certificat de reception 3.1

nach (A02) / acc. DIN EN 10204 : 2005 Nr. (A03) / No. 15-15291 **Datum (Z02) / Date** 09.06.2015

Zeichen des Herstellers (A04) / Manufacturer's brand: [B]

Stempel des Abnehmers (Z03) / Stamp of the testing engineer: TKO B

Überprüft als Hersteller nach AD-Merkblatt W0 / TRD100 und VdTÜV Werkstoffblätter 350/3, 354, 399. / Approved as manufacturer acc. AD-Merkblatt W0 / TRD100 and VdTÜV Material Sheets 350/3, 354, 399.
Zertifiziert nach DGR 97/23/EG durch TÜV CERT Zertifizierungsst. für Druckgeräte der TÜV NORD GmbH Co KG, Benannte Stelle Nr. 0045. / Certified acc. to PED 97/23/EC, certifying body for pressure equipment TÜV NORD GmbH Co KG, registration no. 0045.

Besteller (A06) Customer: Team Alloys USA, Inc.
7350 Roundhouse Lane
HOUSTON, TX 77078

Bestell-Nr (A07) / Order-No. 4916-BB
Auftrag (A08) / Order 3520646
Lieferschein / Delivery No. 3532705
Position (B07.1) / Item 54

Stck (B08) Quantity	Bezeichnung (B01; B09 - B11) Product	Schmelze/Prüflos (B07) Heat no./Test no.
5	20 inch Blind Flange 300 lbs raised face	56666/2

Material (B02; B05) F 304/F 304L - ASTM A 182M-13a / ASME SA-182M
solution annealed > 1040 °C and quenched in water

Anford. (B03) Requirements
ASME B 16.5-2013
NACE MR0175-2011 / MR0103-2010 - DIN EN ISO 15156-2:2009
2013 ASME Boiler & Pressure Vessel Code - Section II Part A
PMI-tested 100%, IC-test acc. to DIN EN ISO 3651-2 Test A / ASTM A 262 practice E

Schmelzenanalyse (C71 - C92) / Ladle analysis **Erschmelzung (C70) / Melting process** E+AOD

C	Si	Mn	P	S	Cr	Ni	Ti	Mo	Nb	V	N	Cu	Al	PREN
0,025	0,29	1,79	0,027	0,001	18,17	8,37		0,27			0,084			20,41

$$CEV = C + \frac{Mn}{6} + \frac{V + Mo + Cr}{5} + \frac{Ni + Cu}{15} \qquad PREN = Cr + 3{,}3 \times Mo + 16 \times N$$

Mechanische Prüfungen / Mechanical tests

Probenlage (C02): T / Position of Specimen: T Zugversuch / Tensile Test - ASTM A 370						Kerbschlagbiegeversuch / Impact test DIN EN ISO 148-1 (V-Kerb / V-notch)				Härte (C32) Hardness ISO 6506-1
Temp (C03) °C	Streckgrenze (C11) / Yield 0,2% MPa (N/mm²)	1,0% MPa (N/mm²)	Zugfestigkeit (C12) Tensile MPa (N/mm²)	Dehnung (C13) Elongation %	Einschnürg. Red. of area %	Temp. (C03) °C	Einzelwerte (C42) Single values J			MW (C43) Average J	HBW 2,5/187,5
20	min 205 max		515	30,0 $5d_0$ / $4d_0$	50	20					
20	315	339	578	68,4	85,5	83	20	291	293	291	291,7	158 156

Country of Melting: Italy - Country of Origin: Germany - Flange marking in accordance to MSS SP-25 - 2013.

Chemical & Physical
Reviewed and Accepted
By [illegible] Date 2/28/1[illegible]

Nozzle N1

Am Material wurden keine Reparaturschweißungen vorgenommen. / No welding repair on the material.
Material ist nicht radioaktiv oder mit Quecksilber kontaminiert. / Material is free from radioactive or mercury contamination.
Sicht- und Maßprüfungen ohne Beanstandungen. (D01) / Visual and dimensional examinations without objections.
Die Anforderungen der Bestellung sind erfüllt. / The product meets the requirements of the order specifications.
Die Angaben in Klammern entsprechen den Vorgaben der DIN EN 10168 / Data in parentheses refer to DIN EN 10168.
APZ ist mit EDV erstellt und ohne Unterschrift gültig. / MTR was electronically generated and is valid without a signature.

R. Sparing
Abnahmebeauftragter des Herstellers (Z02) / Inspection Representative of the Manufacturer

P.O - 2132013

Bin = #16

BEBITZ

Bereich Flansche / Flange Division

Flanschenwerk Bebitz GmbH-Lebendorfer Str.1-06420 Bebitz/GERMANY (A01) Tel. +49 34691 40 0-Fax +49 3469140 329-Email: flanges@bebitz.de
Bebitz Flanges Works Pvt. Ltd.-Survey No. 140/2, Saravali Bolsar - Taluka Palghar - Thane 401501 Maharashtra, INDIA - Email: quality@bebitz.in
Bebitz U.S.A., INC. 100 Quentin Roosevelt BLVD-Garden City, NY11530/USA Tel. +1-516-2808380-Fax +1-516-2808382-Email: bebitzusa@bebitz.de

Abnahmeprüfzeugnis 3.1 / Inspection certificate 3.1 / Certificat de reception 3.1

nach (A02) / acc. DIN EN 10204 : 2005 Nr. (A03) / No. 15-23770 Datum (Z02) / Date 18.09.2015

Zeichen des Herstellers (A04) / Manufacturer's brand: [B]

Stempel des Abnehmers (Z03) / Stamp of the testing engineer: TKO B

Überprüft als Hersteller nach AD-Merkblatt W0 / TRD100 und VdTÜV Werkstoffblätter 350/3, 354, 399. / Approved as manufacturer acc. AD-Merkblatt W0 / TRD100 and VdTÜV Material Sheets 350/3, 354, 399.
Zertifiziert nach DGR 97/23/EG durch TÜV CERT Zertifzierungsst. für Druckgeräte der TÜV NORD GmbH Co KG, Benannte Stelle Nr. 0045. / Certified acc. to PED 97/23/EC, certifying body for pressure equipment TÜV NORD GmbH Co KG, registration no. 0045.

Besteller (A06) / Customer: TEXAS PIPE & SUPPLY Co.
2330 Holmes Road
HOUSTON, TX 77051

Bestell-Nr (A07) / Order-No. 152560-00
Auftrag (A08) / Order 3521881
Lieferschein / Delivery No. 3534288
Position (B07.1) / Item 146

Stck (B08) / Quantity	Bezeichnung (B01; B09 - B11) / Product	Schmelze/Prüflos (B07) / Heat no./Test no.
2	20 inch Blind Flange 300 lbs raised face	56613/2

Material (B02; B05) F 304/F 304L - ASTM A 182M-13a / ASME SA-182M
solution annealed > 1040 °C and quenched in water

Anford. (B03) Require-ments
ASME B 16.5-2013
NACE MR0175-2011 / MR0103-2010 - DIN EN ISO 15156-2:2009
2013 ASME Boiler & Pressure Vessel Code - Section II Part A
PMI-tested 100%, IC-test acc. to DIN EN ISO 3651-2 Test A / ASTM A 262 practice E

Schmelzenanalyse (C71 - C92) / Ladle analysis — **Erschmelzung (C70) / Melting process** E+AOD

C	Si	Mn	P	S	Cr	Ni	Ti	Mo	Nb	V	N	Cu	Al	PREN
0,021	0,35	1,82	0,031	0,001	18,47	8,42		0,37			0,091			21,15

$$CEV = C + \frac{Mn}{6} + \frac{V + Mo + Cr}{5} + \frac{Ni + Cu}{15} \qquad PREN = Cr + 3{,}3 \times Mo + 16 \times N$$

Mechanische Prüfungen / Mechanical tests

Probenlage (C02): T / Position of Specimen: T
Zugversuch / Tensile Test - ASTM A 370

Temp (C03) °C	Streckgrenze (C11) / Yield 0,2% MPa (N/mm²)	Streckgrenze (C11) / Yield 1,0% MPa (N/mm²)	Zugfestigkeit (C12) Tensile MPa (N/mm²)	Dehnung (C13) Elongation %		Einschnürg. Red. of area %
20	min 205 max		515	30,0 $5d_0$	$4d_0$	50
20	316	340	579	63,3	79,1	83

Kerbschlagbiegeversuch / Impact test DIN EN ISO 148-1 (V-Kerb / V-notch)

Temp. (C03) °C	Einzelwerte (C42) Single values J			MW (C43) Average J
20				
20	292	296	297	295,0

Härte (C32) Hardness ISO 6506-1

HBW 2,5/187,5
164 158

Country of Melting: Italy - Country of Origin: Germany

Nozzle N2, N3,

56613-2-2132-SA182-L-20

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 02-24-2017
THE SPITZER COMPANIES

Am Material wurden keine Reparaturschweißungen vorgenommen. / No welding repair on the material.
Material ist nicht radioaktiv oder mit Quecksilber kontaminiert. / Material is free from radioactive or mercury contamination.
Sicht- und Maßprüfungen ohne Beanstandungen. (D01) / Visual and dimensional examinations without objections.
Die Anforderungen der Bestellung sind erfüllt. / The product meets the requirements of the order specifications.
Die Angaben in Klammern entsprechen den Vorgaben der DIN EN 10168 / Data in parentheses refer to DIN EN 10168.
APZ ist mit EDV erstellt und ohne Unterschrift gültig. / MTR was electronically generated and is valid without a signature.

R. Sparing
Abnahmebeauftragter des Herstellers (Z02) / Inspection Representative of the Manufacturer

P° 2132-013

1/1

MAASS GLOBAL GROUP
MAASS FLANGE CORP
6202 Lumberdale Road
Houston Texas,
77092

ISO 9001:2008
Certified

544023-2132-SA182-L-20

Material Test Certification

Certificate Conforms to EN10204:2004 - 3.1

Sold to: EPIC DISTRIBUTION
2900 WESTFORK DR. SUITE 400
BATON ROUGE LA 70827

Cust. PO: 210G

Cert. No.: MR-F00635

Order No.: 217282

Packing Slip: 112285

PL Line No.	Order Line No.	Item No.	Description	Quantity	Lot No.	Heat Number	Material
69	88	2102000213	D-FIN F304-304L 20.00 300 RF BLD	2	B1500	544023	F304/304L

Ladle Analysis (%)

C	MN	P	S	SI	NI	CR	N
0.01	1.2	0.028	0.025	0.39	9.15	18.3	0.07

Mechanical Test

BHN	BHN2	TENSILE (PSI)	YIELD .2% (PSI)	ELONG (%)	R OF A (%)
147	152	75,545	37,990	64	65

Specification

A182M-2015 F304/304L; SA182-2013 F304/304L; NACE MR-0175 2009/ISO 15156, MR-0103 2010. ASME B16.5-2013 as applicable; Material free from mercury contamination. No weld repair was performed.

Heat Treatment

Solution annealed at 1950F/1065C minimum and water quenched.

Comments

A262-E passed

-20°F 155-144-164 ft-lbs: L/E 84-78-89 mils: %Shear 100-100-100

Melt: Sweden

Made in USA

We certify that the material represented by this document has been tested and inspected and is in conformance with the purchase order, drawing('s) and specification requirements.

Approved by Harold Acord

Harold Acord
Quality Assurance Inspector

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 03-3-2017
THIS CERTIFIED CORRECTLY

Nozzle N4

PO 2132-013

3/3/2017

BOM#102

33910-2132-SA182-L-20

TEXAS METAL WORKS®
an AFGlobal Company

Material Test Report

Heat Code: 33910

ISO 9001:2008 Certified

Texas Metal Works
An AFGlobal Company
13770 Industrial Rd. Houston, TX 77015
Sales: (713) 868-4421 Fax: (713) 455-8366

RSD SUPPLY INC RSD0001	PO: 5473500	Sales Order: 156867	Line: 2
13225 FM 529	Item Code: 0301920101-FAV4F	Qty Shipped: 4	
SUITE N	Item Desc: FLG 20.00 0300 WN RF 40S 304/304L SAN TMW		
HOUSTON, TX 77041	Supplier: International Piping	Supplier Heat: 33910	
Spec: ASTM A 182/A 182M (16)/ASME SA 182/SA 182M (15) Section II Part A, F304/F304L			

Element	(%wt)	Ladle	Product	EPCRA	CAS#	Element	(%wt)	Ladle	Product	EPCRA	CAS#
C	Carbon	0.018				Si	Silicon	0.43			
Mn	Manganese	1.20		✓	7439-96-5	Ni	Nickel	8.02		✓	7440-02-0
P	Phosphorous	0.033				Cr	Chromium	18.27		✓	7440-47-3
S	Sulphur	0.027				N	Nitrogen	0.08			

Mechanical Testing		Heat Treat	
Test Lab	SUPPLIER	Solution Annealed (F)	1922
Test Bar Size	SACRIFICIAL PIECE	S.A. Cooling Type	WATER
HBW	161 - 161		
Elg (%)	60.2	**Other**	
RA (%)	67.0	AOD/VOD	AOD
Tensile Specimen Size (in)	.500	EF	Y
Tensile (ksi)	85		
Yield (ksi)	41		
Gauge Length (in)	2		

Compliant with hardness max of 22 HRC (237 BHN) per NACE MR0175/ISO 15156-3:2009 and NACE MR0103-2012.

* No Weld repair performed.
* Ladle Chemical Analysis results are reported from the raw material suppliers MTR.
* Tensile taken from a round specimen. Measurement of elongation after fracture.
* Yield strength was determined using the .2% offset method, unless otherwise specified.
* All material supplied under this order is certified to be free of mercury contamination and no mercury bearing equipment was used in manufacturing, fabrication or testing.
* When reported on MTR: Tensile Testing Per ASTM E8; Brinell Hardness Per ASTM E10; Charpy Testing Per ASTM E23
* AF Global manufactures materials according to a certified Quality Management System conforming to ISO 9001:2008 and PED 2014/68/EU, Annex 1, Section 4.3

Unless otherwise noted on PO, Dimensions of all standard pipe flanges and flange fittings (NPS 1/2 to NPS 24) per ASME B16.5-2013 , large diameter steel flanges (NPS 26 to 60) per ASME B16.47-2011, Orifice flanges per ASME B16.36-2015, Steel pipeline flanges (NPS 1/2 to 60) per MSS SP-44.

The recording of false, fictitious, or fraudulent statement or entries on this document may be punishable as a felony under federal statute.

EPCRA Supplier Notification: This product may contain one or more toxic chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-to-Know Act (Title III of the Superfund Amendments and Reauthorization Act of 1986) and 40 C.F.R. Part 372. Potentially reportable chemicals are indicated with a checkmark in the "EPCRA" column and a Chemical Abstract Services (CAS) registry number is provided for each such chemical in addition to the percent by weight of the chemical present in this product. It is your responsibility alone to determine whether your facility is required to submit a Toxic Release Inventory Report under EPCRA Section 313.

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 11-28-2016
THE SPITZER COMPANIES

Certification No.: 1264527
Certification Date: 11/22/2016
Issued By: Nancy Loos

Rina Sane - Metallurgical Lab Manager

This report is issued in compliance with the requirements of EN10204 3.1 / ISO 10474 3.1.b

BOM#16- N62 N1, N2, N3, N4,

pg 2132-014

506324-2132-SA240-P-0.3728 x 60 x 240

Manufacturer / Fabricante / Herstellerwerk

outokumpu

Type of document / Tipo de documento / Art der Prüfbescheinigung

INSPECTION CERTIFICATE

CERTIFICADO DE INSPECCION

ABNAHMEPRÜFZEUGNIS

according to / de acuerdo con / nach

EN 10204-3.1

Document number / N° de comprobante / Bescheinigungsnr.

0000148737 /

Page / Pagina / Seite

1 / 1

1 ThyssenKrupp Drive; P.O. Box 13000; Calvert, AL 36513-1300

ACTION STAINLESS & ALLOYS INC
1505 HALSEY WAY
CARROLLTON TX 75007-4439
USA

Customer-Ship to / Cliente / Besteller/Empfänger

ACTION STAINLESS & ALLOYS INC,CARROLLTON

Customer's order number / N° de Pedido Cliente / Kundenauftrag-Nr.

p58259

Manufacturer's works order no. / N° de Pedido Manufactura / Werksauftrag-Nr.

901186185 / 001

Delivery note no. / N° de Entrega / Lieferzeugs-Nr.

85351310 / 010

Product / Producto / Erzeugnis

SHEET/HOJAS/BLECH

Terms of delivery / Condiciones de entrega / Lieferbedingungen

ASTM A240/240M, ASME SA-240 Sec.II Part A Ed. 2013
ASTM A480/480M, ASME SA-480 Sec.II Part A Ed. 2013

Steel grade and quality / Acero / Stahlsorte und Güteausführung

TYPE 304L/304

Customer's material no. / N° de material del cliente / Kundenmaterial-Nr.	Product dimensions (Thickness / Width / Length) / Dimensiones (Espesor / Ancho / Largo) / Maße des Erzeugnisses (Dicke / Breite / Länge)	Steelmaking processes / Proceso de elaboración / Herstellart	Finish / Acabado / Ausführung
30400.575-5-20	9.47 mm x 1,524.00 mm x 6,096.00 mm 0.3728 inch x 60.0000 inch x 240.0000 inch	AOD	IIa / 1D / No.1

Packing-No. / N° de Empaque / Paket-Nr.	No.of pieces / Piezas / Stückzahl	Actual weights / Peso actual / Ist-Gewicht	Coil No. / Rollo No. / Band-Nr.	Heat No. / Colada / Schmelze	Sample no. / N° de muestra / Probe-Nr.	Sample no. / N° de muestra / Probe-Nr.
6356390	2	3,023 lb / 1,371 kg	756319	506324	1000295285	1000295286
Sum / Suma / Summe	2	3,023 lb / 1,371 kg				

Heat / Colada / Schmelze	Country of heat / País de colada / Erschmelzungsland	Chemical composition / Composición Química/ Chemische Zusammensetzung									
		% C	% Si	% Mn	% P	% S	% Cr	% Mo	% Ni	% N	% Cu
506324	USA	0.026	0.37	1.34	0.029	0.0010	18.19	0.34	8.05	0.051	0.44

Sample Position / Localización de muestra / Probenlage: TRANSVERSE

Inspection lot / Lote de inspección / Prüflos	YS0.2% PSI / MPa	TS PSI / MPa	El. A2" %	HRB		
1000295285	48,296 / 333	91,950 / 634	57.3	92		
1000295286	52,212 / 360	92,530 / 638	56.6	92		

Dimensions-surface / Dimensiones-Superficie / Maße Oberfläche: OK

Test of identity (spectrum analysis) / Control de identidad (análisis espectográfico) / Verwechslungsprüfung (Spektralanalyse): OK

Heat Treatment: Solution annealed 1920°F Min / Air cooled

No welding or weld repairs were performed on this material

No intentional additions of Mercury compounds were made or used

Free of radioactive contamination

EU RoHS Directive 2011/65/EU Compliant

Country of Heat as per ISO 3166-1

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 12-14-2016
THE SPITZER COMPANIES

Originator of the document / Originador del documento / Aussteller der Bescheinigung

Outokumpu Stainless USA, LLC

An ISO 9001: 2008 certified company
Quality Management System EU PED 97/23/EC certified

Certificate is generated automatically / Certificado es generado automaticamente / Das Zeugnis wurde elektronisch erstellt

The information provided is a true copy of data in the / Los valores mostrados corresponden a los datos archivados en / Die gemachten Werte entsprechen den gespeicherten Daten

Andrew Faucett
Phone: +1 251 929 3462

Name of expert / Nombre del experto / Name des Sachverständigen

Date of issue / Fecha de emisión / Datum Ausstellung: 08/04/2015

po2132-010

(BOM#23) No2 N1, N2, N3, N4

1/1

E76249-2132-SA240-P-.7500 x 96 x 240

注文者 Shipper: KANEMATSU CORPORATION
注文者照合番号 Reference No.: TEB15 00021603
契約番号 Contract No.: 6-868-TH-5-6-BH04
製品名 Commodity: HOT ROLLED STAINLESS STEEL PLATES
規格 Specification: A240-14/A480-14B/SA240-15E/SA480-15E TYPE304/304L
文書番号 Document No.:

新日鐵住金ステンレス株式会社
Nippon Steel & Sumikin Stainless Steel Corporation
鋼材検査証明書
INSPECTION CERTIFICATE

需要家 Customer: SABRE ALLOYS
需要家管理番号 Customer's Control No.: PO 2249

本社 Head Office: 〒100-0004 東京都千代田区大手町二丁目6番1号 2-6-1, Otemachi,Chiyoda-ku,Tokyo 100-0004,Japan
八幡製造所 Yawata Works: 〒805-0058 北九州市八幡東区大字前田字波戸2108－1 2108-1, Azahato, Dazamaeda,Yawata-higashi-ku, Kitakyushu-City,805-0058,Japan

証明書番号 Certificate No.: 01Y6001378 - 1/1
発行年月日 Date Of Issue: 2016-05-19

行番 Item No.	寸法 Dimension INCH	個数 Quantity	質量 Mass LBS KG	製鋼番号 Cast No. / 試験番号 Test No.	製品番号 Plate No.	Location ※1	引張試験 Tensile Test 耐力 0.2% Y.S KSI	引張強さ T.S KSI	伸び EL %	絞り % ※3	Bend Test Direction ※1	Location ※2	Notch ※3	衝撃試験 Impact Test 平均 Avg	個々値 Each	HBW 10/3000	化学成分 Chemical Composition % C X1000	Si X100	Mn X100	P X1000	S X1000	Ni X10	Cr X10	Mo X100
					SPEC. MIN.		30	75	40													80	175	
					MAX.											201	30	75	200	45	30	105	195	75
					MIN.												75	10	10	10					
					MAX.																			
			5009	E76249																				
06	3/4' X96' X240'	1	2272	58075	443279-01	TCH	40	88	64							174	16	45	165	31	4	82	181	24
			5009	E76249													27	6	0	1				
06	3/4' X96' X240'	1	2272	58075	443279-02	TCH	40	88	64							174	16	45	165	31	4	82	181	24
			10018														27	6	0	1				
	TOTAL	2	4544																					

SOLUTION HEAT TREATMENT. . . . . 1055C X 5MIN. WATER COOLED
CORROSION TEST (ASTM A262 PRACTICE-E) : ACCEPTABLE
TEST SPECIMEN : A370/SA-370 SHEET TYPE
VISUAL & DIMENSIONAL INSPECTION : ACCEPTABLE
FINISH : NO.1
ANSI/NACE MR0175/ISO 15156-3:2009/CIR.4:2014(E)
NACE MR0103-2012
AS PER EN 10204 CERTIFICATE ON MATERIAL TESTS 3.1
NO WELD REPAIR / FREE OF MERCURY CONTAMINATION
MELTED AND MANUFACTURED IN JAPAN

注釈 Notes ※1 Location-Orientation 位置・方向 T:頭部 Top, B:底部 Bottom, L:圧延方向 Longitudinal, C:直角方向 Transverse, Z:板厚方向 Through Thickness. ※2 GL標点距離Gage Length. A:50mm平形Rectangular, B:50mm丸形Round, C:70mm平形Rectangular, D:70mm丸形Round, E:80mm平形Rectangular, F:80mm丸形Round, G:200mm, H:2", I:8", J:5.65√So, K:1", L:4√So, S:30mm丸形Round, T:40mm丸形Round, Q:60mm丸形Round
※3 R.A:絞り Reduction Of Area, Y.R:降伏比 Yield Ratio ※4 A.合格 Acceptable ※5 2:2.5mm, 3:3.3mm, 4:3.33mm, 5:5.0mm, 6:6.67mm, 7:7.5mm, 8:6.7mm, 9:製品板厚 Plate Thickness ※6 P:製品分析 Product Analysis
SH:延性破面率 Shear Fracture, CF:脆性破面率 Crystallinity Fracture, LE:横膨出 Lateral Expansion, AGS:オーステナイト粒度 Austenite Grain Size, FGS:フェライト粒度 Ferrite Grain Size, SR:Stress Relieved /Post Weld Heat Treatment

上記注文品は御指定の規格または仕様に従って製造され、その要求事項を満足していることを証明します。

WE HEREBY CERTIFY THAT THE MATERIAL DESCRIBED HEREIN HAS BEEN MADE IN ACCORDANCE WITH THE RULES OF THE CONTRACT.

Y. Yamamoto

八幡製造所
厚板管理室長 山本洋一
Group Manager,Plate Quality Control Dept.
Yawata Works YOICHI YAMAMOTO

NSSC社内分類番号 E05 0 1968** ※ 026 1318

Y16-02-2 Rev. 6

PO 2132-015

Nozzle N2

Chemical & Physical Tests
Reviewed and Accepted
By RK Date 12-5-2016
THE SPITZER COMPANIES

1/1

M452-2132-SA182-L-1 x 300# x 12

FCI™ FORGED COMPONENTS INC. 24/7
14527 Smith Rd.
Humble, Texas 77396
TEL: (281) 441-4088
FAX: (281) 441-8899

REPORT # 17-027273
DATE: 2/22/2017
FCI ORDER # 77049
I.A.W. ASME 2015 ED.

CUSTOMER ORDER # 604037
SOLD / SHIPPED TO: SOUTH COAST SUPPLY

Item	Quantity	Description	
1	2	1" X 300 X 12" LG RF LWN	MTR REVISED ON 3/28/17*

Heat Number: M452
Material Origin: ITALY
Material Type: SA182F304/F304L
Manufactured in: USA

CHEMICAL ANALYSIS

C	.020
Mn	1.890
P	.0310
S	.0250
Si	.660
Cr	18.150
Ni	8.120
N	.0900

PHYSICAL PROPERTIES

Yield PSI	51,400
Tensile PSI	95,400
Elongation	58
Reduction of Area	79.7
Hardness	195 HBW

Heat Treatment SOLUTION ANNEALED
Temperature 1925 °F
Time at Temperature
Cooling Media WATER
Immediately following hot working, while at temperature above, parts were rapidly quenched.

We hereby certify that all test results and process information contained herein are correct and true as contained in the records of the company.

Prepared by: Phyllis Holley
Name: Phyllis Holley Title: QA Representative

Chemical & Physical Tests
Reviewed and Accepted
By RL Date 03-29-2017
THE SPITZER COMPANIES

Date printed: 3/28/2017 2:34:08 PM

PO 2132-009

Nozzle P, Q1

1/1

PO 213 2009

PRECISION COMPONENTS
7311 Galveston Rd. #110, Houston, TX 77034

MADE IN THE USA

ORDER NUMBER 1701612
PO 606297
DATE 2/21/2017
Angelica

ITEM	DESCRIPTION	SPECIFICATION	ALLOY	HEAT CODE	UNS #
1	1 300 RF LWN FLANGE X 12	SA182	304/L	AABAQ17	S30400/30403
2	1 300 RF LWN FLANGE X 12	SA182	304/L	AABAQ17	S30400/30403
3	1 300 RF LWN FLANGE X 12	SA182	304/L	AABAQ17	S30400/30403

AABAQ17-2132-SA182-L-12

CHEMICAL PROPERTIES (%)

ITEM	C	MN	P	S	SI	CR	NI	MO	CU	TI	FE	AL	CO	SN	N	V	TA
1	.018	1.760	.035	.025	.510	18.420	8.420	.530	.510				.130		.080		
2	.018	1.760	.035	.025	.510	18.420	8.420	.530	.510				.130		.080		
3	.018	1.760	.035	.025	.510	18.420	8.420	.530	.510				.130		.080		

ITEM	W	B	MG	NB	ZN	PB	H	O	ZR	HF	NI+CO	NB+TA	Cb+TA	FE+CR	ZR+HF	ORIGINAL
1																A13279
2																A13279
3																A13279

PHYSICAL PROPERTIES

ITEM	YIELD	TENSILE	EL (%)	RA (%)	TEMP	FT-LB	SHEAR	LAT EX	BHN	FLAT	HYDRO	FERRITE	GRAIN
1	40600 PSI	84000 PSI	70.5	80.6					166				7
2	40600 PSI	84000 PSI	70.5	80.6					166				7
3	40600 PSI	84000 PSI	70.5	80.6					166				7

HEAT TREATMENT

1 ANNEALING @ 1900F MIN & WQ
2 ANNEALING @ 1900F MIN & WQ
3 ANNEALING @ 1900F MIN & WQ

TESTING

APPLICABLE COMMENTS

1) ISO 9001 : 2008 CERTIFIED COMPANY
2) ISO 10474 3.1.B
3) NO REPAIRS BY WELDING
4) NO CONTACT WITH LOW MELTING POINT MATERIALS
5) NACE MR-0103, MR-0175
6) EN10204 3.1, EN-1092-1
7) MDSS01 REV2 / MDS C21
8) ISO 15156

The material was processed in accordance with Precision Components' current QA Manual as duly audited and approved. **QC MANUAL DATED 02/08/2017, REV 10**
ISO 9001:2008 Certified
EU PRESSURE EQUIPMENT DIRECTIVE Annex 1, Paragraph 4.3 Certified

We certify that the products covered by this report comply with applicable ASTM and/or ASME specifications, as noted for each item. Furthermore, the above data is correct and represents the data as contained in the records of the company.

Chemical & Physical Tests
Reviewed and Accepted
By _____ Date 2/22/17
THE SPITZER COMPANIES

Certified Mill Test Report

Art Cardenas - QC
Material Control Department

Rev. 5, 02/08/2017

Nozzle Q2, Q3, Q4

Houston-TX
C/O Cargoways 555 Gellhorn Street
Houston, Texas 77020
USA

METALLURGICAL TEST REPORT

O99Y-2132-SA479-T-B-.3750 x 144

6870 Highway 42 East
Ghent, KY 41045-9615
(502) 347-6000

Certificate: 224007 8

Customer: 000810 899

Mail To:
SAMUEL, SON & CO., INC.
CUSTOMER PICKUP
555 GELLHORN AVENUE
HOUSTON, TX 77029

Ship To:
SAMUEL, SON & CO., INC.
CUSTOMER PICKUP
555 GELLHORN AVENUE
HOUSTON, TX 77029

Date: 10/03/2016 Page: 1
Steel: 304/304L
Finish: CD
Corrosion: ASTM A262-10 Prac A/E OK

Your Order: 7228791 NAS Order: PN 0071407 01

PRODUCT DESCRIPTION:

Round Bar, Annealed, Cold Draw
UNS 30400/30403 EN 10204 3.1, ASTM A484/15
ASTM A276/15, ASTM A479/15, ASTM A182/13 CHEM ONLY,
ASME SA479/13, ASME SA182/10 CHEM ONLY
AMS 5639H, AMS 5647J, AMS QQS-763D, QQS-763F, ASTM F899/11
SOLUTION ANNEAL TEMP 1900F MIN, ASTM A320/08 CL 1 GR B8
ASTM A193/10A-ASME SA193/10 CL 1 GR B8

REMARKS:

COMPLIES W/REQUIREMENTS OF DFAR 252.225-7009 EU DIRECTIVE 2011/65/EU.RoHS. EAF+AOD+CC. NO WELD REPAIR. MELTED AND MFG IN USA FREE FROM MERCURY AND LOW MELTING ALLOY CONTAMINATION

Product Id	Skid #	Diameter	Size	Weight	Length	Mark	Pieces	Commodity Code
BI1796 3		.3750		1,041	144.00	3	1	5430031

Lab Accreditation Bureau, ISO/IEC 17025, Certificate# L2323

CHEMICAL ANALYSIS

CM(Country of Melt) ES(Spain) US(United States) ZA(South Africa) JP(Japan)

Chemical Analysis per ASTM A751/14a

HEAT	CM	C %	CO %	CR %	CU %	MN %	MO %	N %	NI %	P %
099Y	US	.0213	.1700	18.2570	.4720	1.3630	.4290	.0645	8.5805	.0280

S %	SI %
.0182	.2735

MECHANICAL PROPERTIES

Product Id	Id Oi Cr	HB No.	.2YS KSI	UTS KSI	RA %	Elng % 2"
BI1796 3	R L	214.0	95.78	109.09	71.46	38.95

Chemical & Physical Tests Reviewed and Accepted
By RR Date 12-29-2016
THE SPITZER COMPANIES

Samuel, Son & Co. Inc.
Houston, Texas
This is a TRUE COPY
of the original MTR

421008

NAS hereby certifies that the analysis on this certification is correct. Based upon the results and the accuracy of the test methods used, the material meets the specifications stated. These results relate only to the items tested and this report cannot be reproduced, except in its entirety, without the written approval of NAS.

Technical Dept. Mgr. KRIS LARK 10/03/2016

PO 2132-016

1/1

Brazos Fasteners, Inc.
312 West Plantation
Clute, TX 77531
Phone: (979) 265-9032
Fax: (979) 265-8631

Certificate of Compliance

Date	Order No.	Page
01-23-17	301090	1 of 1

BILL TO: Curtis Kelly, Inc
P O Box 96097
Houston, TX 77213-6097

SHIP TO: Curtis Kelly, Inc
13863 Industrial Rd
Houston , TX 77015
USA

Customer #	P.O. Number	Salesperson	Terms of Sale	Require Date	Order Date	Shipping Method
1461	2132022	JEF - Jeff Dahl	1%10 Net30	01-23-17	12-29-16	Our Truck

Special Instructions:

ORD	SHP	U/M	PRODUCT CODE / DESCRIPTION
20	20	EA	3/8-16 HEAVY HEX NUT A194 GRADE B8 STAINLESS STEEL certificate of compliance

Chemical & Physical Tests
Reviewed and Accepted
[illegible] Date 1-27-17
[illegible]

THIS IS TO CERTIFY THAT THE PARTS SUPPLIED ON THE REFERENCED ORDER ARE FULLY IN ACCORDANCE WITH THE SPECIFICATIONS AS OUTLINED IN YOUR PURCHASE ORDER.

BRAZOS FASTENERS

MSI SUPPLY, INC.

Certificate of Compliance

Customer: Curtis Kelly
Customer PO#: 2132033
Sales Order: 36516
Ship Date: 02/03/2017

Item Number: 1
Part Number: STBCASHDGNA.375X4.5
Quantity: 32
Description: 3/8 X 4-1/2 GALVANIZED STUD BOLT

Item Number: 2
Part Number: STBCASHDGNA.375X6.5
Quantity: 40
Description: 3/8 X 6-1/2 GALVANIZED STUD BOLT

Item Number: 3
Part Number: STBCASHDGNA.375X4.5
Quantity: 12
Description: 3/8 X 4-1/2 GALVANIZED STUD BOLT

Item Number: 4
Part Number: STBCASHDGNA.375X4.5
Quantity: 4
Description: 3/8 X 4-1/2 GALVANIZED STUD BOLT

Item Number: 5
Part Number: STBCASHDGNA.375X6.5
Quantity: 28
Description: 3/8 X 6-1/2 GALVANIZED STUD BOLT

Item Number: 6
Part Number: STBCASHDGNA.375X6.5
Quantity: 4
Description: 3/8 X 6-1/2 GALVANIZED STUD BOLT

PO Box 7463 – Houston, TX 77248
(713) 733-5500
Fax: (713) 733- 5676

www.msisupply.net

po 2132-033

MSI SUPPLY, INC.

Certificate of Compliance

Customer: Curtis Kelly
Customer PO#: 2132033
Sales Order: 36516
Ship Date: 02/03/2017

Item Number: 7
Part Number: STBCASHDGNA.375X4.5
Quantity: 8
Description: 3/8 X 4-1/2 GALVANIZED STUD BOLT

Item Number: 8
Part Number: STBCASHDGNA.375X6.5
Quantity: 8
Description: 3/8 X 6-1/2 GALVANIZED STUD BOLT

Item Number: 9
Part Number: STBCASHDGNA.375X6.5
Quantity: 8
Description: 3/8 X 6-1/2 GALVANIZED STUD BOLT

Item Number: 10
Part Number: HENCASHDGNA0.375
Quantity: 288
Description: 3/8 HEAVY NUT CARBON HDG

Item Number: 11
Part Number: UFWCASHDGNA0.375
Quantity: 144
Description: 3/8 FLATWASHER CARBON HDG

Item Number: 12
Part Number: FEWCASZPNA.375X1.5
Quantity: 144
Description: 3/8 X 1-1/2 FENDER WASHER CARBON ZP

PO Box 7463 – Houston, TX 77248
(713) 733-5500
Fax: (713) 733- 5676

www.msisupply.net

PO 2132-033

MSI SUPPLY, INC.

Certificate of Compliance

Customer: Curtis Kelly
Customer PO#: 2132033
Sales Order: 36516
Ship Date: 02/03/2017

It is hereby certified that the articles in the quantities shipped on the above mentioned sales order, as listed on your above mentioned purchase order, are in conformance with the: requirements, specifications, and drawings listed on said purchase order.

Sincerely,

Kevin

Quality Control Manager

PO Box 7463 – Houston, TX 77248
(713) 733-5500
Fax: (713) 733- 5676

www.msisupply.net

3/3

PO 2132-033

AL 6168-6 0814

NOTICE OF SHIPMENT/ PACKING LIST

ATI Flat Rolled Products

CERTIFICATE OF TEST
ATCL30056447

CUST. ORD. NO & DATE		CUST. CODE	ACCEPTING MILL	SHIPPER NO	PRODUCT CODE	MILL ORDER NUMBER	DATE SHIPPED
L58489	05/13/16	877195	VANDERGRIFT, PA	512841	13010102060000	30-056-447	07/29/16

FORMS DISTRIBUTION SOLD TO→	SHIP TO→	SPEC→	REPEAT ORDER	DO RATE	PRIORITY	GOVT CONTRACT	MATL	SHIPPING LOCATION		INVOICE	
1		1	00610-2	36			1124	INDIANAPOLIS	IN	651421	399

SOLD TO
TA CHEN INTERNATIONAL, INC
5655 OBISPO AVENUE
LONG BEACH CA 90805

PRIME DSO 504 SEC. DSO

SHIP TO
TA CHEN INTERNATIONAL INC
9525 WALLISVILLE ROAD
HOUSTON TX 77013

GRADE AND SPECIFICATIONS

CARRIER - IDAHO TRUCK LINES INC.

"ATI 304" STAINLESS STEEL SHEET C R CUT LENGTHS ANNEALED 2B FIN 3 EDGE (304/304L) (AMS 5511H R2013) (AMS 5513J) (ASME-SA-480 ED 2015) (ASTM-A-480-16A) (DIN EN 10204:2005 3.1 CERTIFICATE) (ASTM-A-666-15) (ASME-SA-240 ED 2015) (ASTM-A-240-15B) (UNS S30400) (UNS S30403)

ITEM	PCS	DIMENSIONS W/G/L	HEAT #	COIL #	TEST #	GROSS	TARE	NET	THEO	TAG #/ CD SKID #
001B	19	48./.120/120.	848912	AAB46744-AA	8838988	3850	150	3700		882034
	19	48./.120/120.	848912	AAB46744-AB	8838988	3850	150	3700		882036
	19	48./.120/120.	848912	AAB46744-AC	8838988	3850	150	3700		882037
	19	48./.120/120.	848912	AAB46744-AD	8838988	3850	150	3700		882038
	19	48./.120/120.	848912	AAB46744-AE	8838988	3850	150	3700		882040
	3	48./.120/120.	848912	AAB46744-AF	8838988	734	150	584		882041
	14	48./.120/120.	848912	AAB46744-BA	8838988	2876	150	2726		882042
C CUST IDENTITY 304L2B.120X48X120										
	7	SKIDS				22860	1050	21810		

DIST: MAIL S/N TO "ATTN: CLAIR YU" AT THE SOLD TO ADDRESS

TYPE	HEAT/TEST (WT %)	--C--	--MN--	--P--	--S--	--SI--	--CR--	--NI--	--MO--	--CU--	--N---
HEAT	848912	.022	1.63	.031	.0001	.46	18.20	8.10	.31	.37	.07
TEST LOCATION		BN	BN	BN	BN	BN	BN	BN	BN	BN	BN

ITEM	TEST NO	YIELD PSI *	TENSILE PSI	% ELONG IN 2"	% R/A	HARDNESS	BEND	CORROSION ASTM A 262 PR E	GRAIN SIZE	HARDENABILITY
001B	8838988				NR	85.HRBW	T PASS	PASS	NR	NR
		T 44100.	92300.	59. #		85.HRBW				
TEST LOCATION		TC	TC	TC		TC	TC	TC		

* Y.S. BY 0.2% OFFSET METHOD

PAGE 01 - CONTINUED ON PAGE 02

07/29/16 14:32:34

CONSIGNEE--Please Note--This consignment was turned over to carrier in first class condition, being correctly loaded, at which time our responsibility for loss or damage in shipment ceased. For your protection please examine shipment as it arrives. If any shortage or damage is discovered, have a full description made by transportation agent on waybill before signing.

WARNING
Safety Data Sheets for this product are available on our website, www.ATImetals.com. A thorough review of the Safety Data Sheet for the grade of material purchased shall be performed prior to working with this product and all safety & health considerations outlined must be implemented.

The above is a true copy of data on file. The material and test results conform to the sales contract and specification(s) as set forth in ATI Flat Rolled Products' Order Acknowledgement.

Stephen Wolff - Director, Corporate Quality Assurance

Chemical & Physical Tests Reviewed and Accepted
By RR Date 02-01-2017

THE SPITZER COMPANIES

po 2132-032 Gaskets

Customer: ACTHOU PO#:P62120 SO#:LPVT61
Item:11GA481203041.2B Bundle:AAB46744-AB Heat#:848912
Item:11GA481203041.2B Bundle:AAB46744-AC Heat#:848912
TA CHEN INTERNATIONAL, INC.
This MTR contains 4 pages (Page# 1)
MTR#:ATCL30056447.GIF

AL 6168-6 0814

NOTICE OF SHIPMENT/ PACKING LIST

ATI Flat Rolled Products

CERTIFICATE OF TEST
ATCL30056447-2

CUST. ORD. NO. & DATE		CUST. CODE	ACCEPTING MILL	SHIPPER NO	PRODUCT CODE	MILL ORDER NUMBER	DATE SHIPPED
L58489	05/13/16	877195	VANDERGRIFT, PA	512841	13010102060000	30-056-447	07/29/16

FORMS DISTRIBUTION: SOLD TO→ 1 | SHIP TO→ | SPEC→ 1

REPEAT ORDER	DO RATE	PRIORITY	GOVT CONTRACT	MATL.	SHIPPING LOCATION		INVOICE	
00610-2	36			1124	INDIANAPOLIS	IN	651421	399

SOLD TO
TA CHEN INTERNATIONAL, INC
5855 OBISPO AVENUE
LONG BEACH CA 90805

PRIME DSO 504 SEC. DSO

SHIP TO
TA CHEN INTERNATIONAL INC
9525 WALLISVILLE ROAD
HOUSTON TX 77013

GRADE

CARRIER - IDAHO TRUCK LINES INC.

"ATI 304" STAINLESS STEEL SHEET C R CUT LENGTHS ANNEALED 2B FIN 3 EDGE (304/304L)

ITEM	TEST NO	MELT SOURCE	TEST SAMPLE GA.
001B	8838988	1.	.1175
			.1166
TEST LOCATION			TC
		# ELONG AT FRACTURE	

NR = DATA NOT REQUIRED
GRADE VERIFICATION WAS CARRIED OUT SPECTROSCOPICALLY

THESE COMMODITIES OR TECHNOLOGY, WHEN EXPORTED FROM THE UNITED STATES, ARE IN ACCORDANCE WITH THE USA EXPORT ADMINISTRATION REGULATIONS. DIVERSION CONTRARY TO U.S. LAW IS PROHIBITED. U.S. LAW ALSO PROHIBITS DISPOSITION OF THESE COMMODITIES/TECHNICAL DATA TO ANY END-USER OR FOR ANY END-USE RELATED TO THE DESIGN, DEVELOPMENT, PRODUCTION, STOCKPILING, OR USE OF CHEMICAL, BIOLOGICAL, OR NUCLEAR WEAPONS, OR MISSILES, WITHOUT THE PROPER APPROVAL OF THE UNITED STATES GOVERNMENT.

EN 10204:2005 - ATI FLAT ROLLED PRODUCTS IS APPROVED AS A MANUFACTURER ACCORDING TO THE PRESSURE EQUIPMENT DIRECTIVE PED 97/23/EC.

THIS CERTIFIED MATERIAL TEST REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL. FEDERAL LAW PROHIBITS THE RECORDING OF FALSE, FICTITIOUS, OR FRAUDULENT STATEMENTS OR ENTRIES ON THE CERTIFICATE AND MAY BE PUNISHABLE AS A FELONY UNDER FEDERAL LAW. ATI FRP HOLDS SEVERAL QUALITY CERTIFICATIONS THAT INCLUDE ISO-9001, AS9100, NADCAP, AND ISO/IEC 17025. MATERIAL WAS MANUFACTURED IN ACCORDANCE WITH THE ATI FRP QUALITY MANUAL REVISION 24 DATED 10/16/2015.

PAGE 02 - CONTINUED ON PAGE 03

07/29/16 14:32:34

CONSIGNEE--Please Note--This consignment was turned over to carrier in first class condition, being correctly loaded, at which time our responsibility for loss or damage in shipment ceased. For your protection please examine shipment as it arrives. If any shortage or damage is discovered, have a full description made by transportation agent on waybill before signing.

WARNING
Safety Data Sheets for this product are available on our website, www.ATImetals.com. A thorough review of the Safety Data Sheet for the grade of material purchased shall be performed prior to working with this product and all safety & health considerations outlined must be implemented.

The above is a true copy of data on file. The material and test results conform to the sales contract and specification(s) as set forth in ATI Flat Rolled Products' Order Acknowledgement.

Stephen Wolff - Director, Corporate Quality Assurance

PO 2132-032

MILL TEST REPORT
TA CHEN INTERNATIONAL, INC.
Customer: ACTHOU PO#:P62120 SO#:LPVT61
Item:11GA48120304L2B Bundle:AAB46744-AB Heat#:848912
Item:11GA48120304L2B Bundle:AAB46744-AC Heat#:848912
This MTR contains 4 pages (Page# 2)
MTR#:ATCL30056447-2.GI

AL 6168-6 0814

NOTICE OF SHIPMENT/ PACKING LIST

ATI Flat Rolled Products

CERTIFICATE OF TEST
ATCL30056447-3

CUST. ORD. NO. & DATE		CUST. CODE	ACCEPTING MILL	SHIPPER NO.	PRODUCT CODE	MILL ORDER NUMBER	DATE SHIPPED
L58489	05/13/16	877195	VANDERGRIFT, PA	512841	13010102060000	30-056-447	07/29/16

FORMS DISTRIBUTION				REPEAT ORDER	DO RATE	PRI-ORITY	GOVT CONTRACT	MATL	SHIPPING LOCATION		INVOICE	
SOLD TO → 1	SHIP TO →	SPEC → 1		00610-2	36			1124	INDIANAPOLIS	IN	651421	399

SOLD TO	PRIME DSO	SEC. DSO	SHIP TO
TA CHEN INTERNATIONAL, INC	504		TA CHEN INTERNATIONAL INC
5855 OBISPO AVENUE			9525 WALLISVILLE ROAD
LONG BEACH CA 90805			HOUSTON TX 77013

GRADE

CARRIER - IDAHO TRUCK LINES INC.

"ATI 304" STAINLESS STEEL SHEET C R CUT LENGTHS ANNEALED 2B FIN 3 EDGE (304/304L)

QUALITY SYSTEM CERTIFIED ACCORDING TO PRESSURE EQUIPMENT DIRECTIVE 97/23/EC, ANNEX I, 4.3 BY TUV SUD, INDUSTRIE SERVICE GMBH, (NOTIFIED BODY 0036).

ATI FLAT ROLLED PRODUCTS PERFORMS CHEMICAL ANALYSIS BY THE FOLLOWING TECHNIQUES
FOR TESTING LOCATIONS TC, BN, MI, & LO:
C, S BY COMBUSTION/INFRARED
N, O, H BY INERT FUSION/THERMAL CONDUCTIVITY
MN, P, SI, CR, NI, MO, CU, CB, CO, V BY WDXRF
B BY OES
AL AND TI (>=0.10%) BY WDXRF, OTHERWISE BY OES
PB, BI, AG BY GFAA.

THE NUMERIC CODES SHOWN UNDER MELT SOURCE CAN BE INTERPRETED AS FOLLOWS:
→ 1. - MATERIAL MELTED, ROLLED AND TESTED IN THE UNITED STATES.
2. - FOREIGN MELT; ROLLED AND TESTED IN THE UNITED STATES.

ATI FLAT ROLLED PRODUCTS HAS NO CONTROL OVER CUSTOMER PROCESSING OF MATERIAL; INCLUDING, BUT NOT LIMITED TO, BUFFING OR ELECTROPOLISHING MATERIAL WITH A 2B OR OTHER FINISH, AND DOES NOT REPRESENT OR GUARANTY THAT THE MATERIAL IS SUITABLE FOR ANY PARTICULAR PROCESS OR USE OF CUSTOMER.

EN 10204:2005 3.1 CERTIFICATE.

TESTING WAS PERFORMED AT THE FOLLOWING LOCATIONS:
BN = ATI-FLAT ROLLED PRODUCTS; 100 RIVER ROAD; BRACKENRIDGE, PA 15014
TC = ATI-FLAT ROLLED PRODUCTS; 1300 PACIFIC AVENUE; NATRONA HEIGHTS, PA 15065

PAGE 03 - CONTINUED ON PAGE 04

07/29/16 14:32:34

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The above is a true copy of data on file. The material and test results conform to the sales contract and specification(s) as set forth in ATI Flat Rolled Products' Order Acknowledgement.

Stephen Wolff - Director, Corporate Quality Assurance

po 2132-032

MILL TEST REPORT
TA CHEN INTERNATIONAL, INC.
This MTR contains 4 pages (Page# 3)
Customer: ACTHOU PO#:P62120 SO#:LPVT61
MTR#:ATCL30056447-3.GI
Item:11GA481203041.2B Bundle:AAB46744-AB Heat#:848912
Item:11GA481203041.2B Bundle:AAB46744-AC Heat#:848912

AL 6168-6 0814

NOTICE OF SHIPMENT/ PACKING LIST

ATI
Flat Rolled Products

CERTIFICATE OF TEST
ATCL30056447-4

CUST. ORD. NO & DATE		CUST. CODE	ACCEPTING MILL	SHIPPER NO	PRODUCT CODE	MILL ORDER NUMBER	DATE SHIPPED
L58489	05/13/16	877195	VANDERGRIFT, PA	512841	13010102060000	30-056-447	07/29/16

FORMS DISTRIBUTION				REPEAT ORDER	DO RATE	PRIORITY	GOVT CONTRACT	MATL	SHIPPING LOCATION		INVOICE	
SOLD TO→ 1	SHIP TO→	SPEC→ 1		00610-2	36			1124	INDIANAPOLIS	IN	651421	399

SOLD TO
TA CHEN INTERNATIONAL, INC
5855 OBISPO AVENUE
LONG BEACH CA 90805

PRIME DSO 504 SEC. DSO

SHIP TO
TA CHEN INTERNATIONAL INC
9525 WALLISVILLE ROAD
HOUSTON TX 77013

GRADE

CARRIER - IDAHO TRUCK LINES INC.

"ATI 304" STAINLESS STEEL SHEET C R CUT LENGTHS ANNEALED 2B FIN 3 EDGE (304/304L)

<<<<<<<< FOR ACCESS TO ONLINE CERTIFICATES OF TEST >>>>>>>>
<<<<<<<< REGISTER AT MYATI.ATIMETALS.COM >>>>>>>>

PAGE 04 - FINAL PAGE.

07/29/16 14:32:34

CONSIGNEE--Please Note--This consignment was turned over to carrier in first class condition, being correctly loaded, at which time our responsibility for loss or damage in shipment ceased. For your protection please examine shipment as it arrives. If any shortage or damage is discovered, have a full description made by transportation agent on waybill before signing

WARNING
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The above is a true copy of data on file. The material and test results conform to the sales contract and specification(s) as set forth in ATI Flat Rolled Products' Order Acknowledgement.

Stephen Wolff -
Director, Corporate Quality Assurance

PO 2132-032

MTR TEST REPORT
TA CHEN INTERNATIONAL, INC.
Customer: ACTHOU PO#:P62120 SO#:LPVT61
Item:11GA481203041.2B Bundle:AAB46744-AB Heat#:848912
Item:11GA481203041.2B Bundle:AAB46744-AC Heat#:848912
This MTR contains 4 pages (Page# 4)
MTR#:ATCL30056447-4.GI

030M and E50845-2132-A193 A194-F-.7500-10 x 4.7500 STUD HEX NUTS

Material Test Report

Customer
MSI Supply, Inc.
PO Box 26647
Houston , TX 77207
Fax
713-733-5676

USA FASTENER GROUP, INC.

USA Fastener Group, Inc.
1300 Gazin St., Houston, Texas 77020
P: (866)546-5872 | F: (713)641-4655
sales@usafgrp.com

Specification	Year	Description	PO Number	Lot Number
A193	11A	Threaded Rod	27725	118461

Heat Number	Grade	Size	TPI	Length	Finish
030M	B8-1	3/4	10	12FT	

C	Si	S	P	Mn	Mo	Cr	Ni	Al	V	Fe	Ti	Cu
0.046	0.25	0.027	0.029	1.59	0.35	18.15	8.06	0	0	0	0	0

Yield		Scale	Tensile		Scale
82	0	ksi	107	0	ksi

Elong %		R.A %	
50	0	71	0

Hardness		Scale
221	0	HBW

Charpy Set 1			Scale	Temp	Macro Etch			Wedge Tensile	Proof Load
0	0	0			R	C	S		
Charpy Set 2									
0	0	0							

Quenched	Tempered	Stress Relieved
@ 0 ° in	@ 0 °	@ 0 °

Remarks:
N=.077

Memo:
3/4-10 X 4 3/4 AT STUD A193-B8
COUNTRY OF ORIGIN: USA

Quality Assurance
Laura Taylor

The above described product was manufactured, sampled, tested and inspected in accordance with the required specification, including any supplementary requirements or other requirements designated in the purchase order or contract and were found to meet those requirements.

Boil #121: Dun Cnr A

Po 2132-026

Chemical & Physical Tests
Reviewed and Accepted
By KR Date 02-01-2017
THE SPITZER COMPANIES

1/2

Material Test Report

Customer
MSI Supply, Inc.
PO Box 26647
Houston , TX 77207
Fax
713-733-5676

USA FASTENER GROUP, INC.

USA Fastener Group, Inc.
1300 Gazin St., Houston, Texas 77020
P: (866)546-5872 | F: (713)641-4655
sales@usafgrp.com

Specification	Year	Description	PO Number	Lot Number
A194	11	Heavy Hex Nuts	27725	117674

Grade	Size	TPI	Finish	Heat Number	Heat Code	Markings
B8	3/4	10		E50845		

C	Si	S	P	Mn	Mo	Cr	Ni	Cu
0.070	0.490	0.025	0.025	1.050	0.000	18.220	8.040	0.000

Hardness		Scale	Tempered Hardness		Tempered Hardness Scale
94	95	HRB	0	0	

First Charpy Set			Charpy Scale	Charpy Temp
0	0	0		
Second Charpy Set				
0	0	0		

Macro Etch			Proofload
S	C	R	26,720 lbf

Quenching	Tempering
@ 0 ° in	@ 0 °

Remarks

Memos:
3/4-10 HVY HEX NUT A194-GR.8 SS NON CHINA
COUNTRY OF ORIGIN: JAPAN

Quality Assurance
Laura Taylor

The above described product was manufactured, sampled, tested and inspected in accordance with the required specification, including any supplementary requirements or other requirements designated in the purchase order or contract and were found to meet those requirements.

Bom#121: Dun Cur A

po 2132-026

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 02-01-2017
THE SPITZER COMPANIES

2/2

Material Test Report

Customer
MSI Supply, Inc.
PO Box 26647
Houston , TX 77207
Fax
713-733-5676

USA Fastener Group, Inc.
1300 Gazin St., Houston, Texas 77020
P: (866)546-5872 | F: (713)641-4655
sales@usafgrp.com

030M-2132-A193-F-.7500-10 x 5 STUD

Specification	Year	Description	PO Number	Lot Number
A193	11A	Threaded Rod	27724	118461

Heat Number	Grade	Size	TPI	Length	Finish
030M	B8-1	3/4	10	12FT	

C	Si	S	P	Mn	Mo	Cr	Ni	Al	V	Fe	Ti	Cu
0.046	0.25	0.027	0.029	1.59	0.35	18.15	8.06	0	0	0	0	0

Yield		Scale	Tensile		Scale
82	0	ksi	107	0	ksi

Elong %		R.A %	
50	0	71	0

Hardness		Scale
221	0	HBW

Charpy Set 1			Scale	Temp	Macro Etch			Wedge Tensile	Proof Load
0	0	0			R	C	S		
Charpy Set 2									
0	0	0							

Quenched	Tempered	Stress Relieved
@ 0 ° in	@ 0 °	@ 0 °

Remarks:
N=.077

Memo:
3/4-10 X 5 AT STUD A193-B8
COUNTRY OF ORIGIN: USA

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 02-01-2017
THE SPITZER COMPANIES

The above described product was manufactured, sampled, tested and inspected in accordance with the required specification, including any supplementary requirements or other requirements designated in the purchase order or contract and were found to meet those requirements.

Quality Assurance
Laura Taylor

BOM#79 Dwn Cmr A, & Dwn Cmr D

p°2132-024

Material Test Report

Customer
MSI Supply, Inc.
PO Box 26647
Houston , TX 77207
Fax
713-733-5676

USA Fastener Group, Inc.
1300 Gazin St., Houston, Texas 77020
P: (866)546-5872 | F: (713)641-4655
sales@usafgrp.com

101D-2132-A193-F-1.1250-8 x 7.2500 STUD

Specification	Year	Description	PO Number	Lot Number
A193	11A	Threaded Rod	27724	118488

Heat Number	Grade	Size	TPI	Length	Finish
101D	B8-1	1.1/8	8	12FT	

C	Si	S	P	Mn	Mo	Cr	Ni	Al	V	Fe	Ti	Cu
0.048	0.26	0.025	0.029	1.48	0.35	18.24	8.01	0	0	0	0	0.38

Yield		Scale	Tensile		Scale
83	0	ksi	111	0	ksi

Elong %		R.A %	
42	0	56	0

Hardness		Scale
195	0	HBW

Charpy Set 1			Scale	Temp	Macro Etch			Wedge Tensile	Proof Load
0	0	0			R	C	S		
Charpy Set 2									
0	0	0							

Quenched	Tempered	Stress Relieved
@ 0 ° in	@ 0 °	@ 0 °

Remarks:
N=.076

Memo:
1 1/8-8 X 7 1/4 AT STUD A193-B8
COUNTRY OF ORIGIN: USA

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 02-01-2017
THE SPITZER COMPANIES

Quality Assurance
Laura Taylor

The above described product was manufactured, sampled, tested and inspected in accordance with the required specification, including any supplementary requirements or other requirements designated in the purchase order or contract and were found to meet those requirements.

Bom #68: Dwn Cmr C

PO 2132-024

171B and 109190-2132-A193 A194-F-1-8 x 6.7500 STUD HEX NUTS

Material Test Report

Customer
MSI Supply, Inc.
PO Box 26647
Houston , TX 77207
Fax
713-733-5676

USA FASTENER GROUP, INC.

USA Fastener Group, Inc.
1300 Gazin St., Houston, Texas 77020
P: (866)546-5872 | F: (713)641-4655
sales@usafgrp.com

Specification	Year	Description	PO Number	Lot Number
A193	11A	Threaded Rod	27725	118487

Heat Number	Grade	Size	TPI	Length	Finish
171B	B8-1	1	8	12FT	

C	Si	S	P	Mn	Mo	Cr	Ni	Al	V	Fe	Ti	Cu
0.046	0.25	0.026	0.035	1.57	0.4	18.31	8.01	0	0	0	0	0.46

Yield		Scale	Tensile		Scale
83	0	ksi	114	0	ksi

Elong %		R.A %	
42	0	66	0

Hardness		Scale
220	0	HBW

Charpy Set 1			Scale	Temp	Macro Etch			Wedge Tensile	Proof Load
0	0	0			R	C	S		
Charpy Set 2									
0	0	0							

Quenched	Tempered	Stress Relieved
@ 0 ° in	@ 0 °	@ 0 °

Remarks:
N=.081

Memo:
1-8 X 6 3/4 AT STUD A193-B8
COUNTRY OF ORIGIN: USA

Quality Assurance
Laura Taylor

The above described product was manufactured, sampled, tested and inspected in accordance with the required specification, including any supplementary requirements or other requirements designated in the purchase order or contract and were found to meet those requirements.

PO 2132-026

BOM#122: Dwn Cmr B,
BOM#123: Dwn Cmr C,

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 02-01-2017
THE SPITZER COMPANIES

1/2

Material Test Report

Customer
MSI Supply, Inc.
PO Box 26647
Houston , TX 77207
Fax
713-733-5676

USA FASTENER GROUP, INC.

USA Fastener Group, Inc.
1300 Gazin St., Houston, Texas 77020
P: (866)546-5872 | F: (713)641-4655
sales@usafgrp.com

Specification	Year	Description	PO Number	Lot Number
A194	08	Heavy Hex Nuts	27725	103988

Grade	Size	TPI	Finish	Heat Number	Heat Code	Markings
GR 8	1	8	Plain	109190		

C	Si	S	P	Mn	Mo	Cr	Ni	Cu
0.050	0.370	0.022	0.031	1.150	0.300	18.030	8.010	0.300

Hardness		Scale	Tempered Hardness		Tempered Hardness Scale
93	92	HRB	0	0	

First Charpy Set			Charpy Scale	Charpy Temp
0	0	0		
Second Charpy Set				
0	0	0		

Macro Etch			Proofload
S	C	R	48480 LBF

Quenching	Tempering
@ 0 ° in	@ 0 °

Remarks

Memos:
1-8 HVY HEX NUT A194-GR.8 SS NON CHINA
COUNTRY OF ORIGIN: JAPAN

Quality Assurance
Laura Taylor

The above described product was manufactured, sampled, tested and inspected in accordance with the required specification, including any supplementary requirements or other requirements designated in the purchase order or contract and were found to meet those requirements.

Bomb 122: Dun Cmr B,
Bomb 123: Dun Cmr C,

po 2132-026

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 02-01-2017
THE SPITZER COMPANIES

2/2

Material Test Report

Customer
MSI Supply, Inc.
PO Box 26647
Houston , TX 77207
Fax
713-733-5676

USA FASTENER GROUP, INC.

USA Fastener Group, Inc.
1300 Gazin St., Houston, Texas 77020
P: (866)546-5872 | F: (713)641-4655
sales@usafgrp.com

171B-2132-A193-F-1-8 x 6.7500 STUD

Specification	Year	Description	PO Number	Lot Number
A193	11A	Threaded Rod	27724	118487

Heat Number	Grade	Size	TPI	Length	Finish
171B	B8-1	1"	8	12FT	

C	Si	S	P	Mn	Mo	Cr	Ni	Al	V	Fe	Ti	Cu
0.046	0.25	0.026	0.035	1.57	0.4	18.31	8.01	0	0	0	0	0.46

Yield		Scale	Tensile		Scale
83	0	ksi	114	0	ksi

Elong %		R.A %	
42	0	66	0

Hardness		Scale
220	0	HBW

Charpy Set 1			Scale	Temp	Macro Etch			Wedge Tensile	Proof Load
0	0	0			R	C	S		
Charpy Set 2									
0	0	0							

Quenched	Tempered	Stress Relieved
@ 0 ° in	@ 0 °	@ 0 °

Remarks:
N=.081

Memo:
1-8 X 6 3/4 AT STUD A193-B8
COUNTRY OF ORIGIN: USA

Chemical & Physical Tests
Reviewed and Accepted
By RL Date 02-01-2017
THE SPITZER COMPANIES

Quality Assurance
Laura Taylor

The above described product was manufactured, sampled, tested and inspected in accordance with the required specification, including any supplementary requirements or other requirements designated in the purchase order or contract and were found to meet those requirements.

2132-024

Box #63. Dun Cur B

Material Test Report

Customer
MSI Supply, Inc.
PO Box 26647
Houston , TX 77207
Fax
713-733-5676

USA Fastener Group, Inc.
1300 Gazin St., Houston, Texas 77020
P: (866)546-5872 | F: (713)641-4655
sales@usafgrp.com

180E-2132-A193-F-.8750-9 x 6 STUD

Specification	Year	Description	PO Number	Lot Number
A193	11A	Threaded Rod	27724	103970

Heat Number	Grade	Size	TPI	Length	Finish
180E	B8-1	7/8	9	12FT	

C	Si	S	P	Mn	Mo	Cr	Ni	Al	V	Fe	Ti	Cu
0.057	0.24	0.024	0.028	1.58	0.37	18.09	8	0	0	0	0	0.45

Yield		Scale	Tensile		Scale
86	0	ksi	115	0	ksi

Elong %		R.A %	
41	0	68	0

Hardness		Scale
95	0	HRB

Charpy Set 1			Scale	Temp	Macro Etch			Wedge Tensile	Proof Load
0	0	0			R	C	S		
Charpy Set 2									
0	0	0							

Quenched			Tempered			Stress Relieved	
@	0	° in	@	0	°	@	0 °

Remarks:
N=.076
Conforms to ASTM A320-B8 Rev.08

Memo:
7/8-9 X 6 AT STUD A193-B8
COUNTRY OF ORIGIN: USA

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 02-14-2017
THE SPITZER COMPANIES

Quality Assurance
Laura Taylor

The above described product was manufactured, sampled, tested and inspected in accordance with the required specification, including any supplementary requirements or other requirements designated in the purchase order or contract and were found to meet those requirements.

po 2132-024

BOM#73: Dwn Cmr E, F

1/1

Customer
MSI Supply, Inc.
PO Box 26647
Houston , TX 77207
Fax
713-733-5676

Material Test Report

USA Fastener Group, Inc.
1300 Gazin St., Houston, Texas 77020
P: (866)546-5872 | F: (713)641-4655
sales@usafgrp.com

109190-2132-A194-F-1-8 HEX NUT

Specification	Year	Description	PO Number	Lot Number
A194	08	Heavy Hex Nuts	27724	103988

Grade	Size	TPI	Finish	Heat Number	Heat Code	Markings
GR 8	1	8	Plain	109190		

C	Si	S	P	Mn	Mo	Cr	Ni	Cu
0.050	0.370	0.022	0.031	1.150	0.300	18.030	8.010	0.300

Hardness		Scale	Tempered Hardness		Tempered Hardness Scale
93	92	HRB	0	0	

First Charpy Set		
0	0	0

Second Charpy Set		
0	0	0

Charpy Scale	Charpy Temp

Macro Etch		
S	C	R

Proofload
48480 LBF

Quenching	Tempering
@ 0 ° in	@ 0 °

Remarks

Memos:
1-8 HVY HEX NUT A194-GR.8 SS NON CHINA
COUNTRY OF ORIGIN: JAPAN

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 02-01-2017
THE SPITZER COMPANIES

The above described product was manufactured, sampled, tested and inspected in accordance with the required specification, including any supplementary requirements or other requirements designated in the purchase order or contract and were found to meet those requirements.

Quality Assurance
Laura Taylor

P2132-024

Bom#63 : Dun Cnr B

1/1

Customer
MSI Supply, Inc.
PO Box 26647
Houston , TX 77207
Fax
713-733-5676

Material Test Report

USA Fastener Group, Inc.
1300 Gazin St., Houston, Texas 77020
P: (866)546-5872 | F: (713)641-4655
sales@usafgrp.com

500339-2132-A194-F-1.1250-8 HEX NUT

Specification	Year	Description	PO Number	Lot Number
A194	11	Heavy Hex Nuts	27724	104153

Grade	Size	TPI	Finish	Heat Number	Heat Code	Markings
8	1.1/8	8	Plain	500339		

C	Si	S	P	Mn	Mo	Cr	Ni	Cu
0.050	0.470	0.024	0.035	1.350	0.270	18.090	8.050	0.490

Hardness		Scale	Tempered Hardness		Tempered Hardness Scale
98	99	HRB	0	0	

First Charpy Set		
0	0	0
Second Charpy Set		
0	0	0

Charpy Scale	Charpy Temp

Macro Etch		
S	C	R

Proofload
63200 LBF

Quenching	Tempering
@ 0 ° in	@ 0 °

Remarks

Memos:
1 1/8-8 HVY HEX NUT A194-GR.8 SS NON CHINA
COUNTRY OF ORIGIN: JAPAN

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 02-01-2017
THE SPITZER COMPANIES

Quality Assurance
Laura Taylor

The above described product was manufactured, sampled, tested and inspected in accordance with the required specification, including any supplementary requirements or other requirements designated in the purchase order or contract and were found to meet those requirements.

po 2132-024

BOM # 68 : Dwn Cwr C

1/1

Customer
MSI Supply, Inc.
PO Box 26647
Houston , TX 77207
Fax
713-733-5676

Material Test Report

USA Fastener Group, Inc.
1300 Gazin St., Houston, Texas 77020
P: (866)546-5872 | F: (713)641-4655
sales@usafgrp.com

807356-2132-A194-F-.8750-9 HEX NUT

Specification	Year	Description	PO Number	Lot Number
A194	11	Heavy Hex Nuts	27724	101706

Grade	Size	TPI	Finish	Heat Number	Heat Code	Markings
8	7/8	9	Plain	807356		8 (-)

C	Si	S	P	Mn	Mo	Cr	Ni	Cu
0.040	0.340	0.030	0.045	1.130	0.280	18.040	8.020	

Hardness		Scale	Tempered Hardness		Tempered Hardness Scale
95	95	HRB	0	0	

First Charpy Set		
0	0	0
Second Charpy Set		
0	0	0

Charpy Scale	Charpy Temp

Macro Etch		
S	C	R

Proofload
36960 LBF

Quenching	Tempering
@ 0 ° in	@ 0 °

Remarks

Memos:
7/8-9 HVY HEX NUT A194-GR. 8SS NON CHINA
COUNTRY OF ORIGIN: JAPAN

Chemical & Physical Tests
Reviewed and Accepted
By RL Date 02-14-2017
THE SPITZER COMPANIES

Quality Assurance
Laura Taylor

The above described product was manufactured, sampled, tested and inspected in accordance with the required specification, including any supplementary requirements or other requirements designated in the purchase order or contract and were found to meet those requirements.

PO 2132-024

BOM #73 - BLIND BOLTING, Dwn Cmr E, F

USA FASTENER GROUP

Material Test Report

Customer
MSI Supply, Inc.
PO Box 26647
Houston , TX 77207
Fax
713-733-5676

USA FASTENER GROUP, INC.

USA Fastener Group, Inc.
1300 Gazin St., Houston, Texas 77020
P: (866)546-5872 | F: (713)641-4655
sales@usafgrp.com

E50845-2132-A194-F-.5000-13 HEX NUT

Specification	Year	Description	PO Number	Lot Number
A194	11	Heavy Hex Nuts	27951	103050-1

Grade	Size	TPI	Finish	Heat Number	Heat Code	Markings
B8	1/2	13		E50845		

C	Si	S	P	Mn	Mo	Cr	Ni	Cu
0.070	0.490	0.025	0.025	1.050	0.000	18.220	8.040	0.000

Hardness		Scale	Tempered Hardness		Tempered Hardness Scale
96	95	HRB	0	0	

First Charpy Set		
0	0	0

Second Charpy Set		
0	0	0

Charpy Scale	Charpy Temp

Macro Etch		
S	C	R

Proofload
11,350 lbf

Quenching	Tempering
@ 0 ° in	@ 0 °

Remarks

Memos:
1/2-13 HVY HEX NUT A194-GR.8 SS NON CHINA

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 02-01-2017
THE SPITZER COMPANIES

Quality Assurance
Laura Taylor

The above described product was manufactured, sampled, tested and inspected in accordance with the required specification, including any supplementary requirements or other requirements designated in the purchase order or contract and were found to meet those requirements.

BOM #112: Mesh Pad Bolting

PO 2132-025

1/1

Customer
MSI Supply, Inc.
PO Box 26647
Houston , TX 77207
Fax
713-733-5676

Material Test Report

USA Fastener Group, Inc.
1300 Gazin St., Houston, Texas 77020
P: (866)546-5872 | F: (713)641-4655
sales@usafgrp.com

E50845-2132-A194-F-.7500-10 HEX NUT

Specification	Year	Description	PO Number	Lot Number
A194	11	Heavy Hex Nuts	27724	117674

Grade	Size	TPI	Finish	Heat Number	Heat Code	Markings
B8	3/4	10		E50845		

C	Si	S	P	Mn	Mo	Cr	Ni	Cu
0.070	0.490	0.025	0.025	1.050	0.000	18.220	8.040	0.000

Hardness		Scale	Tempered Hardness		Tempered Hardness Scale
94	95	HRB	0	0	

First Charpy Set		
0	0	0
Second Charpy Set		
0	0	0

Charpy Scale	Charpy Temp

Macro Etch		
S	C	R

Proofload
26,720 lbf

Quenching	Tempering
@ 0 ° in	@ 0 °

Remarks

Memos:
3/4-10 HVY HEX NUT A194-GR.8 SS NON CHINA
COUNTRY OF ORIGIN: JAPAN

Chemical & Physical Tests
Reviewed and Accepted
By RA Date 02-01-2017
THE SPITZER COMPANIES

Quality Assurance
Laura Taylor

The above described product was manufactured, sampled, tested and inspected in accordance with the required specification, including any supplementary requirements or other requirements designated in the purchase order or contract and were found to meet those requirements.

Boat #79: Dunn Cnr A & D

PO 2132-024

1/1

N2L3 and 505545-2132-A193 A194-F-1.2500-8 x 8.7500 STUD HEX NUTS

Material Test Report

Customer
MSI Supply, Inc.
PO Box 26647
Houston , TX 77207
Fax
713-733-5676

USA FASTENER GROUP, INC.

USA Fastener Group, Inc.
1300 Gazin St., Houston, Texas 77020
P: (866)546-5872 | F: (713)641-4655
sales@usafgrp.com

Specification	Year	Description	PO Number	Lot Number
A193	09	Threaded Rod	27725	88750

Heat Number	Grade	Size	TPI	Length	Finish
N2L3	B8-1	1.1/4	8	12FT	

C	Si	S	P	Mn	Mo	Cr	Ni	Al	V	Fe	Ti	Cu
0.049	0.24	0.022	0.03	1.57	0	18.09	8.05	0	0	0	0	0

Yield		Scale	Tensile		Scale
90	0	ksi	113	0	ksi

Elong %		R.A %	
42.5	0	66.6	0

Hardness		Scale
210	0	HB

Charpy Set 1			Scale	Temp	Macro Etch			Wedge Tensile	Proof Load
0	0	0			R	C	S		
Charpy Set 2									
0	0	0							

Quenched	Tempered	Stress Relieved
@ 0 ° in	@ 0 °	@ 0 °

Remarks:
Material meets ASTM A320-B8 for service use above -425 deg F.
Carbide Solution Annealed

Memo:
1 1/4-8 X 8 3/4 AT STUD A193-B8
COUNTRY OF ORIGIN: USA

Quality Assurance
Laura Taylor

The above described product was manufactured, sampled, tested and inspected in accordance with the required specification, including any supplementary requirements or other requirements designated in the purchase order or contract and were found to meet those requirements.

po 2132-026

Bomb #58: No. N1, N2, N3, N4

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 02-01-2017
THE SPITZER COMPANIES

1/2

Material Test Report

Customer
MSI Supply, Inc.
PO Box 26647
Houston , TX 77207
Fax
713-733-5676

USA Fastener Group, Inc.
1300 Gazin St., Houston, Texas 77020
P: (866)546-5872 | F: (713)641-4655
sales@usafgrp.com

Specification	Year	Description	PO Number	Lot Number
SA194	11	Heavy Hex Nuts	27725	117782

Grade	Size	TPI	Finish	Heat Number	Heat Code	Markings
8SS	1 1/4	8		505545		

C	Si	S	P	Mn	Mo	Cr	Ni	Cu
0.080	0.310	0.025	0.039	1.160	0.290	18.150	8.150	0.440

Hardness		Scale	Tempered Hardness		Tempered Hardness Scale
170	0	HBW	93	94	HRB

First Charpy Set		
0	0	0
Second Charpy Set		
0	0	0

Charpy Scale	Charpy Temp

Macro Etch		
S	C	R
Pass	Pass	Pass

Proofload
80,000 lbf

Quenching	Tempering
@ 0 ° in	@ 0 °

Remarks

Memos:
1 1/4-8 HVY HEX NUT A194-GR.8 SS NON CHINA
COUNTRY OF ORIGIN: JAPAN

Quality Assurance
Laura Taylor

The above described product was manufactured, sampled, tested and inspected in accordance with the required specification, including any supplementary requirements or other requirements designated in the purchase order or contract and were found to meet those requirements.

PO 2132-026

Bonded: N02 N1, N2, N3, N4

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 02-01-2017
THE SPITZER COMPANIES

4/2

S19668 and E55175-2132-A193 A194-F-.6250-11 x 2 HEX BOLT HEX NUTS

Material Test Report

Customer
MSI Supply, Inc.
PO Box 26647
Houston , TX 77207
Fax
713-733-5676

USA FASTENER GROUP, INC.

USA Fastener Group, Inc.
1300 Gazin St., Houston, Texas 77020
P: (866)546-5872 | F: (713)641-4655
sales@usafgrp.com

Specification	Year	Description	PO Number	Lot Number
A193	10a	Heavy Hex Bolt	27951	118635-4

Heat Number	Grade	Size	TPI	Length	Finish
s19668	B8-1	5/8	11	2	Plain

C	Si	S	P	Mn	Mo	Cr	Ni	Al	V	Fe	Ti	Cu
0.011	0.422	0.005	0.03	1.2	0	18.22	8.58	0	0	0	0	

Yield		Scale	Tensile		Scale
50000	0	psi	80100	0	psi

Elong %		R.A %	
69	0	78	0

Hardness		Scale
135	0	HB

Charpy Set 1			Scale	Temp	Macro Etch			Wedge Tensile	Proof Load
0	0	0			R	C	S	80000 psi	
Charpy Set 2									
0	0	0							

Quenched	Tempered	Stress Relieved
@ 0 ° in	@ 0 °	@ 0 °

Remarks:

Memo:
5/8-11 X 2 HVY HEX C/S A193-B8 CL.1
COUNTRY OF ORIGIN: KOREA

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 02-02-2017
THE SPITZER COMPANIES

Quality Assurance
Laura Taylor

The above described product was manufactured, sampled, tested and inspected in accordance with the required specification, including any supplementary requirements or other requirements designated in the purchase order or contract and were found to meet those requirements.

PO 2132-034 Bomel 101

USA FASTENER GROUP

Material Test Report

Customer
MSI Supply, Inc.
PO Box 26647
Houston , TX 77207
Fax
713-733-5676

USA Fastener Group, Inc.
1300 Gazin St., Houston, Texas 77020
P: (866)546-5872 | F: (713)641-4655
sales@usafgrp.com

Specification	Year	Description	PO Number	Lot Number
A194	11	Heavy Hex Nuts	27951	103050-2

Grade	Size	TPI	Finish	Heat Number	Heat Code	Markings
8.	5/8	11		E55175		

C	Si	S	P	Mn	Mo	Cr	Ni	Cu
0.070	0.480	0.026	0.029	1.060	0.000	18.090	8.050	0.000

Hardness		Scale	Tempered Hardness		Tempered Hardness Scale
92	93	HRB	0	0	

First Charpy Set		
0	0	0
Second Charpy Set		
0	0	0

Charpy Scale	Charpy Temp

Macro Etch		
S	C	R

Proofload
18,080 lbf

Quenching	Tempering
@ 0 ° in	@ 0 °

Remarks
MEETS ASTM A194-GR 8 AND ASME SA194-GR 8 (REV 15)

Memos:
5/8-11 HVY HEX NUT A194-GR.8 SS NON CHINA
COUNTRY OF ORIGIN: JAPAN

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 02-02-2017
THE SPITZER COMPANIES

Quality Assurance
Laura Taylor

The above described product was manufactured, sampled, tested and inspected in accordance with the required specification, including any supplementary requirements or other requirements designated in the purchase order or contract and were found to meet those requirements.

po 2132-034

BOM# 101

USA FASTENER GROUP

Material Test Report

Customer
MSI Supply, Inc.
PO Box 26647
Houston , TX 77207
Fax
713-733-5676

USA FASTENER GROUP, INC.
USA Fastener Group, Inc.
1300 Gazin St., Houston, Texas 77020
P: (866)546-5872 | F: (713)641-4655
sales@usafgrp.com

Specification	Year	Description	PO Number	Lot Number
A193	15	Heavy Hex Bolt	27951	113193-1

Heat Number	Grade	Size	TPI	Length	Finish
T1H5	B8-1	1/2	13	1 1/4	

C	Si	S	P	Mn	Mo	Cr	Ni	Al	V	Fe	Ti	Cu
0.018	0.22	0.001	0.033	1.71	0.31	18.18	8.04	0	0	0	0	0.52

Yield		Scale	Tensile		Scale
30200	0	psi	85500	0	psi

Elong %		R.A %	
62	0	86	0

Hardness		Scale
68	73	HRB

Charpy Set 1			Scale	Temp	Macro Etch			Wedge Tensile	Proof Load
0	0	0			R	C	S		
Charpy Set 2									
0	0	0							

Quenched	Tempered	Stress Relieved
@ 0 ° in	@ 0 °	@ 0 °

Remarks:
FREE FROM MERCURY CONTAMINTION/ NO WELD REPAIR

Memo:
1/2-13 X 1 1/4 FIN HEX C/S A193-B8 CL.1 DOMESTIC
COUNTRY OF ORIGIN: USA

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 02-07-2017
THE SPITZER COMPANIES

Quality Assurance
Laura Taylor

The above described product was manufactured, sampled, tested and inspected in accordance with the required specification, including any supplementary requirements or other requirements designated in the purchase order or contract and were found to meet those requirements.

po 2132-034 BoM# 106

Customer
MSI Supply, Inc.
PO Box 26647
Houston , TX 77207
Fax
713-733-5676

Material Test Report

USA Fastener Group, Inc.
1300 Gazin St., Houston, Texas 77020
P: (866)546-5872 | F: (713)641-4655
sales@usafgrp.com

Specification	Year	Description	PO Number	Lot Number
A194	11	Heavy Hex Nuts	27951	103050-1

Grade	Size	TPI	Finish	Heat Number	Heat Code	Markings
B8	1/2	13		E50845		

C	Si	S	P	Mn	Mo	Cr	Ni	Cu
0.070	0.490	0.025	0.025	1.050	0.000	18.220	8.040	0.000

Hardness		Scale	Tempered Hardness		Tempered Hardness Scale
96	95	HRB	0	0	

First Charpy Set		
0	0	0
Second Charpy Set		
0	0	0

Charpy Scale	Charpy Temp

Macro Etch		
S	C	R

Proofload
11,350 lbf

Quenching	Tempering
@ 0 ° in	@ 0 °

Remarks

Memos:
1/2-13 HVY HEX NUT A194-GR.8 SS NON CHINA
COUNTRY OF ORIGIN: JAPAN

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 02-01-2017
THE SPITZER COMPANIES

Quality Assurance
Laura Taylor

The above described product was manufactured, sampled, tested and inspected in accordance with the required specification, including any supplementary requirements or other requirements designated in the purchase order or contract and were found to meet those requirements.

po 2132-034

BOM #100

USA FASTENER GROUP

Material Test Report

Customer
MSI Supply, Inc.
PO Box 26647
Houston , TX 77207
Fax
713-733-5676

USA Fastener Group, Inc.
1300 Gazin St., Houston, Texas 77020
P: (866)546-5872 | F: (713)641-4655
sales@usafgrp.com

T1H5-2132-025-A193-F-.5000-13 x 1.5000 HEX BOLT

Specification	Year	Description	PO Number	Lot Number
A193	15	Heavy Hex Bolt	27951	113193-2

Heat Number	Grade	Size	TPI	Length	Finish
T1H5	B8-1	1/2	13	1 1/2	

C	Si	S	P	Mn	Mo	Cr	Ni	Al	V	Fe	Ti	Cu
0.018	0.22	0.001	0.033	1.71	0.31	18.18	8.04	0	0	0	0	0.52

Yield		Scale	Tensile		Scale
30200	0	psi	85500	0	psi

Elong %		R.A %	
62	0	86	0

Hardness		Scale
68	73	HRB

Charpy Set 1			Scale	Temp	Macro Etch			Wedge Tensile	Proof Load
0	0	0			R	C	S		
Charpy Set 2									
0	0	0							

Quenched	Tempered	Stress Relieved
@ 0 ° in	@ 0 °	@ 0 °

Remarks:
FREE FROM MERUCRY CONTAMINATION/ NO WELD REPAIR

Memo:
1/2-13 X 1 1/2 FIN HEX C/S A193-B8 CL.1 DOMESTIC
COUNTRY OF ORIGIN: USA

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 02-02-2017
THE SPITZER COMPANIES

Quality Assurance
Laura Taylor

The above described product was manufactured, sampled, tested and inspected in accordance with the required specification, including any supplementary requirements or other requirements designated in the purchase order or contract and were found to meet those requirements.

po 2132-025

BOM #112

USA FASTENER GROUP

506754-2132-SA240-P-0.3717 x 61.5

Manufacturer / Fabricante / Herstellerwerk

outokumpu

Type of document / Tipo de documento / Art der Prüfbescheinigung

INSPECTION CERTIFICATE

CERTIFICADO DE INSPECCION

ABNAHMEPRÜFZEUGNIS

according to / de acuerdo con / nach

EN 10204-3.1

Document number / Nº de certificado / Bescheinigungsnr.: 05/03/2016

0000182979 /

Page / Página / Seite: 1 / 1

1 Steel Drive; P.O. Box 13000; Calvert, AL 36513-1300

USA

Customer/Sold to / Cliente / Besteller/Empfänger

Customer's order number / Nº de Pedido Cliente / Kundenbestellnr.: 27115-0301

Manufacturer's works order no. / Nº de Pedido Manufactura / Werksauftragsnr.: 901197990 / 001

Delivery note no. / Nº de Entrega / Lieferscheign Nr.: 85587232 / 010

Product / Producto / Erzeugnis: COIL/BOBINA/SAND

Terms of delivery / Condiciones de entrega / Lieferbedingungen:
ASTM A240/240M, ASME SA-240 Sec.II Part A Ed. 2015
ASTM A480/480M, ASME SA-480 Sec.II Part A Ed. 2015

Steel grade and quality / Acero / Stahlsorte und Gütequalität: TYPE 304L/304

Customer's material no. / Nº de material del cliente / Kundenmaterial-Nr.	Product dimensions (Thickness / Width / Length) / Dimensiones (Espesor / Ancho / Largo) / Maße des Erzeugnisses (Dicke / Breite / Länge)	Steelmaking procedure / Proceso de manufactu / Herstellart	Finish / Acabado / Ausführung
	9.44 mm x 1,563.00 mm 0.3717 inch x 61.5354 inch	AOD	IIa / 1D / No.1

Packing-No. / Nº de Empaque / Paket-Nr.	No. of pieces / Piezas / Stückzahl	Actual weight / Peso actual / Ist-Gewicht	Coil No. / Bobina Nº / Band-Nr.	Heat No. / Colada Nº / Schmelzen-Nr.	Sample Nº / Nº de muestra / Proben-Nr.	Sample Id. / Nº de muestra / Proben-Id.
6478508	1	28,208 lb / 12,795 kg	760242	506754	1000314435	1000314436
Sum / Suma / Summe	1	28,208 lb / 12,795 kg				

Heat / Colada / Schmelze	Country of Melt / País de colada / Erschmelzungsland	Chemical composition / Composición Química / Chemische Zusammensetzung									
		% C	% Si	% Mn	% P	% S	% Cr	% Mo	% Ni	% N	% Cu
506754	USA	0.024	0.37	1.29	0.027	0.0020	18.35	0.32	8.04	0.074	0.45

Sample Position / Localización de la muestra / Probenlage: TRANSVERSE

Inspection lot / Lote de inspección / Prüflos	YS0.2% PSI / MPa	TS PSI / MPa	El. A2" %	HRB		
1000314435	49,601 / 342	92,530 / 638	59.5	82		
1000314436	50,616 / 349	93,401 / 644	67.1	82		

Dimensions - surface / Dimensiones - Superficie / Maße - Oberfläche: OK

Test of identity (spectrum analysis) / Control de identidad (análisis espectográfico) / Verwechslungsprüfung (Spektralanalyse): OK

Heat Treatment: Solution annealed 1920°F Min / Air cooled

No welding or weld repairs were performed on this material

No intentional additions of Mercury compounds were made or used

Free of radioactive contamination

EU RoHS Directive 2011/65/EU Compliant

Country of Heat as per ISO 3166-1

Originator of the document / Originador del documento / Aussteller der Bescheinigung:

Outokumpu Stainless USA, LLC
An ISO 9001: 2008 certified company
EU PED 97/23/EC, Anex I, 4.3 certified

Certificate is generated automatically / Certificado es generado automáticamente / Das Zeugnis wurde elektronisch erstellt

The information provided is a true copy of data on file / Los valores mostrados corresponden a los datos archivados / Die genannten Werte entsprechen den gespeicherten Daten

Andrew Faucett
Phone: +1 251 020 3402

Name of expert / Nombre del experto / Name des Sachverständigen

Date of issue and validation / Fecha de emisión y validación / Datum Ausstellung / Bestätigung: 05/03/2016

This document shall not be altered or reproduced, except in full. Fraudulent, fictitious, or false statements or entries may be prosecuted by law.

Chemical & Physical Tests
Reviewed and Accepted
By RK Date 12-5-2016
THE SPITZER COMPANIES

po 2132015 Mesh Pad

857975-2A-2132-SA240-P-.5000 x 120 x 246

848172 01

outokumpu

Outokumpu Stainless Plate, LLC

Certificate of Analysis and Tests

****
* RE-CERTIFICATION *
****

OUR ORDER 0286231 - 01 HEAT & PIECE 857975-2A 03/27/14

SOLD TO: CONSOLIDATED POWER SUPPLY
3556 MARY TAYLOR ROAD
BIRMINGHAM AL 35235

SHIP TO: CONSOLIDATED POWER SUPPLY
3556 MARY TAYLOR ROAD
205-655-5515
BIRMINGHAM AL 35235

YOUR ORDER & DATE	
265-41067	1/23/14

ITEM DESCRIPTION

HEAT & PIECE 857975 - 2A PARENT HEAT B140080 Lot No. 9399
WEIGHT 4441
FINISH 1
GRADE 304L / 304 UNS-S30403 / UNS-S30400
DIMENSIONS .500 X 120.000 X 246.000 EXACT

SPECIFICATIONS

*** MFG IN NEW CASTLE, IN, USA
FROM SLABS IMPORTED FROM BRITAIN
ASTM A240-13C ASMESA240-13ED
ASTM A480-13 ASMESA480 13ED
COUPONS REQUIRED
OSI QA MAN ED 2 R 2 02/22/12
REQUIRES PRODUCT ANALYSIS
NO GRIPPER MARKS
NO WELD REPAIRS
ASTM A262-13 PRACTICE A
ASTM A262-13 PRACTICE E

PLATES & TEST PCS SOLUTION ANNEALED @ 1900 DEGREES FAHRENHEIT MINIMUM.
THEN WATER COOLED OR RAPIDLY COOLED BY AIR
FREE FROM MERCURY CONTAMINATION AT CURRENT DETECTION LIMITS
HOT ROLLED, ANNEALED & PICKLED (HRAP)

MECHANICAL & OTHER TESTS

HARDNESS HRBW	87
GRAIN SIZE	6
YIELD STRENGTH (PSI)	39246
TENSILE STRENGTH (PSI)	88020
BEND	OK
INTERGRANULAR CORROSION	OK
ELONGATION % IN 2"	57.9
REDUCTION OF AREA %	63.5

CB&I POWER
JUN 27 2014
083

CHEMICAL COMPOSITION			PRODUCT ANALYSIS	
CARBON	(C)	.021	(C)	.018
MANGANESE	(MN)	1.76	(MN)	1.72
PHOSPHORUS	(P)	.029	(P)	.029
SULFUR	(S)	.005	(S)	.001
SILICON	(SI)	.30	(SI)	.35
CHROMIUM	(CR)	18.21	(CR)	18.21
NICKEL	(NI)	8.11	(NI)	8.58
COBALT	(CO)	.34	(CO)	.32
COPPER	(CU)	.32	(CU)	.33
MOLY	(MO)	.34	(MO)	.31
NITROGEN	(N)	.07	(N)	.09
COLUMBIUM	(CB)	.021	(CB)	.018
TITANIUM	(TI)	.004	(TI)	.003
ALUMINUM	(AL)	.005	(AL)	.002
TIN	(SN)	.008	(SN)	.006
TANTALUM	(TA)	.001	(TA)	
PB	(PB)	.001		

CPS
QA REVIEW
Approved
Date 3/27/14

WE HEREBY CERTIFY THAT THE MATERIAL HEREIN HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE LISTED SPECIFICATION(S) AND THAT THE RESULTS OF ALL TESTS ARE ACCEPTABLE.

JAMES DOUBMAN, QUALITY ASSURANCE MANAGER

CERTIFICATE IN CONFORMANCE WITH EN10204 95 3.1.B/EN10204-2004 3.1

Outokumpu Stainless Plate, LLC
P.O. Box 370
New Castle, Indiana 47362

Chemical & Physical Tests
Reviewed and Accepted
By BR Date 12-5-2016
THE SPITZER COMPANIES

HT# 857975 1/2" x 120" x 240"
po 2132-015
Mesh Pad

1/1

E76249-2132-SA240-P-.7500 x 96 x 240

注文者 Shipper: KANEMATSU CORPORATION
注文者照合番号 Reference No.: TEB15 00021603
契約番号 Contract No.: 6-868-TH-5-6-BH04
製品名 Commodity: HOT ROLLED STAINLESS STEEL PLATES
規格 Specification: A240-14/A480-14B/SA240-15E/SA480-15E TYPE304/304L
文書番号 Document No.:

新日鐵住金ステンレス株式会社
Nippon Steel & Sumikin Stainless Steel Corporation
鋼材検査証明書
INSPECTION CERTIFICATE

需要家 Customer: SABRE ALLOYS
需要家管理番号 Customer's Control No.: PO 2249

本社 Head Office: 〒100-0004 東京都千代田区大手町二丁目6番1号 2-6-1, Otemachi,Chiyoda-ku,Tokyo 100-0004,Japan
八幡製造所 Yawata Works: 〒805-0058 北九州市八幡東区大字前田字波戸2108－1 2108-1, Azahato, Dazamaeda,Yawata-higashi-ku, Kitakyushu-City,805-0058,Japan

証明書番号 Certificate No.: 01Y6001378 - 1/1
発行年月日 Date Of Issue: 2016-05-19

行番 Item No.	寸法 Dimension INCH	員数 Quantity	質量 Mass LBS KG	製鋼番号 Cast No. / 試験番号 Test No.	製品番号 Plate No.	Location Orientation ※1	引張試験 Tensile Test 耐力 0.2% Y.S KSI	引張強さ T.S KSI	伸び EL %	絞り % ※3	Bend Test Specimen	Location ※1	Notch Direction	衝撃試験 Impact Test 平均 Avg	個々値 Each	HBW 10/3000	化学成分 Chemical Composition % C X1000	Si X100	Mn X100	P X1000	S X1000	Ni X10	Cr X10	Mo X100
					SPEC. MIN.		30	75	40													80	175	
					MAX.											201	30	75	200	45	30	105	195	75
					MIN.																			
					MAX.												75	10	10	10					
			5009	E76249																				
06	3/4' X96' X240'	1	2272	58075	443279-01	TCH	40	88	64							174	16	45	165	31	4	82	181	24
			5009	E76249													27	6	0	1				
06	3/4' X96' X240'	1	2272	58075	443279-02	TCH	40	88	64							174	16	45	165	31	4	82	181	24
																	27	6	0	1				
	TOTAL	2	10018 4544																					

SOLUTION HEAT TREATMENT. . . . . 1055C X 5MIN. WATER COOLED
CORROSION TEST (ASTM A262 PRACTICE-E) : ACCEPTABLE
TEST SPECIMEN : A370/SA-370 SHEET TYPE
VISUAL & DIMENSIONAL INSPECTION : ACCEPTABLE
FINISH : NO.1
ANSI/NACE MR0175/ISO 15156-3:2009/CIR.4:2014(E)
NACE MR0103-2012
AS PER EN 10204 CERTIFICATE ON MATERIAL TESTS 3.1
NO WELD REPAIR / FREE OF MERCURY CONTAMINATION
MELTED AND MANUFACTURED IN JAPAN

注釈 Notes ※1 Location-Orientation 位置・方向 T:頭部 Top, B:底部 Bottom, L:圧延方向 Longitudinal, C:直角方向 Transverse, Z:板厚方向 Through Thickness. ※2 GL標点距離Gage Length. A:50mm平形Rectangular, B:50mm丸形Round, C:70mm平形Rectangular, D:70mm丸形Round, E:80mm平形Rectangular, F:80mm丸形Round, G:200mm, H:2", I:8", J:5.65√So, K:1", L:4√So, S:30mm丸形Round, T:40mm丸形Round, Q:60mm丸形Round
※3 R.A:絞り Reduction Of Area, Y.R:降伏比 Yield Ratio ※4 A.合格 Acceptable ※5 2:2.5mm, 3:3.3mm, 4:3.33mm, 5:5.0mm, 6:6.67mm, 7:7.5mm, 8:6.7mm, 9:製品板厚 Plate Thickness ※6 P:製品分析 Product Analysis
SH:延性破面率 Shear Fracture, CF:脆性破面率 Crystallinity Fracture, LE:横膨出 Lateral Expansion, AGS:オーステナイト粒度 Austenite Grain Size, FGS:フェライト粒度 Ferrite Grain Size, SR:Stress Relieved /Post Weld Heat Treatment

上記注文品は御指定の規格または仕様に従って製造され、その要求事項を満足していることを証明します。

WE HEREBY CERTIFY THAT THE MATERIAL DESCRIBED HEREIN HAS BEEN MADE IN ACCORDANCE WITH THE RULES OF THE CONTRACT.

Y. Yamamoto

八幡製造所
厚板管理室長 山本洋一
Group Manager,Plate Quality Control Dept.
Yawata Works YOICHI YAMAMOTO

NSSC社内分類番号 E05 0 1968** ※ 026 1318

Y16-02-2 Rev. 6

PO 2132-015

Mesh Pad

Chemical & Physical Tests
Reviewed and Accepted
By RK Date 12-5-2016
THE SPITZER COMPANIES

1/1

X0T9-2132-SA240-P-.6250 x 48 x 96

NAS NORTH AMERICAN STAINLESS

METALLURGICAL TEST REPORT

6870 Highway 42 East
Ghent, KY 41045-9615
(502) 347-6000

Certificate: 114138 01

Customer: 0095 138

Mail To:
RYERSON, INC.
4075 BLUE RIDGE INDUSTRIAL PKWY.
NORCROSS, GA 30071

Ship To:
RYERSON, INC.
4075 BLUE RIDGE INDUSTRIAL PKWY.
NORCROSS, GA 30071

Date: 11/13/2015 Page: 1

Steel: 304/304L

Finish: HRAP

Your Order: M0141050

NAS Order: AN 0681310 01

Corrosion: ASTM A262/14 A 180Bend-OK

PRODUCT DESCRIPTION:

STAINLESS STEEL PLATE, HRAP; UNS 30400/30403
ASTM A240/15a,A480/14b,A666/15;ASME SA240/13,SA480/13a,SA666/13
CHEM ONLY ON FOLLOWING ASTM: A276/13,A479/13a,A484/13a,A312/13
CHEM ONLY ON FOLLOWING ASME: SA312/13,SA479/13
AMS 5511H/5513J XMRK; MIL-S-5059D AMD3(X CRN MEAS); MIL-S-4043B
NACE MR0175/ISO 15156-3:2009 A, MR0103/07;QQS766D-A X MAG PERM
MIN. SOLUTION ANNEAL TEMP 1900F, WATER QUENCHED

REMARKS:

Mat'l is Free of Mercury Contamination. No weld repairs.
EN 10204:2004 3.1; RoHS 1 & 2 Compliant
Material is Free of Radioactive Contamination
Steel Making Process: EAF, AOD, & Cont. Casting
Product Mfg.by a Quality Mgt.Sys. in Conf. w/ISO 9001
Melted & Manufactured in the USA; Mat'l is DFARs Compliant

Skid #	Prod #	Thickness	Width	Weight	--------Length--------	Mark	Pieces	PART NUMBER
PF9269	* 03X0T9	.6250	48.0000	4,240	PLATE 96.000		5	49809

CHEMICAL ANALYSIS

Lab Accreditation Bureau, ISO/IEC 17025, Certificate# L2323

CM(Country of Melt) ES(Spain) US(United States) ZA(South Africa) JP(Japan)

Chemical analysis per ASTM A751/08

HEAT	CM	C %	CR %	CU %	MN %	MO %	N %	NI %	P %	S %
X0T9	US	.0173	18.3270	.3895	1.7310	.3475	.0852	8.0215	.0315	.0010

SI %
.2410

MECHANICAL PROPERTIES

Skid #	Prod #	Loc	Dir	UTS 20C KSI	.2% YS 20C KSI	ELONG % -2"	Hard RB	A 262 Pr A Pr A	R of A %
PF9269	03X0T9	F	T	85.32	37.41	63.95	79.00	OK	72.27

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 12-5-2016
THE SPITZER COMPANIES

NAS hereby certifies that the analysis on this certification is correct. Based upon the results and the accuracy of the test methods used, the material meets the specifications stated. These results relate only to the items tested and this report cannot be reproduced, except in its entirety, without the written approval of NAS.

Technical Dept. Mgr. Abhijeet Bhave 11/13/2015

po 2132-015

Mesh Pad

Cust: GULF COAST STEEL, IN ORD#: 01-05047-05 Date: 12112015 Time: 065112 To: ATLEVJS(Page 1 of 1

From: Valbruna Stainless Inc Date: 12/27/2016 To: ACTION STAINLESS AND ALLOY INC SO#: A804473 Ln#: 2
PO#: 58550460 Part: 304D2.0.375 Heat#: 268305 Tag: V5136904A

Acciaierie Valbruna S.p.A.

36100 VICENZA (Italia) - Viale della scienze, 25 z.i.
Telefono 0444.968211 - Fax 0444.963836
Stab.: 39100 BOLZANO (Italia) - Via A. Volta, 4/37
Telefono 0471.924111 - Fax 0471.924497

268305-2132-SA479-T-A-2 x 2 x .3750

CERTIFICATO DI COLLAUDO - ABNAHMEPRUEFZEUGNIS - INSPECTION CERTIFICATE - CERTIFICAT DE RECEPTION

In conformità a / Nach/According to/Selon: EN 10204 (2004) , 3.1

Certificato nr. / Prüfung/Test/Essai: MEST951358 / 2016 /

Cliente / Besteller/Purchaser/Client:
VALBRUNA STAINLESS INC.
2400 TAYLOR STREET WEST
46801 - FORT WAYNE, IN 46801 - US

Ordine nr: 51369 STOCK HOUSTON
Bestell / Your order / Commande

Conferma ordine nr: EI16010772
Werks/Our Order/Ref nr.

Avviso di Spedizione: D-VI16027584
Lieferanzeige/Packing list/B.L.

Stato di fornitura: Hot rolled Descaled Annealed Hot rolled
Lieferzustand / Delivery state / Etat de livraison

Tipo di Elaborazione: E+AOD
Erschmelzungsart / Melting process / Mode d'elaboration

Qualità: 304/304L
Werkstoff/Grade/Nuance

Marca: AISL
Markenbezeichnung / Brand / Nuance

Produttore / Hersteller/Item/Usine productrice:
ACCIAIERIE VALBRUNA S.P.A.

Marchi di Fabbrica: AV
Zeichen des Lieferwerkes / Trade marks / Sigles de l'usine productrice

Punzone del Collaudatore: MR
Stempel des Werksachverständigen / Inspector's stamp/Poinçon de l'assayeur

Punzonatura: 304/304L
Kennzeichnung / Marking / Marquage

SPECIFICHE : Anforderungen / Requirements / Exigences	Note: Aufzeichnungen / Notes / Notes
VSI 0 304/304L A	
AISI 304/304L	
AMS 5639 H S30400 A	
AMS 5647 J S30403 A	
AMS-QQ-S-763 D 304/304L A	
ASME SA182 2015 S30400/03 A (0)	(0)SECTION II PT.A 2015 EDITION For products machined directly from bar refer to ASME SA479.
ASME SA193 2015 B8 CLASS1 (1)	(1)SECTION II PT.A 2015 EDITION
ASME SA276 2015 S30400/03 A (2)	(2)SECTION II PT.A 2015 EDITION
ASME SA320 2015 B8 CLASS1 (3)	(3)SECTION II PT.A 2015 EDITION
ASME SA479 2015 S30400/03 A (4)	(4)SECTION II PT.A 2015 EDITION
ASTM A182 2016 S30400/03 A (5)	(5)For products machined directly from bar refer also to ASTM A479.
ASTM A193 2016 B8 CLASS1	
ASTM A262 2015 PRACTICE E	
ASTM A276 2016 S30400/03 A	
ASTM A314 2015 S30400/03	
ASTM A320 2015A B8 CLASS1	
ASTM A473 2001 S30400/03 (6)	(6)Chemical analysis only.
ASTM A479 2016 S30400/03 A	
MIL-S-862 B/1 304/304L	
NACE MR0103 2010 S30400/03 A	
NACE MR0175 2009 S30400/03 A (7)	(7)ANSI/NACE MR0175/ISO 15156-3, second edition 2009-10-15 Technical circular 1:2011 Published 2011-05-14
QQ-S-763 F 304/304L A	

Tolleranza: ASTM A484-16 TABLE 13
Tolleranza/Allowance/Tolerance

Pos. nr.	Oggetto	Dimensioni - in	Lunghezza - in	Colata	Pezzi	Peso - LB	Lotto nr.
Pos. nr. / Item nr. / Nr. de poste	Gegenstand / Produit description / Descrip. de produit	Abmessungen / Dimension / Dimension	Länge / Length / Longueur	Schmelze / Heat / Coulée	Stückzahl / Pieces / Pieces	Gewicht / Weight / Poids	Losnr. / Lot nr. / Lot nr.
0040	Angle	2,0000 x 2,0000 x 0,3750	240/ 246	268305		2.879	528605890

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 12-30-2016
THE SPITZER COMPANIES

Vicenza, 07/11/16
VCQ005 - MEST951358
(Mod. MCE2)

Il collaudatore di stabilimento / der Werkssachverständige / Works inspector / L'agent d'usine
M.Rizzotto

po 2132-019 Mesh Pad Bolt Clip (Bom#105A)

From: Valbruna Stainless Inc Date: 12/27/2016 To: ACTION STAINLESS AND ALLOY INC SO#: A804473 Ln#: 2
PO#: 58550460 Part: 304D2.0.375 Heat#: 268305 Tag: V5136904A

Acciaierie Valbruna S.p.A.

268305-2132-SA479-T-A-2 x 2 x .3750

36100 VICENZA (Italia) - Viale della scienza, 25 z.i.
Telefono 0444.968211 - Fax 0444.963836
Stab.: 39100 BOLZANO (Italia) - Via A. Volta, 4/37
Telefono 0471.924111 - Fax 0471.924497

CERTIFICATO DI COLLAUDO - ABNAHMEPRUEFZEUGNIS - INSPECTION CERTIFICATE - CERTIFICAT DE RECEPTION

In conformità a: EN 10204 (2004) , 3.1 (Nach/According to/Selon)

Certificato nr. MEST951358 / 2016 / (Prüfung/Test/Essai)

Cliente / Besteller/Purchaser/Client
VALBRUNA STAINLESS INC.
2400 TAYLOR STREET WEST
46801 - FORT WAYNE, IN 46801 - US

Ordine nr: 51369 STOCK HOUSTON (Bestell / Your order / Commande)

Conferma ordine nr: EI16010772 (Works/Our Order/Ref nr.)

Avviso di Spedizione: D-VI16027584 (Lieferanzeige/Packing list/B.L.)

Stato di fornitura: Hot rolled Descaled Annealed Hot rolled (Lieferzustand / Delivery state / Etat de livraison)

Tipo di Elaborazione: E+AOD (Erschmelzungsart / Melting process / Mode d'elaboration)

Qualità: 304/304L (Werkstoff/Grade/Nuance)

Marca: AISL (Markenbezeichnung / Brand / Nuance)

Produttore: (Hersteller/Item/Usine productrice)
ACCIAIERIE VALBRUNA S.P.A.

Marchi di Fabbrica: AV (Zeichen des Lieferwerkes / Trade marks / Sigles de l'usine productrice)

Punzone del Collaudatore: MR (Stempel des Werkssachverständigen / Inspector's stamp/Poinçon de l'assayeur)

Punzonatura: 304/304L (Kennzeichnung / Marking / Marquage)

TEST ALLO STATO DI FORNITURA

Test on delivery condition Prüefung auf lieferbereitem produkt test a l'etat de fourniture Prueba sobre el material asi come entregado

1) L=longitudinale/längs, T=trasversale/quer, O=Tangenziale/tangential

TEST	Provetta/ Probestab Specimen/Eprouvette Larg diam Spess. Breite Diam. Dicke Width Diam. Thickness Larg. diam. epais mm	°F	Posiz. Saggio Probenlage Location Emplacement °	Snervamento Streckgrenze Yield Stress Limite elastique Rp 0,2% ksi	Snervamento Streckgrenze Yield Stress Limite elastique	Resistenza Zugfestigkeit Tensile strength Resistance à traction Rm ksi	Allungamento Bruchdehnung Elongation Allongement E 4d %		Strizione Einschnürung Reduction of area Striction RA %	%	Resilienza Kerbschlagarbeit Impact Value Resilience			Durezza Härte Hardness Dureté HB		
Valori richiesti Anforderungen/Required values Valeurs demandées		min		30	-	75	-	40	-	50	-			140		
		max				115								235		
A	8,75	68	L	49		92		53		64				192		

TEST ALLO STATO DI FORNITURA

Test on delivery condition / Prüefung auf lieferbereitem produkt / Test a l'etat de fourniture / Prueba sobre el material asi come entregado

TEST		min	max	
A	Grain size for ASTM E112			6

Analisi chimica

Chemische Zusammensetzung/Chemical Analysis/Analyse chimique

Colata /Heat Schmelze/Coulée	min - max	C % 0,030	Si % 1,00	Mn % 2,00	Cr % 18,00 20,00	Mo % 1,00	Cu % 1,00	Ni % 8,00 10,50	Co % -	P % - 0,040	S % 0,020 0,030	N % 0,100				
268305		0,025	0,41	1,63	18,18	0,36	0,45	8,03	0,100	0,030	0,028	0,096				

Corrosion test in 16% sulfuric acid and copper sulfate solutions

Test standard: ASTM A262-Practice E

Test	Heat treatment before test	Length of Period (h)	Test temp (°C)	Bend Angle (°)	Ø spindle (mm)	Result of visual inspection at 20 x magnification after bend test	Result
Intergranular corrosion	Sensitization	15	boil	180	5	Absence of cracks	SATISFACTORY

Produced without class I-II Ozone depleting substances.
Solution heat treated free from continuous carbide network.
Micro and macro etch test: OK
Reduction ratio = 33,5 : 1
Annealing temperature: 1940°F for 0,5h/water.
Material is DFARS Compliant

Sono state soddisfatte tutte le condizioni richieste
Die gestellten Anforderungen sind it. Anlage erfüllt
The material has been furnished in accordance with the requirements
Le materiel a été trouvé conforme aux exigences

Controllo antimescolanza: OK
Verwechslungprüfung: spectralanalytisch durchgeführt
Antimixing testing performed: OK
Contrôle antimélange fait r.p.s.

Controllo visivo e dimensionale: soddisfa le esigenze
Besichtigung und Ausmessung: ohne Beanstandung
Visual inspection and dimensional checks:satisfactory
Contrôle visuel et dimensions: satisfaisant

Vicenza, 07/11/16
VCQ005 - MEST951358
(Mod. MCE2)

Il collaudatore di stabilimento / der Werkssachverständige / Works inspector / L'agent d'usine
M.Rizzotto

From: Valbruna Stainless Inc Date: 12/27/2016 To: ACTION STAINLESS AND ALLOY INC SO#: A804473 Ln#: 2
PO#: 58550460 Part: 304D2.0.375 Heat#: 268305 Tag: V5136904A

Acciaierie Valbruna S.p.A.

268305-2132-SA479-T-A-2 x 2 x .3750

36100 VICENZA (Italia) - Viale della scienza, 25 z.i.
Telefono 0444.968211 - Fax 0444.963836
Stab.: 39100 BOLZANO (Italia) - Via A. Volta, 4/37
Telefono 0471.924111 - Fax 0471.924497

CERTIFICATO DI COLLAUDO - ABNAHMEPRUEFZEUGNIS - INSPECTION CERTIFICATE - CERTIFICAT DE RECEPTION

In conformità a / Nach/According to/Selon: EN 10204 (2004) , 3.1

Certificato nr. / Prüfung/Test/Essai: MEST951358 / 2016 /

Cliente / Besteller/Purchaser/Client:
VALBRUNA STAINLESS INC.
2400 TAYLOR STREET WEST
46801 - FORT WAYNE, IN 46801 - US

Ordine nr / Bestell / Your order / Commande: 51369 STOCK HOUSTON

Conferma ordine nr / Works/Our Order/Ref nr.: EI16010772

Avviso di Spedizione / Lieferanzeige/Packing list/B.L.: D-VI16027584

Stato di fornitura / Lieferzustand / Delivery state / Etat de livraison: Hot rolled Descaled Annealed Hot rolled

Tipo di Elaborazione / Erschmelzungsart / Melting process / Mode d'elaboration: E+AOD

Qualità / Werkstoff/Grade/Nuance: 304/304L

Marca / Markenbezeichnung / Brand / Nuance: AISL

Produttore / Hersteller/Italy/Usine productrice:
ACCIAIERIE VALBRUNA S.P.A.

Marchi di Fabbrica / Zeichen des Lieferwerkes / Trade marks / Sigles de l'usine productrice: AV

Punzone del Collaudatore / Stempel des Werksachverständigen / Inspector's stamp/Poinçon de l'asseyeur: MR

Punzonatura / Kennzeichnung / Marking / Marquage: 304/304L

Melted and manufactured in Italy — No welding or weld repair — Material free from Mercury contamination

We declare that the finished product is checked for radioactive contamination through Portal System when it leaves the production plant.

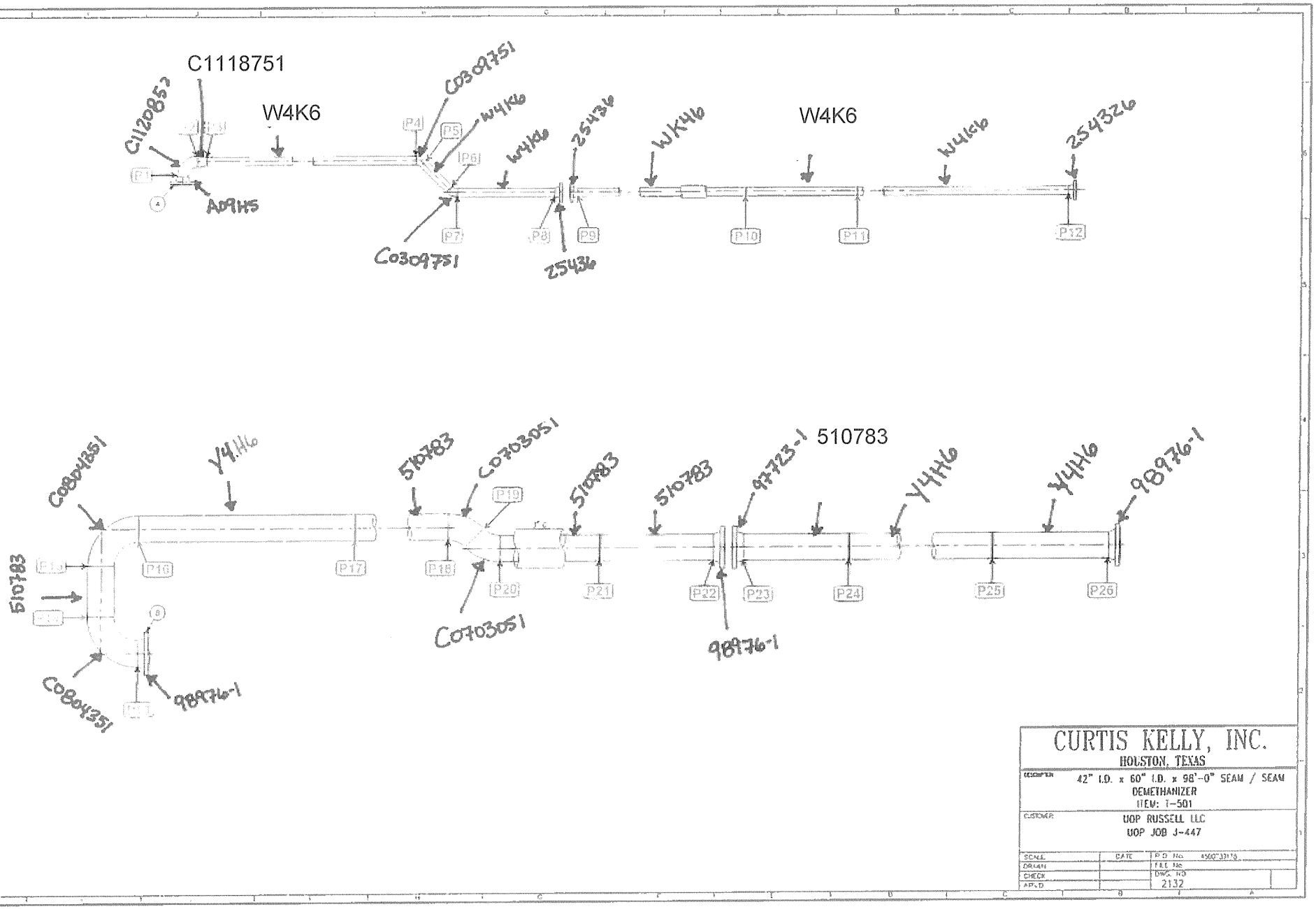
QUALITY MANAGEMENT SYSTEM CERTIFIED BY LLOYD'S REGISTER ACCORDING TO ISO 9001 : 2008, ISO/TS16949 : 2009, AS 9100C

The Quality Management System is Certified acc. Pressure Equipment Directive '['97/23/EC]' Annex 1,s.,4.3 and 2014/68/EU by TUEV and LLOYD'S

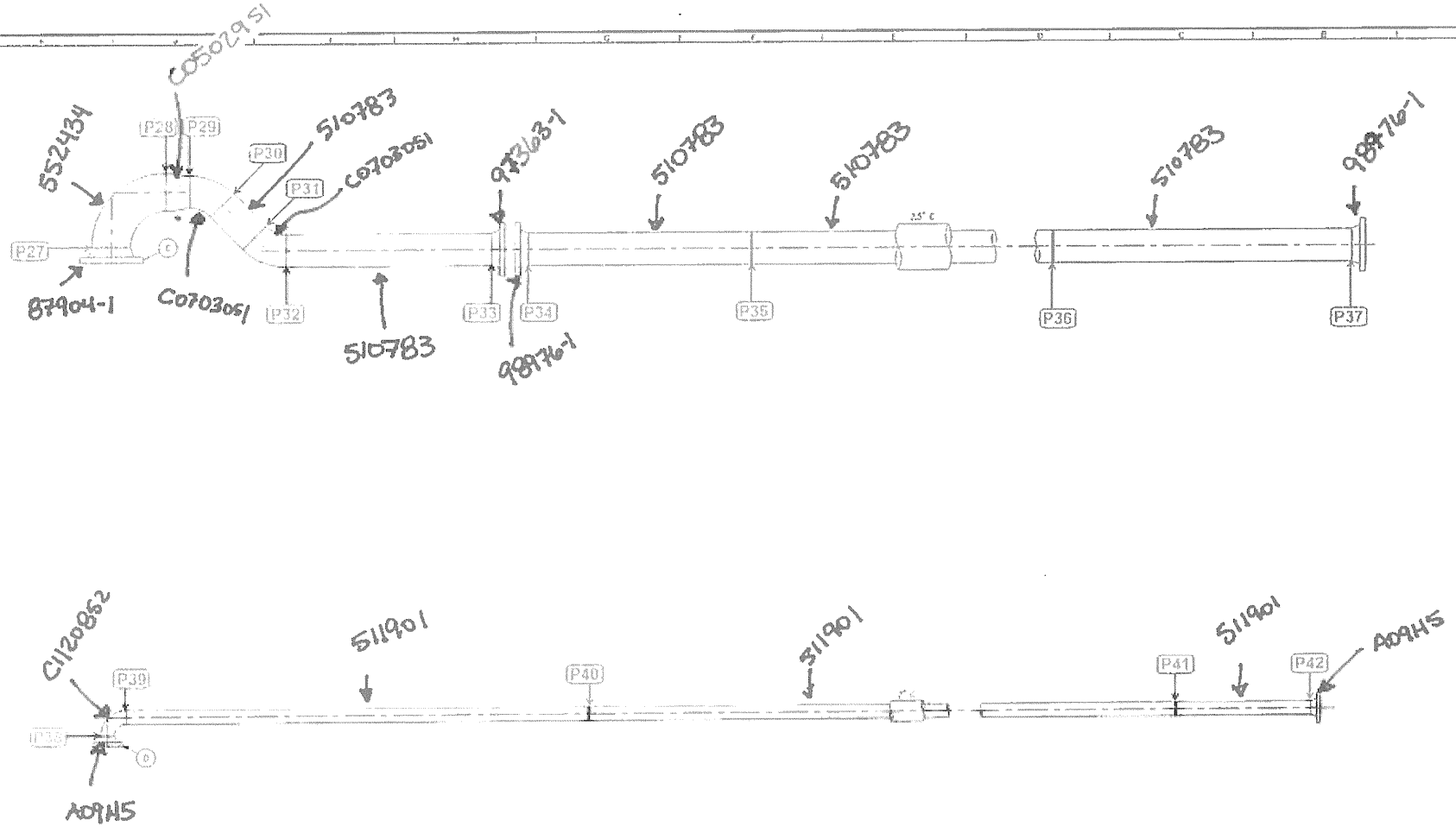
Any act of tampering, modification, alteration, counterfeiting and/or falsification and/or any other action which modifies the contents of this test certificate shall constitute a violation of applicable civil and criminal laws. Acciaierie Valbruna shall protect its rights and interests before any competent court, authority and jurisdiction.

Maxival and/or Valplus grades/products are manufactured with ladle techniques to control composition, distribution, size and shape of non-metallic inclusions for improved machinability.

The supplied product conforms to requirements expressly requested by the purchaser and conforms to requirements specified by certified norms and standards. Should the product be used for more severe, critical and/ or in any case different applications than those the material is generally intended for, any different and/or supplementary requirements shall be specifically demanded, at least, upon order of the Product by the Purchaser. Acciaierie Valbruna SpA shall not be responsible for any improper use of the Products.

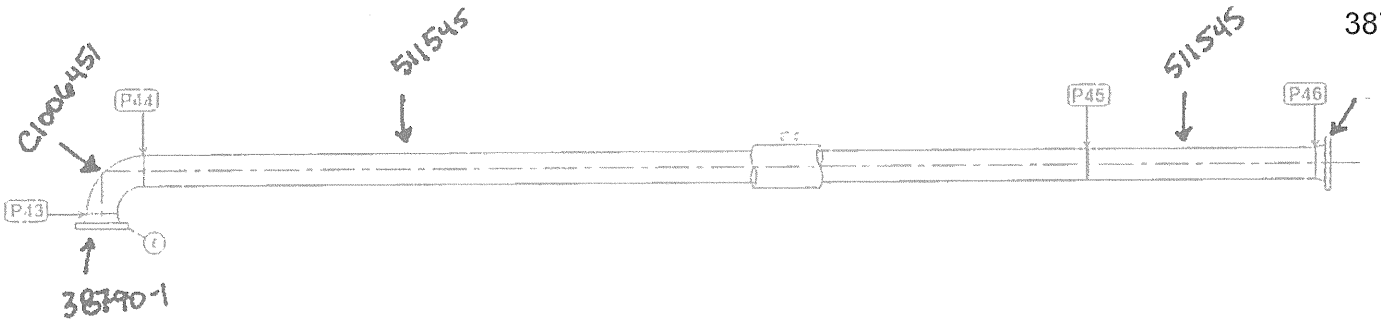


CURTIS KELLY, INC.	
HOUSTON, TEXAS	
42" I.D. x 60" I.D. x 98'-0" SEAM / SEAM DEMETHANIZER ITEM: T-501	
UOP RUSSELL LLC UOP JOB J-447	
SCALE	DATE
DRAWN	
CHECK	
APP'D	
P.O. No. 4500733113	
F&E No.	
DWG. NO. 2132	

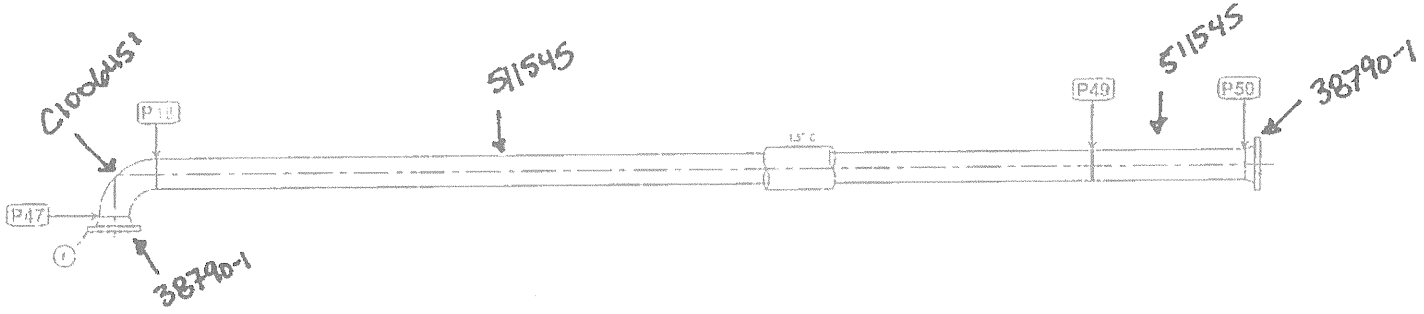


CURTIS KELLY, INC.		
HOUSTON, TEXAS		
DESCRIPTION: 42" I.D. x 60" I.D. x 98'-0" SEAM / SEAM DEMETHANIZER ITEM: T-501		
CUSTOMER: UOP RUSSELL LLC UOP JOB J-447		
SCALE	DATE	P.O. No. 4500720178
DRAWN		F.K.E. No.
CHECK		DWG. No. 2132
APPVD		

38790-1



DETAIL OF 9" DOWNCOMER
ONE (1) REQ'D @ NOZZLE N4 'L'



DETAIL OF 8" DOWNCOMER
ONE (1) REQ'D @ NOZZLE N4 'T'

CURTIS KELLY, INC.
HOUSTON, TEXAS

DESCRIPTION: 42" I.D. x 60" I.D. x 98'-0" SEAM / SEAM
DEMETHANIZER
ITEM: T-501

CUSTOMER: UOP RUSSELL LLC
UOP JOB J-447

SCALE N.T.S.	DATE	P.O. No. 4500726726
DRAWN		TKS No.
CHECK		DWG. No. 2132
APP'D		

CLIENTE / Customer / Client

SOUTHWEST STAINLESS, LP
PO BOX 951037
DALLAS, TEXAS 75395-1037

CERTIFICADO DE INSPECCION

Inspection Certificate - Certificat de Réception

DIN EN 10204 / 3.1
ISO 10474 / 3.1

FECHA: Date: 21/03/2016 14/12/2016

N.º No. 179000 Rev.02

HOJA: Page: 1

ISO 14001 SGI 1922164 · ISO 9001 SGI 6000236 · OHSAS 18001 SGI 6009987

ULMA FORJA, S.COOP.
Management Systems certified by LROAE

8º Zubillaga, 3 - Apdo. 14
20560 OÑATI (Gipuzkoa) SPAIN
Tel.: 34 - 943 780552
Fax: 34 - 943 781808
E-mail ulma@ulmapiping.com

Packing List: 123517

PRODUCTO / Article - Produit: FLANGES

SU PEDIDO N.º / Your Order No. / Votre Cde. N.º: 406539-00/HTON-SWS

DE / of. - de: 28/07/2015

Certified acc. PED 97/23/EC+AD2000-W0 by TÜV Rheinland N.º 01 202 E/Q 02 7443

NORMAS APLICABLES / Requirements - Normes Applicables: ASME B16.5-13

MARCA DEL FABRICANTE / Mark of factory / Marque du fabricant:

MATERIAL CORRESPONDIENTE / Material Correspondent - Qualité: ASME SA182F304/F304L-15, ASTM A182F304/F304L-14b

MODO DE FUSION (*) / Steel Making - Elaboration de l'acier: NACE MR0175/ISO15156-02/03-15 & MR0103-12

E = Elec. Y = Oxigeno básico

DEPARTAMENTO / Section / Département: QUALITY ASSURANCE

A09H5-2132-SA182-L-4

PARTIDA Item Poste	CANTIDAD Quantity Quantité	DESCRIPCION Description Description	OBSERVACIONES Remarks Observations (*)	COLADA N.º Heat No N.ºCoulée	RESISTENCIA T.Strength Resist Rupt N/mm2	LIMITE ELAST Y.Strength 0,2 % N/mm2	ALARGAM Elongation Allongement Lo:50mm/4d %	ESTRICCION Red Area Striction %	RESILIENCIA Impact test Résilience Joules	ENSAYO - TESTING CHARPY V 10x10mm MEDIA Average Moyenne	°C	DUREZA Hardness Dureté HBW
33	90	SO 4 150LB RF A182F304/F304L	HE	A20H5	540	267	50,80	71,10				163 166
34	30	SO 6 150LB RF A182F304/F304L	HE	A20H5	540	267	50,80	71,10				163 166
41	30	SW 1/2 150LB 80S RF A182F304/F304L	HE	A16H4	537	273	57,20	68,70				170 165
84	9	WN 5 150LB 40S RF A182F304/F304L	HE	A09H5	536	278	53,80	69,10				168 173
103	14	WN 10 300LB 40S RF A182F304/F304L	HE	A07H5	538	272	53,10	68,20				168 172
105	18	WN 2 300LB 80S RF A182F304/F304L	HE	A06H5	531	265	51,80	67,30				170 168
109	24	WN 4 300LB 10S RF A182F304/F304L	HE	A09H5	536	278	53,80	69,10				168 173
110	25	WN 4 300LB 40S RF A182F304/F304L	HE	A09H5	536	278	53,80	69,10				168 173

COMPOSICION QUIMICA - STEEL MAKER'S LADLE ANALYSIS - ANALYSE CHIMIQUE

COLADA N.º Heat No N.ºCoulée	C %	Si %	Mn %	P %	S %	Cr %	Ni %	N %	Origin of Steel
A06H5	0,024	0,347	1,359	0,026	0,024	18,200	8,035	0,0830	Spain
A07H5	0,025	0,320	1,480	0,035	0,028	18,220	8,130	0,0830	United Kingdom
A09H5	0,027	0,270	1,810	0,037	0,025	18,220	8,120	0,0820	United Kingdom
A16H4	0,022	0,370	1,520	0,039	0,022	18,080	8,010	0,0707	Spain
A20H5	0,025	0,260	1,850	0,035	0,022	18,230	8,040	0,0860	United Kingdom

- Las dimensiones y la condición superficial se hallaron satisfactorias.
- Dimension and surface condition were found acceptable.
- Les dimensions et états de surface sont satisfaisants.

- Los materiales citados cumplen las normas aplicables.
- Manufacturing requirements are satisfied.
- Les normes applicables sont respectées.

EL INSPECTOR
Works Inspector - L'Inspecteur

ULMA FORJA S. COOP.
Dpto. de Garantía de calidad
Quality Assurance Dept.

(*) OBSERVACIONES:
Remarks
Observations

PMI: 100% OF PIECES TESTED. NO WELD REPAIR. FLANGES WERE MANUFACTURED IN SPAIN.
MATERIAL FREE FROM CONTAMINATION BY MERCURY, LEAD, ZINC, RADIUM, ALPHA SOURCE AND OTHER LOW MELTING POINT ELEMENTS.
H_HEAT TREATMENT SOLUTION ANNEALED. HEATED AT 1060 C AND WATER QUENCHED.

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 01-16-2017
THE SPITZER COMPANIES

PO 2132-027

BOM#77-Dwn Cmr A & D

1/1

C1120852-2132-SA403-F-4 ELBOW

MATERIAL TEST & INSPECTION CERTIFICATE

SUNGKWANG BEND CO., LTD.(SKB)
26, Noksansandan 262-ro, Gangseo-Gu, Busan, Korea
TEL : 82-051-3300-450
FAX : 82-051-3300-335
http://www.skbend.com

CUSTOMER: SOUTHWEST STAINLESS, INC.
PROJECT NAME: N/A

According to
DIN EN 10204 3.1 / ISO 10474 3.1

PURCHASE ORDER NO.	324369-00	SPEC. FOR MATERIAL	ASTM/ASME A/SA403WP304/304L-W 12/13ED	CERTIFICATE NO.	QCLB2014100126
PJT NO.	N/A	SPEC. FOR INSPECTION	ASME B16.9	DATE OF ISSUE	2014.09.01
STARTING MATERIAL	E.F.W PIPE	SKB NO.	2014072307	VISUAL & DIMENSION	SATISFACTORY

NO.	SEQ/LINE/ITEM NO	DESCRIPTION	QTY	HEAT NO.	MFG ID NO.	MILL MAKER	POR/CODE/TAG NO
282		90D ELBOW(L) S40S 4" B.W WELD SUS	200	C1120852	C1120852	bnB Sungwon	
284		90D ELBOW(L) S40S 8" B.W WELD SUS	40	C1006451	C1006451	bnB Sungwon	

CHEMICAL COMPOSITION(%) (L : LADLE, P : PRODUCT)

STD. / HEAT NO.	SPEC.	C	Si	Mn	P	S	Ni	Cr	Mo	Cu	V	Nb	N	Al	B	Zr	Fe	Ti	C.E
	MIN						8.00	18.00											
	MAX	0.030	1.00	2.00	0.045	0.030	11.00	20.00											
C1006451	L	0.023	0.46	1.46	0.029	0.004	8.01	18.05											
	P																		
C1120852	L	0.024	0.43	1.41	0.030	0.002	8.06	18.10											
	P																		

TENSILE TEST

SPEC.	Y.S 0.2% offset KSI	T.S KSI	EL. %	R.A %
MIN	30.0	75.0	28.0	
MAX				
	45.9	91.5	56.0	
	43.4	92.1	53.0	

IMPACT TEST

HEAT NO.	TEST TEMP.	SIZE OF SPECIMEN(mm)		ABSORBED ENERGY STD./ VALUE			AVE.	LATERAL EXPANSION STD./ VALUE			AVE.	PERCENT SHEAR STD./ VALUE			AVE.
C1006451			B/M												
			H.A.Z												
			W/M												
C1120852			B/M												
			H.A.Z												
			W/M												

HARDNESS HRC		HEAT TREATMENT	SOLUTION TREATED. 1050°C, 20Min., 'Water'		
MIN					
MAX	22.0	PMI	N/A	N.D.E	N/A
HB	156	FLATTENING TEST	N/A	**MEMO	
		BENDING TEST	N/A		
		HYDROSTATIC TEST	N/A		
HB	152	CORROSION TEST	N/A		
		GRAIN SIZE TEST	N/A		
		HIC TEST	N/A		

MATERIAL MEETS THE REQUIREMENTS OF NACE MR0175
MERCURY FREE

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 01-13-2017
THE SPITZER COMPANIES

WE CERTIFY THIS MATERIAL HAS BEEN MANUFACTURED AND EXAMINED IN ACCORDANCE WITH ALL REQUIREMENTS OF THE SPECIFICATION AND THE RESULTS OF ALL EXAMINATION ARE ACCEPTABLE.

☐ REVIEWED BY
☐ WITNESSED BY : _____

QM DIV. SENIOR MANAGING DIRECTOR

SKE-8903

* 본 검사증명서에 명기된 규격용외 사용시 안전상 문제가 발생할 수 있으며, 검사증명서 위 변조시 사문서 위조(형법231조)로 불이익을 당하실 수 있습니다.

Bom # 80-Dwn(mr A & D)

po 2132-020

410597 CR 40 SB 403
LR 10 SB 1.4 f

C1118761-2132-SA403-F-4 x 3 REDUCER

MATERIAL TEST & INSPECTION CERTIFICATE

SUNGKWANG BEND CO., LTD.(SKB)
26, Noksansandan 262-ro, Gangseo-Gu, Busan, Korea
TEL : 82-051-3300-450
FAX : 82-051-3300-335
http://www.skbend.com

CUSTOMER: SOUTHWEST STAINLESS, INC.
PROJECT NAME: N/A

According to
DIN 50049 3.1 / EN 10204 3.1 / ISO 10474 3.1

PURCHASE ORDER NO.	410597-00	SPEC. FOR MATERIAL	ASTM/ASME A/SA403WP304/304L-W 12/13ED	CERTIFICATE NO.	QCLR2015110723
PJT NO.	N/A	SPEC. FOR INSPECTION	ASME B16.9	DATE OF ISSUE	2015.10.30
STARTING MATERIAL	E.F.W PIPE	SKB NO.	2015081817	VISUAL & DIMENSION	SATISFACTORY

NO.	SEQ/LINE/ITEM NO	DESCRIPTION					QTY	HEAT NO.	MFG ID NO.	MILL MAKER	POR/CODE/TAG NO
11		CON REDUCER	S40S*S40S	4"*3"	B.W WELD	SUS	200	C1118751	C1118751	bnB Sungwon	
12		90D ELBOW(L)	S10S	1"	B.W WELD	SUS	500	SE79670	SE79670	bnB Sungwon	

CHEMICAL COMPOSITION(%) (L : LADLE, P : PRODUCT)

STD. / HEAT NO.	SPEC.	C	Si	Mn	P	S	Ni	Cr	Mo	Cu	V	Nb	N	Al	B	Zr	Fe	Ti	C.E
	MIN						8.00	18.00											
	MAX	0.030	1.00	2.00	0.045	0.030	11.00	20.00											
C1118751	L	0.021	0.34	1.47	0.031	0.003	8.08	18.09											
	P																		
SE79670	L	0.029	0.34	1.45	0.029	0.005	8.07	18.19											
	P																		

TENSILE TEST

SPEC.	Y.S 0.2% offset KSI	T.S KSI	EL. %	R.A %
MIN	30.0	75.0	28.0	
MAX				
	41.9	86.9	56.0	
	42.1	89.0	54.0	

IMPACT TEST / HEAT NO.	TEST TEMP.	SIZE OF SPECIMEN(mm)		ABSORBED ENERGY STD. / VALUE			AVE.	LATERAL EXPANSION STD. / VALUE			AVE.	PERCENT SHEAR STD. / VALUE			AVE.
C1118751			B/M												
			H.A.Z												
			W/M												
SE79670			B/M												
			H.A.Z												
			W/M												

HARDNESS HRC		HEAT TREATMENT	*SOLUTION TREATED. 1060°C, 20Min., *Water*		
MIN					
MAX	22.0	PMI	N/A	N.D.E	N/A
HB	156	FLATTENING TEST	N/A	*MEMO	
		BENDING TEST	N/A		
		HYDROSTATIC TEST	N/A		
HB	151	CORROSION TEST	N/A		
		GRAIN SIZE TEST	N/A		
		HIC TEST	N/A		

MATERIAL MEETS THE REQUIREMENTS OF NACE MR0175
MERCURY FREE

Chemical & Physical Tests
Reviewed and Accepted
By KR Date 01-13-2017
THE SPITZER COMPANIES

WE CERTIFY THIS MATERIAL HAS BEEN MANUFACTURED AND EXAMINED IN ACCORDANCE WITH ALL REQUIREMENTS OF THE SPECIFICATION AND THE RESULTS OF ALL EXAMINATION ARE ACCEPTABLE.

□ REVIEWED BY :
□ WITNESSED BY : _____

CHIEF QUALITY OFFICER

SKE-8903

*본 검사증명서에 명기된 규격용의 사용시 안전상 문제가 발생할 수 있으며, 검사증명서 위.변조시 사문서 위조(형법231조)로 불이익을 당하실 수 있습니다.

Bom#81: DwnCmr A

po 2132-020

1/1

W4K6-2132-SA312-S-3

BRISMET
BRISTOL METALS, LLC

RM ID NUMBER
40418
SALES ORDER / RLS
20160577300
CERT ID / REV
3931

MILL TEST REPORT

SOLD TO:
ROLLED ALLOYS
6555 SOUTH 57TH WEST AVENUE
TULSA, OK 74131

CUSTOMER P.O.	CUSTOMER PART	HEAT NO.
0140387TUL		W4K6..

DESCRIPTION: 3300300040304312010
3" WELDED PIPE SCHED 40S TP304/TP304L (UNS# S30400/S30403) A312

CERTIFICATION REQUIREMENTS

ENGINEERING
ASTM A312-16 ASME SA312-15

HYDRO PRESSURE
1900 PSI

HEAT TREAT
Annealed at 1900 - 2000 Deg F. and water quenched to below 800 Deg. F. in less than 3 minutes.

Chemical		Mechanical	
Test	Result	Test	Result
Carbon	.0188	Tensile	91520
Manganese	1.751	Yield	46660
Phosphorus	.0335	Elongation	48.17
Sulfur	.0104	Hardness RB	85
Silicon	.352		
Nickel	8.018	Tension	Pass
Chromium	18.053	TG Face Bend	Pass
Molybdenum	.365		
Nitrogen	.0785		
Country of Origin	USA		

This report shall not be altered or reproduced, except in full, without the prior written approval of Bristol Metals LLC. This test report represents the actual attributes of the items furnished and all items were manufactured, sampled, inspected, and tested in full compliance with applicable specifications and your purchase order.
Certification is in accordance with EN10204:2004 type 3.1.
Chemical content is % by weight. Mechanical test results are in English units (inches and pounds).
No weld repairs have been performed on the base material.
Hardness in accordance with NACE MR0175/ISO 15156-3:2009 and MR0103-2012 and material is free of cold work to enhance mechanical properties.
Pipe is Pickled and Passivated in accordance with ASTM A380.
Bristol Metals has a Quality Management System in place that is in compliance with ISO 9001:2008.
In compliance with Pressure Equipment Directive (PED) 97/23/EC as Category 1 material unless otherwise stated.
Bristol Metals does not add mercury or radioactive materials during any manufacturing process.
NAFTA country of origin: USA. Pipe/Tube Manufactured in the USA. Raw Material Melt Source: USA
FAR BAA - Complies, DFARS BAA -Complies, FAR TAA – Complies.
Pipe/Tube has been double welded using an EFW process.
QF-576

Date Printed: 08/24/2016

ROLLED ALLOYS
Receiving Inspection
By: I
Date: 8/30/16

HEAT # W4K6
TRACER # 0487243US

po 2132-029

Bill # 82: Dun Cmr Nbz A

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 01-17-2017
THE SPITZER COMPANIES

1/1

C0309751-2132-SA403-F-3 ELBOW

MATERIAL TEST & INSPECTION CERTIFICATE

SUNGKWANG BEND CO., LTD.(SKB)
26, Noksansandan 262-ro, Gangseo-Gu, Busan, Korea
TEL : 82-051-3300-450
FAX : 82-051-3300-335
http://www.skbend.com

CUSTOMER: SOUTHWEST STAINLESS, INC.
PROJECT NAME: N/A

According to
DIN 50049 3.1 / EN 10204 3.1 / ISO 10474 3.1

PURCHASE ORDER NO.	355361-00	SPEC. FOR MATERIAL	ASTM/ASME A/SA403WP304/304L-W 13a/13ED	CERTIFICATE NO.	QCLH2015020696
PJT NO.	N/A	SPEC. FOR INSPECTION	ASME B16.9	DATE OF ISSUE	2015.01.28
STARTING MATERIAL	E.F.W PIPE	SKB NO.	2014112805	VISUAL & DIMENSION	SATISFACTORY

NO.	SEQ/LINE/ITEM NO	DESCRIPTION				QTY	HEAT NO.	MFG ID NO.	POR/CODE/TAG NO
20		45D ELBOW(L)	S40S	3"	B.W WELD SUS	50	C0309751	C0309751	20
21		45D ELBOW(L)	S40S	4"	B.W WELD SUS	50	C0408051	C0408051	21

CHEMICAL COMPOSITION(%) (L : LADLE, P : PRODUCT)

STD. / HEAT NO.	SPEC.	C	Si	Mn	P	S	Ni	Cr	Mo	Cu	V	Nb	N	Al	B	Zr	Fe	Ti	C.E
	MIN						8.00	18.00											
	MAX	0.030	1.00	2.00	0.045	0.030	11.00	20.00											
C0309751	L	0.024	0.40	1.44	0.026	0.004	8.06	18.14											
	P																		
C0408051	L	0.021	0.35	1.44	0.026	0.003	8.03	18.20											
	P																		

TENSILE TEST

SPEC.	Y.S 0.2% offset KSI	T.S KSI	EL. %	R.A %
MIN	30.0	75.0	28.0	
MAX				
	43.5	83.6	52.0	
	40.8	89.6	59.0	

IMPACT TEST / HEAT NO.	TEST TEMP.	SIZE OF SPECIMEN(mm)		ABSORBED ENERGY STD. / VALUE			AVE.	LATERAL EXPANSION STD. / VALUE			AVE.	PERCENT SHEAR STD. / VALUE			AVE.
C0309751			BIM												
			H.A.Z												
			WIM												
C0408051			BIM												
			H.A.Z												
			WIM												

HARDNESS HRC		HEAT TREATMENT	SOLUTION TREATED, 1060°C, 20Min., "Water"		
MIN					
MAX	22.0	PMI	N/A	N.D.E	N/A
HB	153	FLATTENING TEST	N/A	**MEMO	
		BENDING TEST	N/A		
		HYDROSTATIC TEST	N/A		
HB	159	CORROSION TEST	N/A		
		GRAIN SIZE TEST	N/A		
		HIC TEST	N/A		

MATERIAL MEETS THE REQUIREMENTS OF NACE MR0175
MERCURY FREE

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 01-13-2017
THE SPITZER COMPANIES

WE CERTIFY THIS MATERIAL HAS BEEN MANUFACTURED AND EXAMINED IN ACCORDANCE WITH ALL REQUIREMENTS OF THE SPECIFICATION AND THE RESULTS OF ALL EXAMINATION ARE ACCEPTABLE.

□ REVIEWED BY
□ WITNESSED BY : _____

CHIEF QUALITY OFFICER

SKE-8903

* 본 검사증명서에 명기된 규격용외 사용시 안전상 문제가 발생할 수 있으며, 검사증명서 위 변조시 사문서 위조(형법231조)로 불이익을 당하실 수 있습니다.

PO 2132-020

BOM#83 ; Pwn Cmr A

254326-2132-SA182-L-3

METALFAR PRODOTTI INDUSTRIALI SPA A01
23861 CESANA BRIANZA (LC) - ITALY
VIA G. PARINI, 28
PHONE + 39 031 655441 - FAX +39 031 655149
certificate@metalfaritaly.com

COMPANY WITH MANAGEMENT SYSTEM CERTIFIED BY DNV = ISO 9001 = = ISO 14001 =

INSPECTION CERTIFICATE EN 10204:2004 / 3.1 A02

Nr A03 2015-C_MFF-04155 Data / Dated 03.10.2015 Z02

ITEX PIPING PRODUCTS LLC A06
13411 WEST ROAD
77041 HOUSTON, TEXAS US

Ordine / PO	I-417027-00/SWS	A07
Item	021	
DDT / Delivery note	2015-3E301-0003593	
Packing List	2015-3E401-0003170	
Fattura / Invoice	2015-3E401-0003170	A08
Ns. rif. / Our ref.	2015-3E201-0002405-0021	

Dest. ITEX c/o SOUTHWEST STAINLESS & ALLOY A05
HOUSTON SWS-8505 MONROE BLVD
77061 HOUSTON, TEXAS US

Cod. colata B07 / Heat Code	Nr. colata B07 / Heat Nr	Quantità B08 / Quantity	Descrizione / Description B01 - (B09 - B11)
	254326	100,00	W/N 300 RF 3" 40S F304/L

Mat. in acc. a / Mat. in acc. to B02
ASTM A 182/A 182M - 15 ASME SA 182/SA 182M-E13 ASME CODE SECT. II, PART A, ED. 2013
ASTM A182 F304/F304L
NACE MR-0175/2009 ISO 15156
NACE MR-0103/2012
Q.A.S.IN ACCORD.WITH PRESS.EQUIPM.DIRECT.97/23/EC(PED) ANNEX I,PARAGRAPH 4.3
CERT.4687-2014-CE-ITA-ACCREDIA

Ann. mat. / Mat. remarks B02
INTERGRANULAR CORROSION TEST ACCORDING TO ASTM A262 PRACTICE "E"
P.M.I. 100% PERFORMED AND SATISFACTORY

Elementi / Elements (C71 - C92)	C	Si	Mn	S	P	Cr	Ni	Mo	Ti	Cu	V	Nb	N
LADLE ANALYSIS	0,024	0,490	1,840	0,026	0,025	18,100	8,320	0,000	0,000	0,000	0,000	0,000	0,046
	Al								CE LF	CE SF	F1	F2	PREN
LADLE ANALYSIS	0,000								--	--	--	--	--

Provetta / Test specimen Sez/Sect mm2	L. mm	Forma C10 / Shape 1=O - 2=□	°C C03	Snervamento>0,2% C11 / Yield Strength>0,2% MPa	Snervamento>1,0% C11 / Yield Strength>1,0% MPa	Rottura C12 / Tensile MPa	Allungamento C13 / Elongation %	Contrazione C15 / Reduction of area %
126,60	50,80	1	20	279,0	--	586,0	56,0	74,0

DUREZZA / HARDNESS C22

HBW	Tipo/Type C40	Provetta / Test Specimen	RESILIENZA / IMPACT TEST °C C03	1-Joule C42	2-Joule C42	3-Joule C42	Media/Average C43
168,0 - 174,0	KV	10x10 mm	20	174	162	166	167,3

Tratt. Term. / Heat treatment C70	SOLUTION TREAT AT 1050 °C - QUENCHED IN WATER	ELECTRIC FURNACE
Dim in acc. a / Dim. acc. to B14	ASME/ANSI B16.5 -2013 ASME/ANSI B36.10M -2015	
Finitura / Roughness	125/250 MICROINCH AARH	

Marcatura in acc. B06 / Marking in acc. to	MSS SP25 Ed. 2013	Vis. & Dim.	SATISFACTORY	Origine / Origin of Steel	GERMANY

Note / Notes
100% MANUFACTURED IN ITALY
MANUFACTURING IN ACCORDANCE WITH ORDER AND SPECIFICATION

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 01-16-2017
THE SPITZER COMPANIES

po2132-027

BOM #115-Dwn Cmr A
BOM #84-Dwn Cmr A

UFFICIO CONTROLLO QUALITA' / QUALITY CONTROL DEPARTMENT A05	ENTE UFFICIALE DI COLLAUDO / INSPECTION AUTHORITY Z03	MARCHIO PRODUZIONE / MANUFACTURER'S SYMBOL A04

1/1

98976-1-2132-SA182-L-10

BEBITZ

Bereich Flansche / Flange Division

Flanschenwerk Bebitz GmbH-Lebendorfer Str.1-06420 Bebitz/GERMANY (A01) Tel. +49 34691 40 0-Fax +49 3469140 329-Email: flanges@bebitz.de
Bebitz Flanges Works Pvt. Ltd.-Survey No. 140/2, Saravali Boisar - Taluka Palghar - Thane 401501 Maharashtra, INDIA - Email: quality@bebitz.in
Bebitz U.S.A., INC. 100 Quentin Roosevelt BLVD-Garden City, NY11530/USA Tel. +1-516-2808380-Fax +1-516-2808382-Email: bebitzusa@bebitz.de

Abnahmeprüfzeugnis 3.1 / Inspection certificate 3.1 / Certificat de reception 3.1

nach (A02) / acc. DIN EN 10204 : 2005 Nr. (A03) / No. 15-21831 **Datum (Z02) / Date** 24.08.2015

Zeichen des Herstellers (A04) / Manufacturer's brand: [B]

Stempel des Abnehmers (Z03) / Stamp of the testing engineer: TKO B

Überprüft als Hersteller nach AD-Merkblatt W0 / TRD100 und VdTÜV Werkstoffblätter 350/3, 354, 399. / Approved as manufacturer acc. AD-Merkblatt W0 / TRD100 and VdTÜV Material Sheets 350/3, 354, 399.
Zertifiziert nach DGR 97/23/EG durch TÜV CERT Zertifzierungsst. für Druckgeräte der TÜV NORD GmbH Co KG, Benannte Stelle Nr. 0045. / Certified acc. to PED 97/23/EC, certifying body for pressure equipment TÜV NORD GmbH Co KG, registration no. 0045.

Besteller (A06) / Customer: TEXAS PIPE & SUPPLY Co.
2330 Holmes Road
HOUSTON, TX 77051

Bestell-Nr (A07) / Order-No. 152560-00
Auftrag (A08) / Order 3521881
Lieferschein / Delivery No. 3533966
Position (B07.1) / Item 45FB

Stck (B08) / Quantity	Bezeichnung (B01; B09 - B11) / Product	Schmelze/Prüflos (B07) / Heat no./Test no.
10	10 inch Welding Neck Flange 300 lbs S40s raised face	98976/1

Material (B02; B05): F 304/F 304L - ASTM A 182M-13a / ASME SA-182M
solution annealed > 1040 °C and quenched in water

Anford. (B03) Requirements: ASME B 16.5-2013
NACE MR0175-2011 / MR0103-2010 - DIN EN ISO 15156-2:2009
2013 ASME Boiler & Pressure Vessel Code - Section II Part A
PMI-tested 100%, IC-test acc. to DIN EN ISO 3651-2 Test A / ASTM A 262 practice E

Schmelzenanalyse (C71 - C92) / Ladle analysis — **Erschmelzung (C70) / Melting process** E+AOD

C	Si	Mn	P	S	Cr	Ni	Ti	Mo	Nb	V	N	Cu	Al	PREN
0,018	0,50	1,06	0,033	0,023	18,05	8,08					0,072			19,20

$$CEV = C + \frac{Mn}{6} + \frac{V + Mo + Cr}{5} + \frac{Ni + Cu}{15} \qquad PREN = Cr + 3{,}3 \times Mo + 16 \times N$$

Mechanische Prüfungen / Mechanical tests

Probenlage (C02): T / Position of Specimen: T
Zugversuch / Tensile Test - ASTM A 370

Temp (C03) °C	Streckgrenze (C11) / Yield 0,2% MPa (N/mm²)	Streckgrenze (C11) / Yield 1,0% MPa (N/mm²)	Zugfestigkeit (C12) Tensile MPa (N/mm²)	Dehnung (C13) Elongation %		Einschnürg. Red. of area %
20	min 205 max		515	30,0 5d_0	4d_0	50
20	300	339	575	59,8	74,7	70

Kerbschlagbiegeversuch / Impact test DIN EN ISO 148-1 (V-Kerb / V-notch)

Temp. (C03) °C	Einzelwerte (C42) Single values J			MW (C43) Average J
20				
20	170	174	178	174,0

Härte (C32) Hardness ISO 6506-1 HBW 2,5/187,5: 159

Country of Origin: Germany

Chemical & Physical Tests Reviewed and Accepted
By RR Date 01-16-2017
THE SPITZER COMPANIES

Am Material wurden keine Reparaturschweißungen vorgenommen. / No welding repair on the material.
Material ist nicht radioaktiv oder mit Quecksilber kontaminiert. / Material is free from radioactive or mercury contamination.
Sicht- und Maßprüfungen ohne Beanstandungen. (D01) / Visual and dimensional examinations without objections.
Die Anforderungen der Bestellung sind erfüllt. / The product meets the requirements of the order specifications.
Die Angaben in Klammern entsprechen den Vorgaben der DIN EN 10168 / Data in parentheses refer to DIN EN 10168.
APZ ist mit EDV erstellt und ohne Unterschrift gültig. / MTR was electronically generated and is valid without a signature.

R. Sparing
Abnahmebeauftragter des Herstellers (Z02) / Inspection Representative of the Manufacturer

Po 2132-027
Bom#85 - Dun Cmr B
Bom#87 - Dun Cmr C & B
Bom#116 - Dun Cmr B

1/1

C0804351-2132-SA403-F-10 ELBOW

MATERIAL TEST & INSPECTION CERTIFICATE

SUNGKWANG BEND CO., LTD.(SKB)
1720, Songjeong-Dong, Gangseo-Ku, Busan, Korea
TEL : 82-051-3300-450
FAX : 82-051-3300-335
http://www.skbend.com

CUSTOMER: SOUTHWEST STAINLESS, INC.
PROJECT NAME: N/A

According to
DIN 50049 3.1 / EN 10204 3.1 / ISO 10474 3.1

PURCHASE ORDER NO.	75070	SPEC. FOR MATERIAL	ASTM/ASME A/SA403/WP304/304L-W 07/07ED	CERTIFICATE NO.	QCLA2012030768
PJT NO.	N/A	SPEC. FOR INSPECTION	ASME B16.9	DATE OF ISSUE	2012.02.24
STARTING MATERIAL	E.F.W PIPE	SKB NO.	2011053021	VISUAL & DIMENSION	SATISFACTORY

NO.	SEQ/LINE/ITEM NO	DESCRIPTION	QTY	HEAT NO.	MFG ID NO.	POR/CODE/TAG NO
192		90D ELBOW(L) S10S 8" B.W WELD SUS	2	SC33297	SC33297	
203		90D.ELBOW(L) S40S 10" B.W WELD SUS	2	C0804351	C0804351	

CHEMICAL COMPOSITION(%) (L : LADLE, P : PRODUCT)

STD. / HEAT NO.	SPEC.	C	Si	Mn	P	S	Ni	Cr	Mo	Cu	V	Nb	N	Al	B	Zr	Fe	Ti	C.E
	MIN						8.00	18.00											
	MAX	0.030	1.00	2.00	0.045	0.030	11.00	20.00											
C0804351	L	0.024	0.30	1.84	0.028	0.001	8.10	18.32											
	P																		
SC33297	L	0.020	0.37	1.45	0.029	0.005	8.08	18.15											
	P																		

TENSILE TEST

SPEC.	Y.S 0.2% offset	T.S	EL.	R.A
	KSI	KSI	%	%
MIN	30.0	75.0	28.0	
MAX				
	39.2	87.5	54.0	
	44.2	82.5	54.0	

IMPACT TEST / HEAT NO.	TEST TEMP.	SIZE OF SPECIMEN(mm)		ABSORBED ENERGY STD./ VALUE			AVE.	LATERAL EXPANSION STD./ VALUE			AVE.	PERCENT SHEAR STD./ VALUE			AVE.
SC33297			B/M												
			H.A.Z												
			W/M												
C0804351			B/M												
			H.A.Z												
			W/M												

HARDNESS HRC	MIN	MAX
		22.0
HB	156	
HB	158	

HEAT TREATMENT	SOLUTION TREATED, 1060℃, 20Min., "Water"		
PWHT	N/A	N.D.E	N/A
FLATTENING TEST	N/A	**MEMO	
BENDING TEST	N/A		
HYDROSTATIC TEST	N/A		
CORROSION TEST	N/A		
GRAIN SIZE TEST	N/A		
HIC TEST	N/A		

MATERIAL MEETS THE REQUIREMENTS OF NACE MR0175

WE CERTIFY THIS MATERIAL HAS BEEN MANUFACTURED AND EXAMINED IN ACCORDANCE WITH ALL REQUIREMENTS OF THE SPECIFICATION AND THE RESULTS OF ALL EXAMINATION ARE ACCEPTABLE.

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 01-13-2017
THE SPITZER COMPANIES

□ REVIEWED BY
□ WITNESSED BY : _____

QM DIV. SENIOR MANAGING DIRECTOR

po 2132-020

Box #64 - Dwn Cmr B

510783-2132-SA312-S-10

outokumpu
high performance stainless steel

****
* CERTIFICATION *
****

Page: 1

10/06/16
HEAT 510783 ORDER 0030985/006 B00025686

HEAT # 510783
TRACER # 0490293US

SHIP TO:
ROLLED ALLOYS-TULSA
6555 S. 57TH W. AVENUE
918-594-2621
TULSA OK 74131

ROLLED ALLOYS
Receiving Inspection
By:
Date: 1/13/16

---------- YOUR ORDER & DATE ----------
0141486-TU 10/06/16 CUST# ROLALL01

---------- ITEM DESCRIPTION ----------
10" SCH40S TP304/TP304L A312
Country of Melt : USA
Country of Mfg. : USA

---------- SPECIFICATIONS ----------
ASTM A312-16A/ASME SA312-15 WELDED
PIPING COMPONENTS SUPPLIED TO: FAR BAA _X_ COMPLIES
DFARS BAA _X_ COMPLIES FAR TAA _X_ COMPLIES
Certificate in conformance with EN10204-95 3.1.B / EN10204-2004 3.1

---------- MECHANICAL & OTHER TESTS ----------
Tensile strength,KSI (MPa) 89.5 (617)
Yield strength,KSI (MPa) 51.1 (352)
Elongation % in 2 50.0
Guided Bend Face OK
Bend Test
Hydrotest PSI (MPa) 1100 (7.58)
NACE MR0175/ISO 15156:15 NACE MR0103-15
HRB-88

---------- CHEMICAL COMPOSITION ----------

Carbon	(C)	.026	Manganese	(Mn)	1.790
Phosphorus	(P)	.029	Sulphur	(S)	.013
Silicon	(Si)	.013	Chromium	(Cr)	18.110
Nickel	(Ni)	8.040	Moly	(Mo)	.360
Nitrogen	(N)	.067			

CAUTION: Processing that produces fumes and dust may cause respiratory disease: Especially alloys containing Chromium and Nickel.

CERTIFICATION: We certify that the analysis figures are correct as contained in the records of the company and that the material is free of known mercury, asbestos, and low melting alloy contamination. No weld repair unless otherwise noted.

HEAT TREATMENT & PICKLING: Solution annealed at a range 1900F-2000F and water quenched to below 800F within 3 minutes. Descaled, pickled, and passivated.

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes.

We hereby certify that the chemical analysis and/or test results shown in this report are correct as contained in the records of the company.

Quality Representative

Martha James
Martha James

Outokumpu Stainless Pipe, Inc.
ADDRESS
241 W Clarke Street
Wildwood, Florida 34785-9601
TELEPHONE
(352) 748-1313
TELEFAX
Administration: (352) 748-2751
Purchasing: (352) 748-6576
Production Control: (352) 748-0533
Quality Assurance: (352) 748-0533

Board 65, Run Cmr No2 B

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 01-17-2017
THE SPITZER COMPANIES

po 2132-029

1/1

Y4H6-2132-SA312-S-10

BRISMET
BRISTOL METALS, LLC

RM ID NUMBER
31730
SALES ORDER / RLS
20160577300
CERT ID / REV
3929

MILL TEST REPORT

SOLD TO:
ROLLED ALLOYS
6555 SOUTH 57TH WEST AVENUE
TULSA, OK 74131

CUSTOMER P.O.	CUSTOMER PART	HEAT NO.
0140387TUL		Y4H6

DESCRIPTION: 3301000040304312010
10" WELDED PIPE SCHED 40S TP304/TP304L (UNS# S30400/S30403) A312

CERTIFICATION REQUIREMENTS

ENGINEERING
ASTM A312-16 ASME SA312-15

HYDRO PRESSURE
1000 PSI

HEAT TREAT
Annealed at 1900 - 2000 Deg F. and water quenched to below 800 Deg. F. in less than 3 minutes.

Chemical		Mechanical	
Test	Result	Test	Result
Carbon	.0193	Tensile	92290
Manganese	1.8105	Yield	51270
Phosphorus	.036	Elongation	51.54
Sulfur	.011	Hardness RB	88.5
Silicon	.2645		
Nickel	8.02	Tension	Pass
Chromium	18.1545	TG Face Bend	Pass
Molybdenum	.271		
Nitrogen	.0754		
Country of Origin	USA		

This report shall not be altered or reproduced, except in full, without the prior written approval of Bristol Metals LLC. This test report represents the actual attributes of the items furnished and all items were manufactured, sampled, inspected, and tested in full compliance with applicable specifications and your purchase order.
Certification is in accordance with EN10204:2004 type 3.1.
Chemical content is % by weight. Mechanical test results are in English units (inches and pounds).
No weld repairs have been performed on the base material.
Hardness in accordance with NACE MR0175/ISO 15156-3:2009 and MR0103-2012 and material is free of cold work to enhance mechanical properties.
Pipe is Pickled and Passivated in accordance with ASTM A380.
Bristol Metals has a Quality Management System in place that is in compliance with ISO 9001:2008.
In compliance with Pressure Equipment Directive (PED) 97/23/EC as Category 1 material unless otherwise stated.
Bristol Metals does not add mercury or radioactive materials during any manufacturing process.
NAFTA country of origin: USA. Pipe/Tube Manufactured in the USA. Raw Material Melt Source: USA
FAR BAA - Complies, DFARS BAA -Complies, FAR TAA – Complies.
Pipe/Tube has been double welded using an EFW process.
QF-576

Date Printed: 08/24/2016

Jean R. Bernhardt

ROLLED ALLOYS
Receiving Inspection
By:
Date: 8/30/16

HEAT # Y4H6
TRACER 0487242US

Chemical & Physical Tests
Reviewed and Accepted
By KR Date 01-17-2017
THE SPITZER COMPANIES

po 2132-029

BOM #65: Dwn Cmr Noz B & Noz C

1/1

C0703051-2132-SA403-F-10 ELBOW

MATERIAL TEST & INSPECTION CERTIFICATE

SUNGKWANG BEND CO., LTD.(SKB)
26, Noksansandan 262-ro, Gangseo-Gu, Busan, Korea
TEL : 82-051-3300-450
FAX : 82-051-3300-335
http://www.skbend.com

CUSTOMER: SOUTHWEST STAINLESS, INC.
PROJECT NAME: N/A

According to
DIN EN 10204 3.1 / ISO 10474 3.1

PURCHASE ORDER NO.	324369-00	SPEC. FOR MATERIAL	ASTM/ASME A/SA403WP304/304L-W'12/13ED	CERTIFICATE NO.	QCLB2014100125
PJT NO.	N/A	SPEC. FOR INSPECTION	ASME B16.9	DATE OF ISSUE	2014.09.01
STARTING MATERIAL	E.F.W PIPE	SKB NO.	2014072307	VISUAL & DIMENSION	SATISFACTORY

NO.	SEQ/LINE/ITEM NO	DESCRIPTION	QTY	HEAT NO.	MFG ID NO.	MILL MAKER	POR/CODE/TAG NO
8		45D ELBOW(L) S10S 8" B.W WELD SUS	350	C0807952	C0807952	bnB Sungwon	
20		45D ELBOW(L) S40S 10" B.W WELD SUS	35	C0703051	C0703051	SUNGWON PIPE	

CHEMICAL COMPOSITION(%) (L : LADLE, P : PRODUCT)

STD. / HEAT NO.	SPEC.	C	Si	Mn	P	S	Ni	Cr	Mo	Cu	V	Nb	N	Al	B	Zr	Fe	Ti	C.E
	MIN						8.00	18.00											
	MAX	0.030	1.00	2.00	0.045	0.030	11.00	20.00											
C0703051	L	0.025	0.39	1.45	0.032	0.001	8.02	18.07											
	P																		
C0807952	L	0.017	0.36	1.40	0.033	0.003	8.04	18.13											
	P																		

TENSILE TEST

SPEC.	Y.S 0.2% offset KSI	T.S KSI	EL. %	R.A %
MIN	30.0	75.0	25.0	
MAX				
	46.8	87.5	52.0	
	41.3	80.6	57.0	

IMPACT TEST / HEAT NO.	TEST TEMP.	SIZE OF SPECIMEN(mm)		ABSORBED ENERGY STD./ VALUE			AVE.	LATERAL EXPANSION STD./ VALUE			AVE.	PERCENT SHEAR STD./ VALUE			AVE.
C0703051			B/M												
			H.A.Z												
			W/M												
C0807952			B/M												
			H.A.Z												
			W/M												

HARDNESS HRC		HEAT TREATMENT	SOLUTION TREATED. 1060°C, 20Min., 'Water'		
MIN					
MAX	22.0	PMI	N/A	N.D.E	N/A
HB	155	PLATTENING TEST	N/A	**MEMO	
		BENDING TEST	N/A		
		HYDROSTATIC TEST	N/A		
HB	156	CORROSION TEST	N/A		
		GRAIN SIZE TEST	N/A		
		HIC TEST	N/A		

MATERIAL MEETS THE REQUIREMENTS OF NACE MR0175
MERCURY FREE

Chemical & Physical Passed
Reviewed and Accepted
By RR Date 01-13-2017
THE SPITZER COMPANIES

WE CERTIFY THIS MATERIAL HAS BEEN MANUFACTURED AND EXAMINED IN ACCORDANCE WITH ALL REQUIREMENTS OF THE SPECIFICATION AND THE RESULTS OF ALL EXAMINATION ARE ACCEPTABLE.

☐ REVIEWED BY
☐ WITNESSED BY : _____

QM DIV. SENIOR MANAGING DIRECTOR

SKE-8003

*본 검사증명서에 명기된 규격용외 사용시 안전상 문제가 발생할 수 있으며, 검사증명서 위 변조시 사문서 위조(형법231조)로 불이익을 당하실 수 있습니다.

PO 2132-020

BOM#66-Dwg G, P, Rev C, No. C

1/1

97723-1-2132-SA182-L-10

BEBITZ

Bereich Flansche / Flange Division

Flanschenwerk Bebitz GmbH-Lebendorfer Str.1-06420 Bebitz/GERMANY (A01) Tel. +49 34691 40 0-Fax +49 3469140 329-Email: flanges@bebitz.de
Bebitz Flanges Works Pvt. Ltd.-Survey No. 140/2, Saravali Boisar - Taluka Palghar - Thane 401501 Maharashtra, INDIA - Email: quality@bebitz.in
Bebitz U.S.A., INC. 100 Quentin Roosevelt BLVD-Garden City, NY11530/USA Tel. +1-516-2808380-Fax +1-516-2808382-Email: bebitzusa@bebitz.de

Abnahmeprüfzeugnis 3.1 / Inspection certificate 3.1 / Certificat de reception 3.1

nach (A02) / acc. DIN EN 10204 : 2005 Nr. (A03) / No. 15-13288 Datum (Z02) / Date 19.05.2015

Zeichen des Herstellers (A04) / Manufacturer's brand: [B]

Stempel des Abnehmers (Z03) / Stamp of the testing engineer: TKO B

Überprüft als Hersteller nach AD-Merkblatt W0 / TRD100 und VdTÜV Werkstoffblätter 350/3, 354, 399. / Approved as manufacturer acc. AD-Merkblatt W0 / TRD100 and VdTÜV Material Sheets 350/3, 354, 399.
Zertifiziert nach DGR 97/23/EG durch TÜV CERT Zertifzierungsst. für Druckgeräte der TÜV NORD GmbH Co KG, Benannte Stelle Nr. 0045. / Certified acc. to PED 97/23/EC, certifying body for pressure equipment TÜV NORD GmbH Co KG, registration no. 0045.

Besteller (A06) / Customer: TEXAS PIPE & SUPPLY Co.
2330 Holmes Road
HOUSTON, TX 77051

Bestell-Nr (A07) / Order-No. 145639-00
Auftrag (A08) / Order 3423012
Lieferschein / Delivery No. 3532312
Position (B07.1) / Item 55FB

Stck (B08) / Quantity	Bezeichnung (B01; B09 - B11) / Product	Schmelze/Prüflos (B07) / Heat no./Test no.
7	10 inch Welding Neck Flange 300 lbs S40s raised face	97723/1

Material (B02; B05): F 304/F 304L - ASTM A 182M-13a / ASME SA-182M
solution annealed > 1040 °C and quenched in water

Anford. (B03) Requirements:
ASME B 16.5-2013
NACE MR0175-2011 / MR0103-2010 - DIN EN ISO 15156-2:2009
2013 ASME Boiler & Pressure Vessel Code - Section II Part A
PMI-tested 100%, IC-test acc. to DIN EN ISO 3651-2 Test A / ASTM A 262 practice E

Schmelzenanalyse (C71 - C92) / Ladle analysis **Erschmelzung (C70) / Melting process** E+AOD

C	Si	Mn	P	S	Cr	Ni	Ti	Mo	Nb	V	N	Cu	Al	PREN
0,023	0,41	1,11	0,036	0,012	18,28	8,07					0,082			19,59

$$CEV = C + \frac{Mn}{6} + \frac{V + Mo + Cr}{5} + \frac{Ni + Cu}{15} \qquad PREN = Cr + 3{,}3 \times Mo + 16 \times N$$

Mechanische Prüfungen / Mechanical tests

Probenlage (C02): T / Position of Specimen: T Zugversuch / Tensile Test - ASTM A 370						Kerbschlagbiegeversuch / Impact test DIN EN ISO 148-1 (V-Kerb / V-notch)			Härte (C32) Hardness ISO 6506-1
Temp (C03) °C	Streckgrenze (C11) / Yield 0,2% MPa (N/mm²)	1,0% MPa (N/mm²)	Zugfestigkeit (C12) Tensile MPa (N/mm²)	Dehnung (C13) Elongation %	Einschnürg. Red. of area %	Temp. (C03) °C	Einzelwerte (C42) Single values J	MW (C43) Average J	HBW 2,5/187,5
20	min 205 max		515	30,0 $5d_0$ $4d_0$	50	20			
20	319	332	558	57,0 71,2	70	20	180 174 168	174,0	163

- Country of Origin: Germany

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 01-16-2017
THE SPITZER COMPANIES

Am Material wurden keine Reparaturschweißungen vorgenommen. / No welding repair on the material.
Material ist nicht radioaktiv oder mit Quecksilber kontaminiert. / Material is free from radioactive or mercury contamination.
Sicht- und Maßprüfungen ohne Beanstandungen. (D01) / Visual and dimensional examinations without objections.
Die Anforderungen der Bestellung sind erfüllt. / The product meets the requirements of the order specifications.
Die Angaben in Klammern entsprechen den Vorgaben der DIN EN 10168 / Data in parentheses refer to DIN EN 10168.
APZ ist mit EDV erstellt und ohne Unterschrift gültig. / MTR was electronically generated and is valid without a signature.

R. Sparing po 2132-027 Bom#117-Dun Cur C

87904-1-2132-SA182-L-12

EN ISO 9001 : 2008

Flanschenwerk Bebitz GmbH - Lebendorfer Str. 1 - 06420 Bebitz / GERMANY
Tel. +49 34691 40 0 - Fax +49 3469140 329 - Email: flanges@bebitz.de
Bebitz Flanges Works Pvt. Ltd. - Survey No. 140/2, Sarawali Boisar - Taluka Palghar - Thane 401501 - Maharashtra, INDIA
Tel. +91-0-9049991039/42/43 - Fax +91-0-2525 274266/67 - Email: quality@bebitz.de

Abnahmeprüfzeugnis 3.1 / Inspection certificate 3.1 / Certificat de reception 3.1

nach (A02) / acc. DIN EN 10204 : 2005 Nr. (A03) / No. 12-50390 Datum (Z02) / Date 2/6/2012

Zeichen des Herstellers (A04) / Manufacturer's brand: B

Stempel des Abnehmers (Z03) / Stamp of the testing engineer: TKO 7

Überprüft als Hersteller nach AD-Merkblatt W0 / TRD100 und VdTÜV Werkstoffblätter 350/3, 354, 399. / Approved as manufacturer acc. AD-Merkblatt W0 / TRD100 and VdTÜV Material Sheets 350/3, 354, 399.
Zertifiziert nach DGR 97/23/EG durch TÜV CERT Zertifizierungsst. für Druckgeräte der TÜV NORD GmbH Co KG, Benannte Stelle Nr. 0045. / Certified acc. to PED 97/23/EC, certifying body for pressure equipment TÜV NORD GmbH Co KG, registration no. 0045.

Besteller (A06) / Customer: S W STAINLESS
2751 MILLER RD.
DECATUR, GA 30035, USA

Bestell-Nr (A07) / Order-N: 108159-00
Auftrag (A08) / Order: BFW/1825
Lieferschein / Delivery No.: 2532339
Position (B07.1) / Item: 175

Stck (B08) / Quantity	Bezeichnung (B01; B09 - B11) / Product	Schmelze/Prüflos (B07) / Heat no./Test no.
6	12 inch Welding Neck Flange 300 lbs S40s raised Face	87904/1

Material (B02; B05): F 304/F 304L - ASTM A 182M-10 / ASME SA-182M
austenitis. > 1040 °C and quenched in water

Anford. (B03) Demands: ASME B 16.5-2003
NACE MR0175-2002 / MR0103-2007 - DIN EN ISO 15156-2 : 2005
2010 ASME Boiler & Pressure Vessel Code - Section II Part A
PMI-tested 100%, IGC-test acc. to DIN EN ISO 3651-2 Test A

Schmelzenanalyse (C71 - C92) / Ladle analysis — Erschmelzung (C70) / Melting process: E

C	Si	Mn	P	S	Cr	Ni	Ti	Mo	Nb	V	N	Cu	Al	PREN
0.021	0.53	1.74	0.038	0.022	18.12	8.120	0.00	0.000	0.000	0.000	0.084	0.000	0.000	19.46

Mechanische Prüfungen / Mechanical tests

$$CEV = C + \frac{Mn}{6} + \frac{V + Mo + Cr}{5} + \frac{Ni + Cu}{15} \qquad PREN = Cr + 3{,}3 \times Mo + 16 \times N$$

Probenlage (C02): q/t / Position of Specimen: q/t Tensile Test - ASTM A 370				$l_0 = 4d_0$		KBV / Charpy Impact Test DIN EN 10045-1			Härte (C32) Hardness ISO 6506
Temp (C03) °C	Streckgr. (C11) / Yield strenght 0,2% N/mm²	1,0% N/mm²	Zugfestigk. (C12) Tensile strenght N/mm²	Dehng. (C13) Elongation %	Einschnürg. Red. of area %	Temp. (C03) °C	Einzelwerte (C42) Single values J	MW (C43) Average J	HBW 2,5/187,5
20	min 205 max		515	30.0	50	20			
20	307	342	589	58.3	72	20	148 162 156	155.3	150

✓ Country of Origin: Germany

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 01-16-2017
THE SPITZER COMPANIES

Besichtigung und Ausmessung ohne Beanstandungen. (D01) / Results of inspection and dimension without objections.
Die gestellten Anforderungen sind erfüllt. (Z01) / The product meets the requirements.

Ranjan Kumar Jena,
Inspection Representative of the Manufacturer (Z02)
Bebitz Flanges Works Pvt. Ltd., Sarawali, Boisar, India

po 2132-027

BoM#76-Duncan C

F - QAC-09-04 1/1

552434-2132-SA403-F-12 ELBOW

MATERIAL TEST & INSPECTION CERTIFICATE

SUNGKWANG BEND CO., LTD.(SKB)
26, Noksansandan 262-ro, Gangseo-Gu, Busan, Korea
TEL : 82-051-3300-450
FAX : 82-051-3300-335
http://www.skbend.com

CUSTOMER: SOUTHWEST STAINLESS, INC.
PROJECT NAME: N/A

According to
DIN 50049 3.1 / EN 10204 3.1 / ISO 10474 3.1

PURCHASE ORDER NO.	466208-00	SPEC. FOR MATERIAL	ASTM/ASME A/SA403WP304/304L-W 14/15ED	CERTIFICATE NO.	QCLH2016080780
PJT NO.	N/A	SPEC. FOR INSPECTION	ASME B16.9	DATE OF ISSUE	2016.08.16
STARTING MATERIAL	A312TP304L EFW PIPE	SKB NO.	2016042806	VISUAL & DIMENSION	SATISFACTORY

NO.	SEQ/LINE/ITEM NO	DESCRIPTION	QTY	HEAT NO.	MFG ID NO.	MILL MAKER	POR/CODE/TAG NO
20		90D ELBOW(L) S40S 12" B.W WELD SUS	50	552434	552434	SUNGWON	

CHEMICAL COMPOSITION(%) (L : LADLE, P : PRODUCT)

STD. / HEAT NO.	SPEC.	C	Si	Mn	P	S	Ni	Cr	Mo	Cu	V	Nb	N	Al	B	Zr	Fe	Ti	C.E
	MIN						8.00	18.00											
	MAX	0.030	1.00	2.00	0.045	0.030	11.00	20.00											
552434	L	0.017	0.32	1.13	0.030	0.001	8.07	18.15											
	P																		
	L																		
	P																		

TENSILE TEST

SPEC.	Y.S 0.2% offset KSI	T.S KSI	EL. %	R.A %
MIN	30.0	75.0	28.0	
MAX				
	48.7	82.9	58.0	

IMPACT TEST HEAT NO.	TEST TEMP.	SIZE OF SPECIMEN(mm)		ABSORBED ENERGY STD. / VALUE			AVE.	LATERAL EXPANSION STD. / Min:0.38mm VALUE			AVE.	PERCENT SHEAR STD. / VALUE			AVE.
552434	-196℃	10X7.5	B/M					0.96	0.90	0.88	0.91				
			H.A.Z												
			W/M												
			B/M												
			H.A.Z												
			W/M												

HARDNESS HRC	MIN	
	MAX	22.0
	HB	160

HEAT TREATMENT	SOLUTION TREATED. 1050℃, 20Min., "Water"		
PMI	N/A	N.D.E	N/A
FLATTENING TEST	N/A	**MEMO	
BENDING TEST	N/A		
HYDROSTATIC TEST	N/A		
CORROSION TEST	*1		
GRAIN SIZE TEST	N/A		
HIC TEST	N/A		

MATERIAL MEETS THE REQUIREMENTS OF NACE MR0103/0175.
*1 Corrosion Test ASTM A262 Practice "E" - ACCEPT
MATERIALS IS FREE FROM CONTAMINATION BY MERCURY / NO WELD REPAIR ON BASE METAL
□ REVIEWED BY :
□ WITNESSED BY :

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 01-13-2017
THE SPITZER COMPANIES

WE CERTIFY THIS MATERIAL HAS BEEN MANUFACTURED AND EXAMINED IN ACCORDANCE WITH ALL REQUIREMENTS OF THE SPECIFICATION AND THE RESULTS OF ALL EXAMINATION ARE ACCEPTABLE.

CHIEF QUALITY OFFICER

SKE-8903

* 본 검사증명서에 명기된 규격용외 사용시 안전상 문제가 발생할 수 있으며, 검사증명서 위 변조시 사문서 위조(형법231조)로 불이익을 당하실 수 있습니다.

po 2132-020
BOM #69 - Dwn Cmr Noz C

1/1

C0502951-2132-SA403-F-12 x 10 REDUCER

MATERIAL TEST & INSPECTION CERTIFICATE

SUNGKWANG BEND CO., LTD.
1720, Songjeong-Dong, Gangseo-Ku,Busar
TEL : 82-051-3300-450
FAX : 82-051-3300-335
http://www.skbend.com

CUSTOMER: SOUTHWEST STAINLESS, INC.
PROJECT NAME: N/A

According to
DIN 50049 3.1 / EN 10204 3.1 / ISO 10474 3.1

PURCHASE ORDER NO.	75061	SPEC. FOR MATERIAL	ASTM/ASME A/SA403WP304/304L-W 07/07ED	CERTIFICATE NO.	QCLJ2012010922
PJT NO.	N/A	SPEC. FOR INSPECTION	ASME B16.9	DATE OF ISSUE	2011.12.26
STARTING MATERIAL	E.F.W PIPE	SKB NO.	2011053012	VISUAL & DIMENSION	SATISFACTORY

NO.	SEQ/LINE/ITEM NO	DESCRIPTION					QTY	HEAT NO.	MFG ID NO.	POR/CODE/TAG
200	CR40SB10X4	CON REDUCER	S40S*S40S	10"*4"	B.W WELD	SUS	5	C0503751	C0503751	
201	CR40SB10X5	CON REDUCER	S40S*S40S	10"*5"	B.W WELD	SUS	4	C0503751	C0503751	
202	CR40SB10X6	CON REDUCER	S40S*S40S	10"*6"	B.W WELD	SUS	2	C0503751	C0503751	
203	CR40SB10X8	CON REDUCER	S40S*S40S	10"*8"	B.W WELD	SUS	5	C0503751	C0503751	
204	CR40SB12X10	CON REDUCER	S40S*S40S	12"*10"	B.W WELD	SUS	2	C0502951	C0502951	
206	CR40SB12X8	CON REDUCER	S40S*S40S	12"*8"	B.W WELD	SUS	13	C0502951	C0502951	

CHEMICAL COMPOSITION(%) (L : LADLE, P : PRODUCT)

STD. / HEAT NO.	SPEC.	C	Si	Mn	P	S	Ni	Cr	Mo	Cu	V	Nb	N	Al	B	Zr	Fe	Ti	C.E
	MIN						8.00	18.00											
	MAX	0.030	1.00	2.00	0.045	0.030	11.00	20.00											
C0502951	L	0.019	0.35	1.67	0.030	0.001	8.10	18.14											
	P																		
C0503751	L	0.019	0.46	0.98	0.037	0.004	8.02	18.21											
	P																		

TENSILE TEST

SPEC.	Y.S 0.2% offset KSI	T.S KSI	EL. %
MIN	30.0	75.0	28.0
MAX			
	42.5	83.9	43.0
	43.5	81.4	55.0

IMPACT TEST / HEAT NO.	TEST TEMP.	SIZE OF SPECIMEN(mm)		ABSORBED ENERGY STD. / VALUE			AVE.	LATERAL EXPANSION STD. / VALUE			AVE.	PERCENT SHEAR STD. / VALUE			AVE.
C0502951			B/M												
			H.A.Z												
			W/M												
C0503751			B/M												
			H.A.Z												
			W/M												

HARDNESS HRC		HEAT TREATMENT	SOLUTION TREATED. 1060°C, 20Min., "Water"		
MIN					
MAX	22.0	PMI	N/A	N.D.E	N/A
HB	148	FLATTENING TEST	N/A	**MEMO	
		BENDING TEST	N/A		
		HYDROSTATIC TEST	N/A		
HB	158	CORROSION TEST	N/A		
		GRAIN SIZE TEST	N/A		
		HIC TEST	N/A		

MATERIAL MEETS THE REQUIREMENTS OF NACE MR0175

Chemical & Physical Test
Reviewed and Accepted
By RR Date 01-13-2017
THE SPITZER COMPANIES

WE CERTIFY THIS MATERIAL HAS BEEN MANUFACTURED AND EXAMINED IN ACCORDANCE W
REQUIREMENTS OF THE SPECIFICATION AND THE RESULTS OF ALL EXAMINATION ARE ACCE

QM DIV. SENIOR MANAGING DIRECT

☐ REVIEWED BY
☐ WITNESSED BY : _____

po 2132-020

Boat #70 - Dun Cmr Nor C

97363-1-2132-SA182-L-10

BEBITZ

Bereich Flansche / Flange Division

Flanschenwerk Bebitz GmbH-Lebendorfer Str.1-06420 Bebitz/GERMANY (A01) Tel. +49 34691 40 0-Fax +49 3469140 329-Email: flanges@bebitz.de
Bebitz Flanges Works Pvt. Ltd.-Survey No. 140/2, Saravali Boisar - Taluka Palghar - Thane 401501 Maharashtra, INDIA - Email: quality@bebitz.in
Bebitz U.S.A., INC. 100 Quentin Roosevelt BLVD-Garden City, NY11530/USA Tel. +1-516-2808380-Fax +1-516-2808382-Email: bebitzusa@bebitz.de

Abnahmeprüfzeugnis 3.1 / Inspection certificate 3.1 / Certificat de reception 3.1

nach (A02) / acc. DIN EN 10204 : 2005 Nr. (A03) / No. 15-13289 Datum (Z02) / Date 19.05.2015

Zeichen des Herstellers (A04) / Manufacturer's brand: [B]

Stempel des Abnehmers (Z03) / Stamp of the testing engineer: TKO B

Überprüft als Hersteller nach AD-Merkblatt W0 / TRD100 und VdTÜV Werkstoffblätter 350/3, 354, 399. / Approved as manufacturer acc. AD-Merkblatt W0 / TRD100 and VdTÜV Material Sheets 350/3, 354, 399.
Zertifiziert nach DGR 97/23/EG durch TÜV CERT Zertifzierungsst. für Druckgeräte der TÜV NORD GmbH Co KG, Benannte Stelle Nr. 0045. / Certified acc. to PED 97/23/EC, certifying body for pressure equipment TÜV NORD GmbH Co KG, registration no. 0045.

Besteller (A06) Customer	TEXAS PIPE & SUPPLY Co. 2330 Holmes Road HOUSTON, TX 77051	**Bestell-Nr (A07) / Order-No.** **Auftrag (A08) / Order** **Lieferschein / Delivery No.** **Position (B07.1) / Item**	145639-00 3423012 3532312 55FB

Stck (B08) Quantity	Bezeichnung (B01; B09 - B11) Product	Schmelze/Prüflos (B07) Heat no./Test no.
7	10 inch Welding Neck Flange 300 lbs S40s raised face	97363/1

Material (B02; B05) F 304/F 304L - ASTM A 182M-13a / ASME SA-182M
solution annealed > 1040 °C and quenched in water

Anford. (B03) Requirements
ASME B 16.5-2013
NACE MR0175-2011 / MR0103-2010 - DIN EN ISO 15156-2:2009
2013 ASME Boiler & Pressure Vessel Code - Section II Part A
PMI-tested 100%, IC-test acc. to DIN EN ISO 3651-2 Test A / ASTM A 262 practice E

Schmelzenanalyse (C71 - C92) / Ladle analysis **Erschmelzung (C70) / Melting process** E

C	Si	Mn	P	S	Cr	Ni	Ti	Mo	Nb	V	N	Cu	Al	PREN
0,026	0,44	1,26	0,036	0,021	18,42	8,07					0,080			19,70

$$CEV = C + \frac{Mn}{6} + \frac{V + Mo + Cr}{5} + \frac{Ni + Cu}{15} \qquad PREN = Cr + 3{,}3 \times Mo + 16 \times N$$

Mechanische Prüfungen / Mechanical tests

Probenlage (C02): T / Position of Specimen: T Zugversuch / Tensile Test - ASTM A 370						Kerbschlagbiegeversuch / Impact test DIN EN ISO 148-1 (V-Kerb / V-notch)				Härte (C32) Hardness ISO 6506-1
Temp (C03) °C	Streckgrenze (C11) / Yield 0,2% MPa (N/mm²)	1,0% MPa (N/mm²)	Zugfestigkeit (C12) Tensile MPa (N/mm²)	Dehnung (C13) Elongation %	Einschnürg. Red. of area %	Temp. (C03) °C	Einzelwerte (C42) Single values J		MW (C43) Average J	HBW 2,5/187,5
20	min 205 max		515	30,0 $5d_0$ $4d_0$	50	20				
20	329	341	581	60,4 75,5	69	20	182	178 174	178,0	163

- Country of Origin: Germany

Chemical & Physical Tests
Reviewed and Accepted
By MK Date 01-16-2017
THE SPITZER COMPANIES

Am Material wurden keine Reparaturschweißungen vorgenommen. / No welding repair on the material.
Material ist nicht radioaktiv oder mit Quecksilber kontaminiert. / Material is free from radioactive or mercury contamination.
Sicht- und Maßprüfungen ohne Beanstandungen. (D01) / Visual and dimensional examinations without objections.
Die Anforderungen der Bestellung sind erfüllt. / The product meets the requirements of the order specifications.
Die Angaben in Klammern entsprechen den Vorgaben der DIN EN 10168 / Data in parentheses refer to DIN EN 10168.
APZ ist mit EDV erstellt und ohne Unterschrift gültig. / MTR was electronically generated and is valid without a signature.

R. Sparing po 2132-027 BOM#117-DunCmr C

511901-2132-SA312-S-4

outokumpu
high performance stainless steel

****
* CERTIFICATION *
****

Page: 1

11/21/16
HEAT 511901 ORDER 0030985/003 B00025810

SHIP TO:
ROLLED ALLOYS-TULSA
6555 S. 57TH W. AVENUE
918-594-2621
TULSA OK 74131

---------- YOUR ORDER & DATE ----------
0141486-TU 11/21/16 CUST# ROLALL01

---------- ITEM DESCRIPTION ----------
4" SCH40S TP304/TP304L A312
Country of Melt : USA
Country of Mfg. : USA

---------- SPECIFICATIONS ----------
ASTM A312-16A/ASME SA312-15 WELDED
PIPING COMPONENTS SUPPLIED TO: FAR BAA _X_ COMPLIES
DFARS BAA _X_ COMPLIES FAR TAA _X_ COMPLIES
Certificate in conformance with EN10204-95 3.1.B / EN10204-2004 3.1

---------- MECHANICAL & OTHER TESTS ----------

		Tensile strength,KSI (MPa)	84.8 (585)
		Yield strength,KSI (MPa)	57.1 (394)
		Elongation % in 2	50.0
Flatten	OK		
		Eddy Test	OK
		Bend Test	
NACE MR0175/ISO 15156:15		NACE MR0103-15	
HRB-87			

---------- CHEMICAL COMPOSITION ----------

Carbon	(C)	.023	Manganese	(Mn)	1.730
Phosphorus	(P)	.024	Sulphur	(S)	.010
Silicon	(Si)	.550	Chromium	(Cr)	18.030
Nickel	(Ni)	8.010	Moly	(Mo)	.230
Nitrogen	(N)	.068			

CAUTION: Processing that produces fumes and dust may cause respiratory disease: Especially alloys containing Chromium and Nickel.

CERTIFICATION: We certify that the analysis figures are correct as contained in the records of the company and that the material is free of known mercury, asbestos, and low melting alloy contamination. No weld repair unless otherwise noted.

HEAT TREATMENT & PICKLING: Solution annealed at a range 1900F-2000F and water quenched to below 800F within 3 minutes. Descaled, pickled, and passivated.

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes.

We hereby certify that the chemical analysis and/or test results shown in this report are correct as contained in the records of the company.

Quality Representative

ROLLED ALLOYS
Receiving Inspection
By: T
Date: 12/2/16

OK HEAT # 511901
TRACER # 0493589US

Martha James
Martha James

Outokumpu Stainless Pipe, Inc.
ADDRESS 241 W Clarke Street Wildwood, Florida 34785-9601
TELEPHONE (352) 748-1313
TELEFAX
Administration: (352) 748-2751
Purchasing: (352) 748-6576
Production Control: (352) 748-0533
Quality Assurance: (352) 748-0533

Po 2132-029

BOM#82: Dwn Cmr Noz D

Chemical & Physical Tests Reviewed and Accepted
By KR Date 01-17-2017
THE SPITZER COMPANIES

1/1

38790-1-2132-SA182-L-8

BEBITZ

Bereich Flansche / Flange Division

Flanschenwerk Bebitz GmbH-Lebendorfer Str.1-06420 Bebitz/GERMANY (A01) Tel. +49 34691 40 0-Fax +49 3469140 329-Email: flanges@bebitz.de
Bebitz Flanges Works Pvt. Ltd.-Survey No. 140/2, Saravali Boisar - Taluka Palghar - Thane 401501 Maharashtra, INDIA - Email: quality@bebitz.in
Bebitz U.S.A., INC. 100 Quentin Roosevelt BLVD-Garden City, NY11530/USA Tel. +1-516-2808380-Fax +1-516-2808382-Email: bebitzusa@bebitz.de

Abnahmeprüfzeugnis 3.1 / Inspection certificate 3.1 / Certificat de reception 3.1

nach (A02) / acc. DIN EN 10204 : 2005 Nr. (A03) / No. 16-05185 **Datum (Z02) / Date** 05.04.2016

Zeichen des Herstellers (A04) / Manufacturer's brand: [B]

Stempel des Abnehmers (Z03) / Stamp of the testing engineer: TKO B

Überprüft als Hersteller nach AD-Merkblatt W0 / TRD100 und VdTÜV Werkstoffblätter 350/3, 354, 399. / Approved as manufacturer acc. AD-Merkblatt W0 / TRD100 and VdTÜV Material Sheets 350/3, 354, 399.
Zertifiziert nach DGR 97/23/EG durch TÜV CERT Zertifzierungsst. für Druckgeräte der TÜV NORD GmbH Co KG, Benannte Stelle Nr. 0045. / Certified acc. to PED 97/23/EC, certifying body for pressure equipment TÜV NORD GmbH Co KG, registration no. 0045.

Besteller (A06) / Customer: TEXAS PIPE & SUPPLY Co.
2330 Holmes Road
HOUSTON, TX 77051

Bestell-Nr (A07) / Order-No. 156332-00
Auftrag (A08) / Order 3522721
Lieferschein / Delivery No. 3630789
Position (B07.1) / Item 42FB

Stck (B08) / Quantity	Bezeichnung (B01; B09 - B11) / Product	Schmelze/Prüflos (B07) / Heat no./Test no.
4	8 inch Welding Neck Flange 300 lbs S40s raised face	38790/1

Material (B02; B05): F 304/F 304L - ASTM A182M-15 / ASME SA-182M
solution annealed > 1040 °C and quenched in water

Anford. (B03) Requirements: ASME B 16.5-2013
NACE MR0175-2011 / MR0103-2010 - DIN EN ISO 15156-2:2009
2015 ASME Boiler & Pressure Vessel Code - Section II Part A
PMI-tested 100%, IC-test acc. to DIN EN ISO 3651-2 Test A / ASTM A262 practice E

Schmelzenanalyse (C71 - C92) / Ladle analysis — **Erschmelzung (C70) / Melting process** E+AOD

C	Si	Mn	P	S	Cr	Ni	Ti	Mo	Nb	V	N	Cu	Al	PREN
0,017	0,35	1,21	0,036	0,023	18,30	8,09					0,085			19,66

$$CEV = C + \frac{Mn}{6} + \frac{V + Mo + Cr}{5} + \frac{Ni + Cu}{15} \qquad PREN = Cr + 3{,}3 \times Mo + 16 \times N$$

Mechanische Prüfungen / Mechanical tests

Probenlage (C02): T / Position of Specimen: T
Zugversuch / Tensile Test - ASTM A 370

Temp (C03) °C	Streckgrenze (C11) / Yield 0,2% MPa (N/mm²)	1,0% MPa (N/mm²)	Zugfestigkeit (C12) Tensile MPa (N/mm²)	Dehnung (C13) Elongation %		Einschnürg. Red. of area %
20	min 205 max		515	30,0 $5d_0$	$4d_0$	50
20	307	341	570	60,2	75,3	71

Kerbschlagbiegeversuch / Impact test DIN EN ISO 148-1 (V-Kerb / V-notch)

Temp. (C03) °C	Einzelwerte (C42) Single values J			MW (C43) Average J
20				
20	180	178	188	182,0

Härte (C32) Hardness ISO 6506-1 HBW 2,5/187,5: 159

Country of Origin: Germany

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 01-16-2017
THE SPITZER COMPANIES

Am Material wurden keine Reparaturschweißungen vorgenommen. / No welding repair on the material.
Material ist nicht radioaktiv oder mit Quecksilber kontaminiert. / Material is free from radioactive or mercury contamination.
Sicht- und Maßprüfungen ohne Beanstandungen. (D01) / Visual and dimensional examinations without objections.
Die Anforderungen der Bestellung sind erfüllt. / The product meets the requirements of the order specifications.
Die Angaben in Klammern entsprechen den Vorgaben der DIN EN 10168 / Data in parentheses refer to DIN EN 10168.
APZ ist mit EDV erstellt und ohne Unterschrift gültig. / MTR was electronically generated and is valid without a signature.

R. Sparing
Abnahmebeauftragter des Herstellers (Z02) / Inspection Representative of the Manufacturer

PO 2132-027

Bolt # 71 - DwnCmr E, DwnCmr F

1/1

C1006451-2132-SA403-F-8 ELBOW

MATERIAL TEST & INSPECTION CERTIFICATE

SUNGKWANG BEND CO., LTD.(SKB)
26, Noksansandan 262-ro, Gangseo-Gu, Busan, Korea
TEL : 82-051-3300-450
FAX : 82-051-3300-335
http://www.skbend.com

CUSTOMER: SOUTHWEST STAINLESS, INC.
PROJECT NAME: N/A

According to
DIN 50049 3.1 / EN 10204 3.1 / ISO 10474 3.1

PURCHASE ORDER NO.	355358-00	SPEC. FOR MATERIAL	ASTM/ASME A/SA403WP304/304L-W 12/13ED	CERTIFICATE NO.	QCLR2015020609
PJT NO.	N/A	SPEC. FOR INSPECTION	ASME B16.9	DATE OF ISSUE	2015.01.28
STARTING MATERIAL	E.F.W PIPE	SKB NO.	2014112803	VISUAL & DIMENSION	SATISFACTORY

NO.	SEQ/LINE/ITEM NO	DESCRIPTION					QTY	HEAT NO.	MFG ID NO.	POR/CODE/TAG NO
327		90D ELBOW(L)	S40S	6"	B.W WELD	SUS	270	SE69768	SE69768	327
328		90D ELBOW(L)	S40S	8"	B.W WELD	SUS	230	C1006451	C1006451	328

CHEMICAL COMPOSITION(%) (L : LADLE, P : PRODUCT)

STD. / HEAT NO.	SPEC.	C	Si	Mn	P	S	Ni	Cr	Mo	Cu	V	Nb	N	Al	B	Zr	Fe	Ti	C.E
	MIN						8.00	18.00											
	MAX	0.030	1.00	2.00	0.045	0.030	11.00	20.00											
C1006451	L	0.023	0.46	1.46	0.029	0.004	8.01	18.05											
	P																		
SE69768	L	0.024	0.35	1.46	0.030	0.002	8.05	18.09											
	P																		

TENSILE TEST

SPEC.	Y.S 0.2% offset KSI	T.S KSI	EL. %	R.A %
MIN	30.0	75.0	28.0	
MAX				
	45.9	91.5	66.0	
	44.4	89.6	56.0	

IMPACT TEST / HEAT NO.	TEST TEMP.	SIZE OF SPECIMEN(mm)		ABSORBED ENERGY STD. / VALUE			AVE.	LATERAL EXPANSION STD. / VALUE			AVE.	PERCENT SHEAR STD. / VALUE			AVE.
C1006451			B/M												
			H.A.Z												
			W/M												
SE69768			B/M												
			H.A.Z												
			W/M												

HARDNESS HRC		HEAT TREATMENT	SOLUTION TREATED. 1060℃, 20Min., "Water"		
MIN					
MAX	22.0	PMI	N/A	N.DE	N/A
HB	156	FLATTENING TEST	N/A	**MEMO	
		BENDING TEST	N/A		
		HYDROSTATIC TEST	N/A		
HB	152	CORROSION TEST	N/A		
		GRAIN SIZE TEST	N/A		
		HIC TEST	N/A		

MATERIAL MEETS THE REQUIREMENTS OF NACE MR0175
MERCURY FREE

Chemical & Physical Tested
Reviewed and Accepted
By RR Date 01-17-2017
THE SPITZER COMPANIES

WE CERTIFY THIS MATERIAL HAS BEEN MANUFACTURED AND EXAMINED IN ACCORDANCE WITH ALL REQUIREMENTS OF THE SPECIFICATION AND THE RESULTS OF ALL EXAMINATION ARE ACCEPTABLE.

CHIEF QUALITY OFFICER

□ REVIEWED BY :
□ WITNESSED BY : _____

SKE-8903

*본 검사증명서에 명기된 규격용외 사용시 안전상 문제가 발생할 수 있으며, 검사증명서 위 변조시 사문서 위조(형법231조)로 불이익을 당하실 수 있습니다.

BoM#74 - Pwn Cmr E, F

Po 2132-020

511545-2132-SA312-S-8

outokumpu
high performance stainless steel

241 W Clarke Street
Wildwood, Florida 34785

TELEPHONE
(352) 748-1313

CERTIFICATION

11/21/16
HEAT 511545 ORDER 0031044/006 BO0025810

SHIP TO:
ROLLED ALLOYS-TULSA
6555 S. 57TH W. AVENUE
918-594-2621
TULSA OK 74131

YOUR ORDER & DATE
0142732-TU 11/21/16 CUST# ROLALL01

ITEM DESCRIPTION
8" SCH40S TP304/TP304L A312
Country of Melt : USA
Country of Mfg. : USA

SPECIFICATIONS
ASTM A312-16A/ASME SA312-15 WELDED
PIPING COMPONENTS SUPPLIED TO: FAR BAA _X_ COMPLIES
DFARS BAA _X_ COMPLIES FAR TAA _X_ COMPLIES
Certificate in conformance with EN10204-95 3.1.B / EN10204-2004 3.1

MECHANICAL & OTHER TESTS

Tensile strength KSI (MPa)	89.3 (616)
Yield strength,KSI (MPa)	56.2 (387)
Elongation % in 2	50.0
Guided Bend Face	Bend Test
Hydrotest PSI (MPa)	1200 (8.27)

NACE MR0175/ISO 15156:15 NACE MR0103-15
HRB-88

CHEMICAL COMPOSITION

Carbon	(C)	.025	Manganese	(Mn)	1.750
Phosphorus	(P)	.030	Sulphur	(S)	.013
Silicon	(Si)	.520	Chromium	(Cr)	18.120
Nickel	(Ni)	8.010	Moly	(Mo)	.500
Nitrogen	(N)	.065			

CAUTION: Processing that produces fumes and dust may cause respiratory disease: Especially alloys containing Chromium and Nickel.

CERTIFICATION: We certify that the analysis figures are correct as contained in the records of the company and that the material is free of known mercury, asbestos, and low melting alloy contamination. No weld repair unless otherwise noted.

HEAT TREATMENT & PICKLING: Solution annealed at a range 1900F-2000F and water quenched to below 800F within 3 minutes. Descaled, pickled, and passivated.

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes.

We hereby certify that the chemical analysis and/or test results shown in this report are correct as contained in the records of this company.

Receiving Inspection
By:
Date: 11/29/16

511545
TRACER # 0493324US

Martha James
Martha James
Quality Representative

Outokumpu Stainless Pipe, Inc.
ADDRESS
241 W Clarke Street
Wildwood, Florida 34785-9601
TELEPHONE
(352) 748-1313
TELEFAX
Administration: (352) 748-2751
Purchasing: (352) 748-6576
Production Control: (352) 748-0533
Quality Assurance: (352) 748-0533

po 2132-029

Chemical & Physical Tests
Reviewed and Accepted:
By RR Date 01-17-2017
THE SPITZER COMPANIES

Dom#75: Dun Cmr No: E & F

1/1

DAVIT ARM KIT MTR'S

FROM CUBECO

Bill Of Material

CUBECO,INC.
1415 HARRIS
HOUSTON, TX. 77020
PH: 713-671-2466
FAX: 713-671-9610

CURTIS KELLY
PO# 2132018
ITEM # T-501

Cubeco S.O. 3491

SHEET # 1 OF 1
Revision # 0
DATE 1/10/2017

ITEM	QTY	DESCRIPTION	Length	P.O.NO.	ORDERED CO.	DATE ORDER	DATE RCV'D	Heat Number
1	1	2" SCH XXS 106B	16'-0"	3491	TUBETECH	1/10/2017		494643
2	1	2 1/2" SCH 40 106B	4"	STOCK				FA1483
3	1	2 1/2" SCH 40 304-SS	2'-6"	3491	ACTION S.S.	1/17/2017		570022
4	4	1/2" PL PER DWG 304-SS		3491	MSM	1/18/2017		052M
5	1	3/4" ROUND ROD 304-SS	3'-6"	3491	ACTION S.S.	1/17/2017		270228
6	4	3/4" EYEBOLT 2N, FW	11 1/4"	3491	BRAZOS	1/10/2017		
7	4	1/4" NPT GREASE FITTING		STOCK				
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								

2" XXS 106B

Heat: 494643
Your PO: 4506
2" X 0.436" SMLS A53/API5L/A106
GR B/X-42 PEB SRL

CERTIFICATE OF TESTING
IPSCO KOPPEL TUBULARS, LLC
Chemistry

Certificate Number:	294675-1
Wednesday, September 21, 2016, 8:14:55 AM	

Diameter: 2.375 in	Gage: 0.436 in	Grade: BCX42-1SML	Mill Order No: 076889-002	Customer PO: 165217-00

Specification: ASME ASTM SA53/A53-12 GR B/ASME-A106-15 GR B/C
ASTM A106-15 GR B
API 5L PSL1 GR B/X42 FORTY-FIFTH EDITION

Customer: TEXAS PIPE & SUPPLY INC.

Heat	Product ID	Type	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Sn	Al	V	Cb	N	Ti	B	Ca	API	Sb	Pb	As	GS
494643		HEAT	0.24	0.62	0.007	0.004	0.29	0.18	0.09	0.03	0.02	0.009	0.015	0.003	0.001	0.0106	0.001	0.0001	0.0017	0.382	0.005	0.0002	0.0049	
	KO-076889-002 P1-0768-2	PRODUCT	0.24	0.61	0.007	0.002	0.30	0.16	0.08	0.03	0.02	0.006	0.015	0.001	0.001	0.0105	0.002	0.0001	0.0017	0.378	0.004	0.0004	0.0054	
	KO-076889-002 P2-0768-2	PRODUCT	0.24	0.61	0.007	0.002	0.30	0.15	0.08	0.03	0.02	0.006	0.015	0.001	0.001	0.0103	0.002	0.0001	0.0018	0.378	0.004	0.0002	0.0057	
494644		HEAT	0.23	0.61	0.007	0.003	0.29	0.21	0.08	0.03	0.02	0.009	0.017	0.003	0.001	0.0086	0.002	0.0001	0.0026	0.372	0.003	0.0001	0.0047	
	KO-076889-002 P1-0768-2	PRODUCT	0.23	0.61	0.007	0.002	0.30	0.19	0.08	0.03	0.02	0.005	0.018	0.001	0.001	0.0084	0.002		0.0027	0.370	0.004	0.0001	0.0058	
	KO-076889-002 P2-0768-2	PRODUCT	0.23	0.61	0.007	0.002	0.30	0.18	0.08	0.03	0.02	0.004	0.017	0.001	0.001	0.0088	0.002	0.0001	0.0026	0.368	0.004	0.0001	0.0065	

Test Method Used: ASTM E415
- Fine Grain Melt Practice
FBN - Full Body Normalized
- Q&T = Quench & Tempered
Material was not exposed to mercury during processing
No welding or weld repair performed on this material
Material is free of harmful radiation
This certification may not be reproduced except in full

- Hydrostatic Test Pressure: 3000 PSI for 5 secs
GS - Grain Size
Grain Size Test Method ASTM E112
- API - API Carbon Equivalent
CEQ - Canadian Carbon Equivalent

Melted and Manufactured in the USA

We certify that the product described above has been manufactured, sampled, inspected, and tested in accordance to the referenced specification. The product has been found to be in compliance with all requirements.

Amber Kitajima
Amber Kitajima
Quality Coordinator Wednesday, September 21, 2016, 8:15:58

form CRTR3003

MILL ADDRESS - 6403 SIXTH AVENUE | KOPPEL, PA 16136

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 12-4-2017
THE SPITZER COMPANIES

po 2132-018

1/4

2" X 0.436" SMLS A53/API5L/A106 GR B/X-42 PEB SRL

Heat: 494643
Your PO: 4506

CERTIFICATE OF TESTING
IPSCO KOPPEL TUBULARS, LLC
Tensile

Certificate Number:	294675-3
Wednesday, September 21, 2016, 8:14:55 AM	

Diameter: 2.375 in	Gage: 0.436 in	Grade: BCX42-1SML	Mill Order No: 076889-002	Customer PO: 165217-00

Specification: ASME ASTM SA53/A53-12 GR B/ASME-A106-15 GR B/C
ASTM A106-15 GR B
API 5L PSL1 GR B/X42 FORTY-FIFTH EDITION

Customer: TEXAS PIPE & SUPPLY INC.

Heat	Product ID		Test Type	Orientation	Width (in)	YS (psi)	TS (psi)	Elong% (2 in)	Y/T
494643	KO-076889-002	CC	APPLY/TEST	PIPE LPA	0.750	55300	82100	32.5	0.67
494644	KO-076889-002	DX	APPLY/TEST	PIPE LPA	0.753	52400	77400	34.0	0.68

Test Method Used: ASTM E8
Fine Grain Melt Practice
Material was not exposed to mercury during processing
No welding or weld repair performed on this material
Material is free of harmful radiation
This certification may not be reproduced except in full

Hydrostatic Test Pressure: 3000 PSI for 5 secs
LPA - Longitudinal Pipe Axis
TPA - Transverse Pipe Axis
FBN - Full Body Normalized
Q&T - Quenched and Tempered
0.5% EUL
0.1% Offset

Melted and Manufactured in the USA

We certify that the product described above has been manufactured, sampled, inspected, and tested in accordance to the referenced specification. The product has been found to be in compliance with all requirements.

Amber Kitajima
Quality Coordinator

Wednesday, September 21, 2016, 8:15:56

form CRTR3002

2" X 0.436" SMLS A53/API5L/A106
GR B/X-42 PEB SRL
Heat: 494643
Your PO: 4506

CERTIFICATE OF TESTING
IPSCO KOPPEL TUBULARS, LLC
Macro Hardness

Certificate Number:	294675-2
Wednesday, September 21, 2016, 8:14:55 AM	

Diameter: 2.375 in	Gage: 0.436 in	Grade: BCX42-1SML	Mill Order No: 076889-002	Customer PO: 165217-00

Specification: ASME ASTM SA53/A53-12 GR B/ASME-A106-15 GR B/C
ASTM A106-15 GR B
API 5L PSL1 GR B/X42 FORTY-FIFTH EDITION

Customer: TEXAS PIPE & SUPPLY INC.

Heat	Product ID		Test Type	Scale	MS	Location	Q1			Q2			Q3			Q4			AVG			
							Q1	Q2	Q3	Q4	AVG											
494643	KO-076889-002	CC	APPLY/TEST	Rockwell		OD	79.0	81.0	81.0										80.3			
						MID	82.0	82.0	83.0										82.3			
						ID	80.0	81.0	81.0										80.7			
494644	KO-076889-002	DX	APPLY/TEST	Rockwell		OD	80.0	80.0	80.0										80.0			
						MID	82.0	80.0	81.0										81.0			
						ID	81.0	80.0	80.0										80.3			

MS = Micro Structure
☒ - Measurement Taken In Rc
☐ - Measurement Taken In Rb

Test Method Used: ASTM E18
Fine Grain Melt Practice
Material was not exposed to mercury during processing
No welding or weld repair performed on this material
Material is free of harmful radiation
This certification may not be reproduced except in full

form CRTR3006

Melted and Manufactured in the USA

We certify that the product described above has been manufactured, sampled, inspected, and tested in accordance to the referenced specification. The product has been found to be in compliance with all requirements.

Amber Kitajima
Quality Coordinator

Wednesday, September 21, 2016, 8:15:55

2" X 0.436" SMLS A53/API5L/A106
GR B/X-42 PEB SRL

Heat: 494643
Your PO: 4506

CERTIFICATE OF TESTING
IPSCO KOPPEL TUBULARS, LLC
General Comments

Certificate Number:	294675-G
Wednesday, September 21, 2016, 8:14:55 AM	

Diameter: 2.375 in	Gage: 0.436 in	Grade: BCX42-1SML	Mill Order No: 076889-002	Customer PO: 165217-00

Specification: **ASME ASTM SA53/A53-12 GR B/ASME-A106-15 GR B/C**
ASTM A106-15 GR B
API 5L PSL1 GR B/X42 FORTY-FIFTH EDITION

Customer: **TEXAS PIPE & SUPPLY INC.**

BENDS(S) - SATISFACTORY
EMI INSPECTION WITH OD N10 NOTCHES
LONGITUDINAL - SATISFACTORY
MATERIAL COMPLIES WITH EN10204 TYPE 2.1 REQUIREMENT
TMK IPSCO IS NOT PED CERTIFIED
MEETS 22 HRC MAX STATED IN
ANSI/NACE MR0175/MR0103/ISO 15156-1:2009 (E) -
ANNEX A/TABLE A1

Material was not exposed to mercury during processing
No welding or weld repair performed on this material
Material is free of harmful radiation
This certification may not be reproduced except in full

Melted and Manufactured in the USA

We certify that the product described above has been manufactured, sampled, inspected, and tested in accordance to the referenced specification. The product has been found to be in compliance with all requirements.

Amber Kitajima

Amber Kitajima
Quality Coordinator

Wednesday, September 21, 2016, 8:15:56

form crtr3013

34520

Pg 1 of 2

UNITED STATES STEEL

TUBULAR PRODUCTS
CERTIFIED TEST REPORT
(IN ACCORDANCE WITH ISO 10474/EN10204/DIN50049 "type 3.1")

DATE: 12/28/11
TIME: 04:07:10
SERIAL NO: L0038985

MILL ORDER/ITEM NO	SHIPPERS NO.	P.O. NUMBER	VEHICLE I.D
DR02994 03	R87096	6594	CTRN501233

SOLD TO ADDRESS
DIXIE PIPE SALES LP
PO BOX 300650
HOUSTON TX 77230-0650

MAIL TO ADDRESS
DIXIE PIPE SALES LP
PO BOX 300650
HOUSTON TX 77230-0650

VENDOR
USS TUBULAR PRODUCTS
2199 EAST 28TH ST.
LORAIN, OH 44055

SPECIFICATION AND GRADE

PIPE CARBON SMLS STD PIPE API 5L-*44TH ED DTD OCT 2007 AND ISO 3183:2007 MOD PSL-1 GRADE B AND GRADE X42 R N OR Q ASTM A53-*07 ASTM A106-*08 GRADE B QUAD STENCIL ASME SA53-*2010 EDITION ASME SA106-*2010 EDITION GRADE B BLK REG MILL COAT PE BEV 30 DEG MEETING ALL THE APPLICABLE REQUIREMENTS OF NACE STANDARD MR-01-75 *:2003/COR.1:2005 AND MR0103-2007

MATERIAL COND: AS ROLLED

O.D.: 2.875 (73.025) In (mm)

WALL: 0.203 (5.156) In (mm)

PRODUCT IDENTIFICATION	TENSILE TEST TYPE/ ORIENTATION	TEST COND.	GAUGE WIDTH IN	YIELD PSI	EXT %	TENSILE PSI	Y/T	ELONG % (IN 2 ")	HARDNESS SCALE: HRB	MIN HYDRO PSI	DWELL(SEC)
				MIN: 42100 MAX:		MIN: 70000 MAX:	MAX:	MIN: 21.0	MIN: 66.0 MAX: 99.5	2970	5
FA1483	STRIP/L/B	AR	0.750	53000	.50	77000	0.69	34.0	B 81.9	2970	5
HA1489	STRIP/L/B	AR	0.750	51500	.50	76500	0.67	33.2	B 80.4	2970	5
		**	END OF DATA THIS SHEET			**					

LEGEND: L - LONGITUDINAL, T - TRANSVERSE, U - UPSET, NM - NORMALIZED, QT - QUENCH & TEMPERED, SR - STRESS RELIEVED, AR - AS ROLLED, TR - THERMOMECHANICAL ROLLED, B - BODY, W - WELD

PRODUCT IDENTIFICATION	TYPE	C	MN	P	S	SI	CU	NI	CR	MO	AL	N	V	B	TI	CB	CO	C.E.* MAX .50
FA1483	HEAT	18	101	013	002	21	15	12	09	02	028		00	0000	002	001		.39
FA1483	PROD	16	104	010	001	23	16	13	08	02	030		00	0008	002	001		.37
FA1483	PROD	16	104	011	001	22	15	13	08	02	029		00	0002	002	001		.37
HA1489	HEAT	18	101	013	008	19	15	13	08	03	027		00	0000	002	000		.39
HA1489	PROD	15	106	009	004	22	15	13	07	02	031		00	0001	004	001		.36
HA1489	PROD	16	104	011	006	24	16	14	07	02	032		00	0003	004	001		.37
		** END OF DATA THIS SHEET **																

*C.E. IS BASED ON THE FOLLOWING EQUATION(S): CE=C+(MN/6)+(CR+MO+V)/5+(NI+CU)/15

DECIMAL POSITIONS FOR ELEMENTS ARE INDICATED BY THE LEFT MARGIN, VERTICAL DOTTED LINE OR DECIMAL POINT. ELEMENTS REPORTED IN MASS FRACTION (%)

PAGE 1 OF 2

PO 2132-018

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 02-4-2017
THE SPITZER COMPANIES

34528
pg 2 of 2

UNITED STATES STEEL

TUBULAR PRODUCTS
CERTIFIED TEST REPORT
(IN ACCORDANCE WITH ISO 10474/EN10204/DIN50049 "type 3.1")

DATE: 12/28/11
TIME: 04:07:10
SERIAL NO: L0038986

MILL ORDER/ITEM NO	SHIPPERS NO.	P.O. NUMBER
DR02994 03	R87096	6594

0011896

MATERIAL COND: AS ROLLED

O.D.: 2.875 (73.025) in (mm)

WALL: 0.203 (5.156) in (mm)

PRODUCT IDENTIFICATION	FLAT	BEND	GRAIN SIZE	MIN COLLAPSE	CHARPY V-NOTCH IMPACT TESTING											
					DIR	TEST LOC.	TEMP	SIZE	TEST COND.	FT-LBS				% SHEAR			
										1	2	3	AVG	1	2	3	AVG
					DEG												
FA1483	OK																
HA1489	OK																
			**	END OF DATA THIS SHEET **													

LEGEND L - LONGITUDINAL T - TRANSVERSE B - BODY W - WELD HAZ - HEAT AFFECTED ZONE

TESTING / INSPECTION INFORMATION

TEST / INSPECTION	YES	RESULTS / COMMENTS
FULL LENGTH VISUAL	X	
FULL LENGTH EMI		OD ____ OD/ID ____ L ____ L/T ____
FULL LENGTH MPI		
FULL LENGTH UT		ID ____ OD/ID ____ L ____ L/T ____
END AREA INSPECTION (PLAIN END)		MPI ____ UT ____
SPECIAL END AREA (SEA) INSP		MPI ____ UT ____
FULL LENGTH DRIFT		DRIFT MANDREL SIZE:

ADDITIONAL NOTES/COMMENTS

MELTED AND MANUFACTURED IN THE USA. NO REPAIRS BY WELDING. NO MERCURY OR MERCURY COMPOUNDS ARE ADDED TO THE STEEL AND ALL MERCURY BEARING EQUIPMENT IS PROTECTED BY A DOUBLE BOUNDARY OF CONTAINMENT.
PRODUCT WAS HOT ROLLED AND HOT FINISHED
PIPE ALSO MEET THE REQUIREMENTS OF ASTM A106 GRADE C & ASME SA106 GRADE C

THIS IS TO CERTIFY THAT THE PRODUCT DESCRIBED HEREIN WAS MANUFACTURED, SAMPLED, TESTED AND/OR INSPECTED IN ACCORDANCE WITH THE SPECIFICATION AND FULFILLS THE REQUIREMENTS IN SUCH RESPECTS.

PREPARED BY THE OFFICE OF: R. HARRIS - MANAGER, Q.A.

DATE 12/28/11

Mill Test Reports
For PO# _____
Dixie Pipe Sales, Inc.

PO 2132-018

**

Houston-TX
C/O Cargoways 555 Gellhorn Street
Houston, Texas 77020
USA

METALLURGICAL TEST REPORT

6870 Highway 42 Ea.
Ghent, KY 41045-9615
(502) 347-6000

Certificate: 197796 3

Date: 7/13/2016 Page: 1

Customer: 000810 899

Steel: 304/304L

Finish: 1

Corrosion: ASTM A262/15 A 180Bend-OK

Your Order: 7214892 NAS Order: PN 0067862 10

PRODUCT DESCRIPTION:

STAINLESS STEEL PLATE, HRAP; UNS 30400/30403
ASTM A240/15b,A480/15,A666/15;ASME SA240/15,SA480/15,SA666/15
CHEM ONLY ON FOLLOWING ASTM: A276/16,A479/16,A484/15,A312/16
CHEM ONLY ON FOLLOWING ASME: SA312/13,SA479/13
AMS 5511H/5513J XMRK; MIL-S-5059D AMD3(X CRN MEAS); MIL-S-4043B
NACE MR0175/ISO 15156-3:2009 A, MR0103/07;QQS766D-A X MAG PERM
MIN. SOLUTION ANNEAL TEMP 1900F, WATER QUENCHED

REMARKS:

Mat'l is Free of Mercury Contamination. No weld repairs.
EN 10204:2004 3.1; RoHS 1 & 2 Compliant
Material is Free of Radioactive Contamination
Steel Making Process: EAF, AOD, & Cont. Casting
Product Mfg.by a Quality Mgt.Sys. in Conf. w/ISO 9001
*Melted & Manufactured in the USA; Mat'l is DFARs Compliant

Product Id	Plate#	Skid #	Thickness	Width	Weight	-------Length------	Mark	Pieces	Commodity Code
02052M HA	02052M HA	PH7829	.5000	48.0000	675	PLATE 096.00	38	1	5315191

Lab Accreditation Bureau, ISO/IEC 17025, Certificate# L2323

CHEMICAL ANALYSIS

CM(Country of Melt) ES(Spain) US(United States) ZA(South Africa) JP(Japan) Chemical Analysis per ASTM A751/14a

HEAT	CM	C %	CR %	CU %	MN %	MO %	N %	NI %	P %	S %
052M	US	.0155	18.0625	.4415	1.8505	.3480	.0784	8.0295	.0300	.0010

SI %
.3190

MECHANICAL PROPERTIES

Product Id#	Plate#	i c	d i r	UTS KSI	20C .2% YS KSI	20C ELONG %-2"	Hard RB	R of A %
02052M HA	02052M HA	F	T	85.97	38.04	61.95	77.50	67.97

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 02-4-2017
THE SPITZER COMPANIES

415657

NAS hereby certifies that the analysis on this certification is correct. Based upon the results and the accuracy of the test methods used, the material meets the specifications stated. These results relate only to the items tested and this report cannot be reproduced, except in its entirety, without the written approval of NAS.

Technical Dept. Mgr. KRIS LARK 7/13/2016

P02132-018

1/1

DMF0613004 v03

SALZGITTER MANNESMANN STAINLESS TUBES
A Member of the Salzgitter Group

SMST Deutschland GmbH (A01)
Postfach 16 01 20 - D-42830 Remscheid - DEUTSCHLAND
www.smst-tubes.com

Page/Seite 1/4

INSPECTION CERTIFICATE
Abnahmeprüfzeugnis
Certificat de réception

EN 10204: 2004 TYPE 3.1 (A02)

No/Nr/N° (A03)
261449-035334

DMPS7145-7

SMST Deutschland GmbH - Postfach 16 01 20 - D-42830 Remscheid - DEUTSCHLAND
TA CHEN INTERNATIONAL CORPORAT
5855 OBISPO AVENUE
90805 LONG BEACH
USA

Purchaser/Besteller/Acheteur

Customer order no./Kunde Auftragsnr./N° Commande client (A07)
L52323S
SMST-Tubes order no/Auftragsnr./N° Commande (A08)
0000261449
SMST-Tubes item Part number/Teilenummer/N° d'article (A09)
0000261449-000003

Product Description/Produkt Beschreibung/Description du produit (B01) (B02) (B04)
Seamless Stainless Steel Hot Finished Tubes Annealed Condition Pickled Plain Ends Square Cut Deburred
Warmgefertigte, nahtlose Edelstahlrohre geglühter Zustand Gebeizt Enden Glatt Abgeschnitten
Tubes en Acier Inox Sans Soudure Finis à Chaud Remis en Solution Pickled Coupés d'equerre, lisses, ébavuré

Specifications/Spezifikationen/Spécifications ASME SA 312 13 / ASME SA 376 13 / ASTM A 312 14 b / ASTM A 376 14 / NACE MR0103 2012 / NACE MR0175/ISO 15156-3 2009

Grade/Werkstoff/Nuance TP 304 / TP 304L

Tolerances/Toleranzen/Tolérances A 312

Supplementary requirements/Zusatzanforderungen/Exigences supplémentaires (B03)

MARKING:
DMV-D - DMV 304L - TP 304 - TP 304L - HEAT – 73 x 5,16 - NPS 2 1/2 x SCH 40S – ASTM A 312/A 376 - ASME SA 312/SA376 - SML - GERMANY – WA – NH.ET

Quantity/Menge/Quantité						Dimensions / Abmessungen			
Heat no Schmelze Nr. N° de Coulée	Quality lot Qualitätslos Lot qualité	SMST item	Pieces Stück Pièces (B08)	Total weight Gesamtgewicht Masse totale (B13)	Total length Gesamtlänge Longueur totale	OD (B09)	WT (B10)	Tube length Rohrlänge Longueur tube min	(B11) max
570022	QL20039613	000003	24	1480.00 Kg 3263 Lbs	171.250 m 561.84 Ft	73.00 mm NPS 2 1/2	5.16 mm SCH 40S	6096 mm 20.00 Ft	7315 mm 24.00 Ft

Chemical Analysis / Chemische Zusammensetzung / Analyse chimique (C71 - C92)
Heat no/Schmelzen Nr./N° de coulée 570022
Melting Process/Erschmelzungsart/Élaboration (C70)
Heat Origin/Ursp. der Schmelze/Origine de la Coulee Italy

Heat Analysis / Analyse de coulée

	C	Si	Mn	P	S	Cr	Ni
Min	0.00	0.00	0.00	0.00	0.0000	18.0	8.0
Max	0.035	0.75	2.0	0.045	0.0300	20.0	11.0
	0,025	0,48	1,57	0,024	0,008	18,24	10,25

This certificate is issued by SALZGITTER MANNESMANN STAINLESS TUBES via a computerized system bearing a traceable unique number. It is valid without signature. An intermediary may only pass on the original certificate without any alterations. Providing a copy of the original is only permitted subject to strict compliance with the prerequisites set out in § 6 of EN 10204:2004 i.e. traceability and availability of the original upon request . Any modification or alteration of the certificate or any copies are strictly prohibited . Any contravention of this notice or § 6 of EN 10204:2004 is illegal and will be prosecuted. Any falsification of a certificate e.g. by introducing false or fraudulent data for the purpose of promoting the sales of goods is a criminal offence under German law (and many other jurisdictions) punishable with fines and imprisonment. If an authentification is needed, please contact dmv@smst-tubes.com.

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 02-4-2017
THE SPITZER COMPANIES

PO 2132-018

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EN 10204: 2004 TYPE 3.1 (A02)

No/Nr/N° (A03)
261449-035334

DMPS7145-8

Mechanical testing

Quality Lot : QL20039613

Tensile test at room temperature/Zugversuch bei Raumtemperatur/Essai de traction à température ambiante (C10)

ASTM A 370

Test no Proben Nr. N° d'échantillon (C00)	Direction Probenrichtung Direction (C02)	Yield strength/Dehngrenze/Limite d'élasticité (C11)			Tensile strength / Zugfestigkeit / Résistance à la traction (C12)	Elongation/Bruchdehnung/Allongement (C13)					Reduction of area Z%
		0.2 %	0.5 %	1 %		2 "	50 mm	5D	5,65 √So	4D	
		ksi	/	/	ksi	%	/	/	/	/	/
	Min	30	/	/	75	35	/	/	/	/	/
	Max	/	/	/	/	/	/	/	/	/	/
20035519	LONGITUDINAL	43	/	/	92	47	/	/	/	/	/

Hardness test/Härteprüfung/Essai de dureté (C30)

NACE MR0103 NACE MR0175/ISO 15156-3

Load /

Test no Proben Nr. N° d'échantillon	HB			HRC			HV			HRB			HR 15-T			HR 30-T		
Min	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Max	/	/	/	22	22	22	/	/	/	/	/	/	/	/	/	/	/	/
	min	max	avg	min	max	avg	min	max	avg	min	max	avg	min	max	avg	min	max	avg
20035519	/	/	/	<22,0	<22,0	22.0	/	/	/	83,0	83,0	83,00	/	/	/	/	/	/

Flattening test/Faltversuch/Essai d'aplatissement (C50)

ASTM A 999

Test Number	Result
20035518	OK
20035519	OK

Other testing

Quality Lot : QL20039613

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EN 10204: 2004 TYPE 3.1 (A02)

No/Nr/N° (A03)
261449-035334

DMPS7145-9

Intergranular corrosion test/Prüfung interkristallinen Korrosion/Essai de corrosion intergranulaire

MIL-P-24691/3 Feb. 1991 Ad 1 MIL-P-1144D 23.08.1975 ASTM A 262 PRACTICE E

Test Number	Result
20035518	Satisfactory
20035519	Satisfactory

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Certificat de réception

No/Nr/N° (A03)

261449-035334

EN 10204: 2004 TYPE 3.1 (A02)

DMPS 7145-10

Other Tests and Declarations / Andere Prüfungen und Prüffeststellungen / Autres tests et déclarations

QL20039613

Visual and dimensional inspection(VT) / Besichtigung und MassKontrolle / Examen visuel et dimensionel : Satisfactory/Bestanden/Satisfaisant

EDDY CURRENT TEST ACC. ASTM A 999: WITHOUT OBJECTION
WIRBELSTROMPRUEFUNG GEMAESS ASTM A 999: BESTANDEN
HEAT TREATMENT: HOT EXTRUDED (1200° C / AIR) / WAERMEBEHANDLUNG: WARM GEPRESST (1200° C / LUFT)

Antimixing check (PMI) of all tubes by spectrographic analysis / Verwechselungsprüfung an allen Rohren mittels Spektralprüfung / Contrôle anti-mélange par PMI : Satisfactory/Bestanden/Satisfaisant

No Weld repair / Keine Reparaturschweissung / Aucune réparation par soudure

The material is conforming to directive 2000/53/EC, 2002/95/EC and CD 2005/618/EC. / Das Material entspricht den Anforderungen der Richtlinien 2000/53/EC, 2002/95/EC und CD 2005/618/EC. / Le matériau est conforme aux directives 2000/53/EC, 2002/95/EC et CD 2005/618/EC.

Tubes are free from mercury contamination and from radioactive contamination / Die Rohre sind frei von Quecksilberverunreinigungen und frei vom radioaktiver Verunreinigung / Les tubes sont exempts de contamination par le mercure et de contamination radioactive

Confirmation with reference to Pressure Equipment Directive 97/23/EC:
The works operates a quality management system that has undergone a specific assessment for materials for pressure equipment and is certified by a competent body (TÜV-Cert.No:01202811/Q-020025)
Bestätigung in Bezug auf Druckgeräterichtlinie 97/23/EC:
Das Werk wendet ein Qualitätsmanagementsystem an, das in Bezug auf Werkstoffe für Druckgeräte einer spezifischen Bewertung unterzogen wurde und von einer zuständigen Stelle (TÜV-Cert.No:01202811/Q-020025) zertifiziert ist.
Confirmation concernant la Directive Equipements sous Pression 97/23/EC : L'usine applique un système de management de la qualité qui a fait l'objet d'une évaluation spécifique pour les matériaux pour équipements sous pression et qui est certifié par un organisme compétent (TÜV-Cert.No:01202811/Q-020025)

SMST certify that the delivered products comply with the requirements stipulated in the order. / Die Erzeugnisse wurden bestellungsgemäß geprüft und für in Ordnung befunden. / SMST-Tubes atteste que les produits livrés sont conformes aux stipulations de la commande.

Validation by manufacturer's representative / Validierung durch Vertreter des Herstellers

Mill's Inspector Werksachverständiger Le contrôleur usine	D. Brozulat
Date of edition Ausgabedatum Date d'édition	20/07/2015

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From: Valbruna Stainless Inc Date: 11/17/2016 To: ACTION STAINLESS AND ALLOY INC SO#: A797939 Ln#: 8 PO#: P62835
Part: 304D0.75 Heat#: 270228 Tag: V4959603B

Acciaierie Valbruna S.p.A.

36100 VICENZA (Italia) - Viale della scienza, 25 z.i.
Telefono 0444.968211 - Fax 0444.983836
Steb.: 39100 BOLZANO (Italia) - Via A. Volta, 4/37
Telefono 0471.924111 - Fax 0471.924497

CERTIFICATO DI COLLAUDO - ABNAHMEPRUEFZEUGNIS - INSPECTION CERTIFICATE - CERTIFICAT DE RECEPTION

In conformità a : EN 10204 (2004) , 3.1
Nach/According to/Selon

Certificato nr. MEST889215 / 2016 /
Prüfung/Test/Essai

Cliente / Besteller/Purchaser/Client
VALBRUNA STAINLESS INC.
2400 TAYLOR STREET WEST
46801 - FORT WAYNE, IN 46801 - US

Ordine nr: 49596 STOCK HOUSTON
Bestell
Your order
Commande

Conferma ordine nr: EI16005776
Werks/Our Order/Ref nr.

Avviso di Spedizione: D-VI16015452
Lieferanzeige/Packing list/B.L.

Stato di fornitura : Hot rolled - Annealed Cold Drawn
Lieferzustand
Delivery state
Etat de livraison

Tipo di Elaborazione: E+AOD
Erschmelzungsart
Melting process
Mode d'elaboration

Qualità: 304/304L
Werkstoff/Grade/Nuance

Marca: MVAISL MAXIVAL
Markenbezeichnung
Brand / Nuance

Produttore :
Hersteller/Item/Usine productrice
ACCIAIERIE VALBRUNA S.P.A.

Marchi di Fabbrica:
Zeichen des Lieferwerkes
Trade marks
Sigles de l'usine productrice
AV

Punzone del Collaudatore:
Stempel des Werkssachverständigen
Inspector's stamp/Poinçon de l'assayeur
MR

Punzonatura: 304/304L
Kennzeichnung
Marking
Marquage

SPECIFICHE : Anforderungen / Requirements / Exigences	Note: Aufzeichnungen / Notes / Notes
VSI 0 304/304L A,CF	
AISI 304/304L	
AMS 5639 H S30400 (0)	(0)Chemical analysis only.
AMS 5647 J S30403 (1)	(1)Chemical analysis only.
AMS-QQ-S-763 D 304 (2)	(2)Chemical analysis only.
AMS-QQ-S-763 D 304L A,CF	
ASME SA182 2015 S30400/03 (3)	(3)SECTION II PT.A 2015 EDITION Chemical analysis only.
ASME SA193 2015 B8 (4)	(4)SECTION II PT.A 2015 EDITION Chemical analysis only.
ASME SA276 2015 S30400/03 A,CF (5)	(5)SECTION II PT.A 2015 EDITION
ASME SA320 2015 B8 (6)	(6)SECTION II PT.A 2015 EDITION Chemical analysis only.
ASME SA479 2015 S30400/03 A (7)	(7)SECTION II PT.A 2015 EDITION
ASTM A182 2015 S30400/03 (8)	(8)Chemical analysis only.
ASTM A193 2016 B8 (9)	(9)Chemical analysis only.
ASTM A262 2015 PRACTICE E	
ASTM A276 2016 S30400/03 A,CF	
ASTM A314 2015 S30400/03	
ASTM A320 2015A B8 (A)	(A)Chemical analysis only.
ASTM A370 2015 .	
ASTM A473 2001 S30400/03 (B)	(B)Chemical analysis only.
ASTM A479 2016 S30400/03 A	
MIL-S-862 B/1 304/304L	

Tolleranza: ASTM A484-16 TABLE 7
Tolleranza/Allowance/Tolerance

Pos. nr. Pos. nr. Item nr. Nr. de poste	Oggetto Gegenstand Product description Descrip. du produit	Dimensioni - In Abmessungen Dimension Dimension	Lunghezza - In Länge Length Longueur	Colata Schmelze Heat Coulée	Pezzi Stückzahl Pieces Pieces	Peso - LB Gewicht Weight Poids	Lotto nr. Losnr. Lot nr. Lot nr.
0030	Round	0,7500	146/ 147	270228		2.754	607105990

TEST ALLO STATO DI FORNITURA
Test on delivery condition Prüefung auf lieferbereitem produkt test a l'etat de fourniture Prueba sobre el material así come entregado

1) L=longitudinale/längs, T=trasversale/quer, C=Tangenziale/tangential

TEST	Provetta/ Probestab Specimen/Eprouvete Larg.diam Spess. Breite Diam. Dicke Width Diam. Thickness Larg. diam. epais mm	°F	Posiz. Saggio Probenlage Location Emplacement	Snervamento Streckgrenze Yield Stress Limite elastique Rp 0,2% k.s.i.	Snervamento Streckgrenze Yield Stress Limite elastique	Resistenza Zugfestigkeit Tensile strength Resistance à traction Rm k.s.i.	Allungamento Bruchdehnung Elongation Allongement E 4d %		Strizione Einschnürung Reduction of area Striction %	RA %	Resilienza Kerbschlagarbeit Impact Value Resilience	Durezza Haerte Hardness Durete HB
Valori richiesti Anforderungen/Required values Valeurs demandées		min max		30	-	75	-	30	-	40	-	-
A	12,5	68	L	80		107		38		71		270

TEST ALLO STATO DI FORNITURA
Test on delivery condition / Prüefung auf lieferbereitem produkt / Test a l'etat de fourniture / Prueba sobre el material así come entregado

TEST		min	max	
A	Grain size for ASTM E112			6

Vicenza, 21/06/16
VCQ008
(Mod. MCE2)

Il collaudatore di stabilimento / der Werkssachverständige / Works Inspector / L'agent d'usine
M.Rizzotti

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 02-4-2017
THE SPITZER COMPANIES

po 2132-018

1/2

From: Valbruna Stainless Inc Date: 11/17/2016 To: ACTION STAINLESS AND ALLOY INC SO#: A797939 Ln#: 8 PO#: R62835
Part: 304D0.75 Heat#: 270228 Tag: V4959603B

Acciaierie Valbruna S.p.A.

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CERTIFICATO DI COLLAUDO - ABNAHMEPRUEFZEUGNIS - INSPECTION CERTIFICATE - CERTIFICAT DE RECEPTION

In conformità a : EN 10204 (2004) , 3.1
Nach/According to/Selon

Certificato nr. MEST889215 / 2016 /
Prüfung/Test/Essai

Cliente / Besteller/Purchaser/Client
VALBRUNA STAINLESS INC.
2400 TAYLOR STREET WEST
46801 - FORT WAYNE, IN 46801 - US

Stato di fornitura : Hot rolled - Annealed Cold Drawn
Lieferzustand / Delivery state / Etat de livraison

Produttore :
Hersteller/Item/Usine productrice
ACCIAIERIE VALBRUNA S.P.A.

Ordine nr: 49596 STOCK HOUSTON
Bestell / Your order / Commande

Tipo di Elaborazione: E+AOD
Erschmelzungsart / Melting process / Mode d'elaboration

Marchi di Fabbrica:
Zeichen des Lieferwerkes / Trade marks / Sigles de l'usine productrice

Conferma ordine nr: EI16005776
Werks/Our Order/Ref nr.

Qualità: 304/304L
Werkstoff/Grade/Nuance

Punzone del Collaudatore:
Stempel des Werkssachverständigen / Inspector's stamp/Poinçon de l'assayeur

Avviso di Spedizione: D-VI16015452
Lieferanzeige/Packing list/B.L.

Marca: MVAISL MAXIVAL
Markenbezeichnung / Brand / Nuance

Punzonatura: 304/304L
Kennzeichnung / Marking / Marquage

Mechanical properties according to ASTM A370.

Analisi chimica
Chemische Zusammensetzung/Chemical Analysis/Analyse chimique

Colata / Heat / Schmelze/Coulée															
	min -	-	-	18,00	-	-	8,00	-	-	0,020	-	-	-	-	-
	max 0,030	1,00	2,00	20,00	1,00	1,00	10,50	-	0,040	0,030	0,100	-	-	-	-
	C %	Si %	Mn %	Cr %	Mo %	Cu %	Ni %	Co %	P %	S %	N %				
270228	0,018	0,51	1,80	18,31	0,46	0,38	8,08	0,134	0,030	0,027	0,084				

Corrosion test in 16% sulfuric acid and copper sulfate solutions

Test standard: ASTM A262-Practice E

Test	Heat treatment before test	Length of Period (h)	Test temp (°C)	Bend Angle (°)	Ø spindle (mm)	Result of visual inspection at 20 x magnification after bend test	Result
Intergranular corrosion	Sensitization	15	boil	180	5	Absence of cracks	SATISFACTORY

Produced without class I-II Ozone depleting substances.
Solution heat treated free from continuous carbide network.
Micro and macro etch test: OK
Reduction ratio = 103,2 : 1
Material solution annealed 1060° C for 0.5h/water cooled.
Material is DFARS Compliant

Sono state soddisfatte tutte le condizioni richieste
Die gestellten Anforderungen sind it. Anlage erfüllt
The material has been furnished in accordance with the requirements
Le materiel à été trouvé conforme aux exigences

Controllo antimescolanza: OK
Verwechslungprüfung: spektralanalytisch durchgeführt
Antimixing testing performed: OK
Contrôle antimelange fait: r.a.s.

Controllo visivo e dimensionale: soddisfa le esigenze
Besichtigung und Ausmessung: ohne Beanstandung
Visual inspection and dimensional checks:satisfactory
Contrôle visuel et dimensions: satisfaisant

Melted and manufactured in Italy No welding or weld repair Material free from Mercury contamination

We declare that the finished product is checked for radioactive contamination through Portal System when it leaves the production plant.

QUALITY MANAGEMENT SYSTEM CERTIFIED BY LLOYD'S REGISTER ACCORDING TO ISO 9001 : 2008, ISO/TS16949 : 2009, AS 9100C

The Quality Management System is Certified acc. Pressure Equipment Directive '97/23/EC' Annex 1,s.,4.3 by TUEV and LLOYD`S
Any act of tampering, modification, alteration, counterfeiting and/or falsification and/or any other action which modifies the contents of this test certificate shall constitute a violation of applicable civil and criminal laws. Acciaierie Valbruna shall protect its rights and interests before any competent court, authority and jurisdiction.
Maxival and/or Valplus grades/products are manufactured with ladle techniques to control composition, distribution, size and shape of non-metallic inclusions for improved machinability.
The supplied product conforms to requirements expressly requested by the purchaser and conforms to requirements specified by certified norms and standards. Should the product be used for more severe, critical and/ or in any case different applications than those the material is generally intended for, any different and/or supplementary requirements shall be specifically demanded, at least, upon order of the Product by the Purchaser. Acciaierie Valbruna SpA shall not be responsible for any improper use of the Products.

Vicenza, 21/06/16 VCQ008 (Mod. MCE2)	Il collaudatore di stabilimento / der Werkssachverständige / Works inspector / L'agent d'usine M.Rizzotto	Pagina - 2 di 2

po 2132-018

2/2

GERDAU

US-ML-MIDLOTHIAN
300 WARD ROAD
MIDLOTHIAN, TX 76065
USA

CUSTOMER SHIP TO	CUSTOMER BILL TO
AMERICAN ANCHOR BOLT MFG INC 13913 BUXLEY ST HOUSTON,TX 77045-5303 USA	AMERICAN ANCHOR BOLT MFG INC 13913 BUXLEY ST HOUSTON,TX 77045-5303 USA

GRADE	SHAPE / SIZE	DOCUMENT ID:
M1022M	Pitch Diameter Round / .677"	0000074909

LENGTH	WEIGHT	HEAT / BATCH
30'0"	8,078 LB	58027474/04

SALES ORDER	CUSTOMER MATERIAL N°
4601559/000040	STOCK MATERIAL

SPECIFICATION / DATE or REVISION
ASTM A29-15
ASTM A575-96(2013)E1

CUSTOMER PURCHASE ORDER NUMBER	BILL OF LADING	DATE
1221M	1327-0000219809	12/23/2016

CHEMICAL COMPOSITION

C %	Mn %	P %	S %	Si %	Cu %	Ni %	Cr %	Mo %	Sn %	V %	Nb %	Al %
0.21	1.04	0.016	0.036	0.20	0.24	0.08	0.17	0.025	0.007	0.033	0.001	0.003

CHEMICAL COMPOSITION

Ti %	B %	CEqvA706 %
0.002	0.0001	0.41

MECHANICAL PROPERTIES

UTS KSI	UTS MPa	YS KSI	YS MPa	Elong. %	G/L Inch
91.9	634	70.0	483	21.70	8.000

MECHANICAL PROPERTIES

ROA %
59.7

GEOMETRIC CHARACTERISTICS

R:R
117.4

METALURGICAL CHARACTERISTICS

FineGr
OK

HARDENABILITY

DI A255 Inch
1.00

The above figures are certified chemical and physical test records as contained in the permanent records of company. We certify that these data are correct and in compliance with specified requirements. This material, including the billets, was melted and manufactured in the USA. CMTR complies with EN 10204 3.1.

BHASKAR YALAMANCHILI
QUALITY DIRECTOR
Phone: (409) 769-1014 Email: Bhaskar.Yalamanchili@gerdau.com

TOM HARRINGTON
QUALITY ASSURANCE MGR
Phone: 972-779-1872 Email: Tommy.Harrington@gerdau.com

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 02-4-2017
AMS SPITZER CHARLOTTE

po 2132-018

GERDAU

US-ML-MIDLOTHIAN
300 WARD ROAD
MIDLOTHIAN, TX 76065
USA

CUSTOMER SHIP TO	CUSTOMER BILL TO
AMERICAN ANCHOR BOLT MFG INC 13913 BUXLEY ST HOUSTON,TX 77045-5303 USA	AMERICAN ANCHOR BOLT MFG INC 13913 BUXLEY ST HOUSTON,TX 77045-5303 USA

GRADE	SHAPE / SIZE	DOCUMENT ID
M1022M	Pitch Diameter Round / .677"	0000074909

LENGTH	WEIGHT	HEAT / BATCH
30'0"	8,078 LB	58027474/04

SALES ORDER	CUSTOMER MATERIAL N°
4601559/000040	STOCK MATERIAL

SPECIFICATION / DATE or REVISION
ASTM A29-15
ASTM A575-96(2013)E1

CUSTOMER PURCHASE ORDER NUMBER	BILL OF LADING	DATE
1221M	1327-0000219809	12/23/2016

COMMENTS / NOTES

Chemical and physical properties of bar stock suitable for manufacture per ASTM F1554 Grd 55, S1 and AASHTO M314 Grd 55, S1.

The above figures are certified chemical and physical test records as contained in the permanent records of company. We certify that these data are correct and in compliance with specified requirements. This material, including the billets, was melted and manufactured in the USA. CMTR complies with EN 10204 3.1.

Bhaskar Yalamanchili
BHASKAR YALAMANCHILI
QUALITY DIRECTOR
Phone: (409) 769-1014 Email: Bhaskar.Yalamanchili@gerdau.com

Tom Harrington
TOM HARRINGTON
QUALITY ASSURANCE MGR.
Phone: 972-779-1872 Email: Tommy.Harrington@gerdau.com

2132-018

Certificate of Compliance

BRIGHTON-BEST INTERNATION,INC.

6911 FAIRBANKS N. HOUSTON #150

HOUSTON TX 77040

U.S.A.

713-466-0336

G10005

AMERICAN ANCHOR BOLT MFG., L.P.

13913 BUXLEY ST

HOUSTON TX 77045

Date : 09/07/2016

RELEASE# : ULEKS707

P.O.# : 44650-J

This is to certify that the MED. CARBON HEX NUTS on the purchase order note above, confirm to the requirements and specifications per

ASME B18.2.2, ASTM A194 Gr.2H, Heavy Hex Nuts, HDG PER ASTM A153/ASTM F2329, Marking: 2HZN & Mfg's ID, Nuts must meet the proof load values of ASTM A194 2H nuts with oversize tapping for HDG finish

or the revision in effect at the time of manufacture.

Item code	Size	Description	Quantity
292200	3/4"-10	MED. CARBON HEX NUTS	1,000

Signature Stephen McFalls.

PO 2132-018

MILL TEST REPORT
Lot#: 367505A Part#: 292200

BRIGHTON-BEST INTERNATIONAL INC.
www.BrightonBest.com

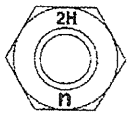
This MTR contains 1 pages (Page: 1)

NUCOR
FASTENER DIVISION

LOT NO.
367505A

Post Office Box 6100
Saint Joe, Indiana 46785
Telephone 260/337-1600

CUSTOMER NO/NAME
1554 BRIGHTON-BEST/CA
TEST REPORT SERIAL# FB485622
TEST REPORT ISSUE DATE 2/05/16
DATE SHIPPED 4/04/16
NUCOR ORDER # 942626
CUST PART # 292200
CUSTOMER P.O. # U30405
NAME OF LAB SAMPLER: RYAN UNGER, LAB TECHNICIAN



**********CERTIFIED MATERIAL TEST REPORT**********

NUCOR PART NO	QUANTITY	LOT NO.	DESCRIPTION
175707S	14000	367505A	3/4-10 GR 2H HVY HEX NUT
MANUFACTURE DATE 10/31/15			HEX NUT HOT DIP GALV

--CHEMISTRY MATERIAL GRADE -1045L

MATERIAL NUMBER	HEAT NUMBER	**CHEMISTRY COMPOSITION (WT% HEAT ANALYSIS) BY MATERIAL SUPPLIER C	MN	P	S	SI	
RM030314	DL15105376	.45	.65	.006	.019	.20	NUCOR STEEL - SOUTH CAROL

--MECHANICAL PROPERTIES IN ACCORDANCE WITH ASTM A194-14a

SURFACE HARDNESS (R30N)	CORE HARDNESS (RC)	PROOF LOAD 58500 LBS	TENSILE STRENGTH (LBS)	DEG-WEDGE STRESS (PSI)
N/A	27.8	PASS	N/A	N/A
N/A	28.8	PASS	N/A	N/A
N/A	28.0	PASS	N/A	N/A
N/A	29.0	PASS	N/A	N/A
N/A	27.6	PASS	N/A	N/A
AVERAGE VALUES FROM TESTS	28.2			

PRODUCTION LOT SIZE 139000 PCS
PASSED 24 HOUR TEMPER TEST AT 1000 F. SPEC. HRB89 MIN. PER ASTM A194-14a, CLASS 2H

--VISUAL INSPECTION IN ACCORDANCE WITH ASTM A194-14a 80 PCS. SAMPLED LOT PASSED

--COATING - HOT DIP GALVANIZED TO ASTM F2329-13 - GALVANIZING PERFORMED IN THE U.S.A.

1.	0.00272	2.	0.00286	3.	0.00277	4.	0.00315	5.	0.00355	6.	0.00348	7.	0.00245	
8.	0.00423	9.	0.00308	10.	0.00338	11.	0.00458	12.	0.00297	13.	0.00417	14.	0.00319	
15.	0.00252													

AVERAGE THICKNESS FROM 15 TESTS .00327
HEAT TREATMENT - AUSTENITIZED, OIL QUENCHED & TEMPERED (MIN 850 DEG F)

--MACROETCH O.K.

--DIMENSIONS PER ASME B18.2.6-2012

CHARACTERISTIC	#SAMPLES TESTED	MINIMUM	MAXIMUM
Width Across Corners	8	1.4030	1.4150
Thickness	32	0.7210	0.7360

ALL TESTS ARE IN ACCORDANCE WITH THE LATEST REVISIONS OF THE METHODS PRESCRIBED IN THE APPLICABLE SAE AND ASTM SPECIFICATIONS. THE SAMPLES TESTED CONFORM TO THE SPECIFICATIONS AS DESCRIBED/LISTED ABOVE AND WERE MANUFACTURED FREE OF MERCURY CONTAMINATION.
THE STEEL WAS MELTED AND MANUFACTURED IN THE U.S.A. AND THE PRODUCT WAS MANUFACTURED AND TESTED IN THE U.S.A. PRODUCT COMPLIES WITH DFARS 252.225-7014. WE CERTIFY THAT THIS DATA IS A TRUE REPRESENTATION OF INFORMATION PROVIDED BY THE MATERIAL SUPPLIER AND OUR TESTING LABORATORY. THIS CERTIFIED MATERIAL TEST REPORT RELATES ONLY TO THE ITEMS LISTED ON THIS DOCUMENT AND MAY NOT BE REPRODUCED EXCEPT IN FULL.

ACCREDITED
MECHANICAL FASTENER
CERTIFICATE NO. A2LA 0139.01
EXPIRATION DATE 02/29/16

NUCOR FASTENER
A DIVISION OF NUCOR CORPORATION
John W. Ferguson
JOHN W. FERGUSON
QUALITY ASSURANCE SUPERVISOR

REV: Test Report Serial FB485114 with original date 02/02/16
revised for PROOF TEST DONE AT INCORRECT LOAD

Chemical & Physical Tests
Reviewed and Accepted
By RR Date 02-4-2017
THE SPITZER COMPANIES

P# 2132-018

STAMPING THE FUTURE

WROUGHT WASHER MFG., INC.

January 7, 2015

Certification of Compliance

07 2476
ALBRITTON & GROVES - HOUSTON
3605 WILLOWBEND BLVD. #550
HOUSTON, TX 77054

Wrought Washer Ordr/Lot Number
288024

HT ORDER 281091

Chemical Analysis

Heat Number	C	Mn	P	S	Si
A68982	0.290	0.490	0.009	0.002	0.200

Purchase Order Number	Part Description	Date Shipped	Quantity Shipped
HARDENED 2015	3/4 F436 S MARK HDG	01/05/2015	122,400

We hereby certify that the subject parts conform to the requirements of the applicable specification indicated for the subject parts and are in complete conformance to F436-11. We hereby certify that the subject parts were hardened to RC 26-45. We hereby certify that the subject parts were hot dip galvanized in accordance with specification ASTM A153 CLASS D.

We hereby certify that all statutory requirements as to American Production and Labor Standards and all conditions of purchase applicable to the transaction have been complied with and that the subject parts were melted and manufactured in the U.S.A. No weld repairs were made to the material.

Truly yours,
Wrought Washer Mfg., Inc.

Paul H. Schaefer

Paul Schaefer
Q.C. Manager

Susan M. Daoust

Sworn and subscribed before me on January 7, 2015
My commission expires April 24, 2017.

SUSAN M. DAOUST NOTARY PUBLIC STATE OF WISCONSIN

(032) SMARK, HT, HDG, F436
WW INTERNAL USE : 60467042/790/017295/51337

1901 CHICORY RD. • MOUNT PLEASANT, WI 53403 • PHONE (262) 554-9550 • FAX (262) 554-9584
VISIT OUR WEBSITE: www.wroughtwasher.com

po 2132-018

GALLATIN STEEL

Gallatin Steel Company
4831 U.S. Highway 42 West
Ghent, KY 41045-9704
Phone: 1(800)581-3853 Fax: (859)567-3165

80847

METALLURGICAL TEST REPORT

InvoiceTo: Wrought Washer Mfg Inc
2100 S Bay Street
Milwaukee, WI 53207

Ship To: Wrought Washer Mfg Inc
Heidtman Steel Processing
4400 County Rd 59
Butler, IN 46721

Customer No: 8747
Mill Order No: 176493-2

Customer P.O. No: H2801
Customer Reference No: NA

Date: 09/30/13
Load No: 559400

This product was melted and manufactured in the USA to meet the requirements of:

Excess,
Excess HR Sheet Steel Bands

Ordered Size: Nom 0.132 (In.) X 48.76 (In.) X Coil

Coil Number(s): 1180442

CHEMICAL ANALYSIS (Weight %)

Heat No	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Al	Ca	Nb	V	B	Ti	N	Sn
A68982	0.29	0.49	0.009	0.002	0.20	0.11	0.08	0.85	0.20	0.031	0.0011	0.004	0.002	0.0001	0.002	0.0102	0.006

Hot rolled coils manufactured through Gallatin Steel do not contain welds or weld repairs at the time of shipment (fca mill). Mercury was not added during production of this material. The material was produced using a fully killed fine grain practice.

Above tests performed in accordance to ASTM standards E8 (yield strength determined using 0.2% offset method and elongation determined using after fracture method) or JIS Z2241, E18, E415, and E1019 and are correct as contained in the records of the company.

The elongation original gage length is 2 inches for ASTM test method and 1.97 inches for JIS test method.
Above test results were performed in accordance to EN 10204 3.1

This report shall not be reproduced, except in full, without written approval of the undersigned laboratory managers.
* This mechanical property has been tested at a subcontractor's laboratory.

Stephen S. Sipple
Chemical Laboratory

Mark Holtman
Mechanical Laboratory

The information contained in this report may be confidential information intended only for the use of the individual or entity named above.

PO 2132-018

ROGERS BROTHERS INC.

HOT DIP GALVANIZING

CERTIFICATE OF COMPLIANCE

FOR HOT DIP GALVANIZING

CUSTOMER: WROUGHT WASHER MFG., INC.

DATE: NOVEMBER 17, 2014

PO#: 288024-01

ROGERS ORDER#: 98364

DESCRIPTION: (1.468 OD - .828 ID - .128 THK) 3/4" S MARK

WWIC#: 017295

COATING THICKNESS

TAG#	QTY.	AVERAGE	HIGH	LOW
396491	295,559	4.17	5.81	2.48

WE HEREBY CERTIFY THAT THE ABOVE SIZE AND LOT NUMBER WHICH WAS HOT DIP GALVANIZED IN OUR PLANT MEETS THE SPECIFICATIONS OF ASTM A153, CLASS D.

THE ABOVE SIZES AND LOT NUMBERS COMPLY WITH THE COATING, WORKMANSHIP, FINISH, AND APPEARANCE REQUIREMENTS OF ASTM F2329.

THE HOT DIP GALVANIZING IS ROHS COMPLIANT. THE GALVANIZING PROCESS WAS CONDUCTED IN A TEMPERATURE RANGE OF 830F TO 850F.

THIS PRODUCT WAS GALVANIZED IN ROCKFORD, IL USA.

ROGERS BROTHERS INC.

Lorraine P Shelburn

Lorraine P. Shelburne
Vice President

LPS:pd

SUBSCRIBED AND SWORN
BEFORE ME THIS 17TH DAY
OF NOVEMBER 2014, AD

Judith A Ferolie
NOTARY PUBLIC

OFFICIAL SEAL
JUDITH A FEROLIE
NOTARY PUBLIC - STATE OF ILLINOIS
MY COMMISSION EXPIRES:01/23/16

ROGERS BROTHERS, INC. 1925 KISHWAUKEE STREET, ROCKFORD, ILLINOIS 61104-5197 PHONE: 815/965-5132 FAX: 815/965-3765
E-MAIL: rogersbros@tds.net

po 2132-018

STAMPING THE FUTURE
WROUGHT WASHER MFG., INC.

Heat Treat Certification

Wrought Washer Mfg. Inc. certifies the listed results of inspection and testing to accurately reflect the processes performed and data obtained as a result of our heat treatment of the specified product.

Heat Treat Order Number	Approx Pieces	Pounds	Part Number	Tag Number	Date Heat Treated
281091	242,000	12,308	017290	994790	11/5/2014

Heat Treat Requirement: HRC 38-45

The above parts were heat treated, quenched and tempered to obtain a hardness of: HRC 41 44

The above parts were processed in the USA.

Paul H. Schaefer
Quality Manager
Wrought Washer Mfg., Inc.

2100 South Bay Street, Milwaukee, WI 53207
Phone 414-744-0771 Fax 414-482-0144 Toll Free 800-558-5217
Visit our website: www.wroughtwasher.com

PO 2132-018

CURTIS KELLY, INC.

ITEM#: T - 501 JOB# 3491

PIPE SUPPORT	KNEEBRACE	VESSEL CLIPS	# PCS.	NOTES
	N1		1	
	N2		1	
	N3		1	
	N4		1	

1-23-2017

SECTION 5
NDE REPORTS

UOP RUSSELL LLC
42" ID X 60" ID X 98'-0" SM/SM
DEMETHANIZER
ITEM: T-501
JOB # 2132

Weld Matrix

Weld #	Welder	Final PT / MT	RT	NDE Reject	Comments
CS-1	H81, M1	See Below	REJECTED	031217SY-RT4 Views 4-5, 7-8, 8-9	
CS-1 R1	H92	See Below	REJECTED	031617SY-RT4 4-5, 8-9	47367 PT CAVITY Views 4-5, 7-8, 8-9
CS-1 R2	H51, H92	PT062617EDS3	032317-JB04		47408 PT Cavity View 4-5
CS-2	5, EE	N/A	021217SY-RT1		
CS-3	5, H61	N/A	021217SY-RT1		
CS-4	5, EE	N/A	021217SY-RT2		
CS-5	E, M1	N/A	031217SY-RT4		
CS-6	H61, EE	N/A	021217SY-RT3		
CS-7	H61, EE	N/A	021217SY-RT3		
CS-8	H61, H25	PT - 39128	061117-JB01		
CS-9	H61, T	43462 PT	'030217SY-RT3		
CS-10	H61, 5	N/A	021217SY-RT4		
CS-11	H61, 5	N/A	021217SY-RT5		
CS-12	H61	N/A	030217SY-RT4 030317-JB04		
LS-1	E	N/A	020217SY-RT2		
LS-2	E	N/A	020217SY-RT2*		*Reshoot Views 6-7, 10-11
LS-3	E	N/A	020217SY-RT3		
LS-4	H61	N/A	020217SY-RT3		
LS-5	H61	N/A	020317SY-RT1		
LS-6	H61	N/A	020317SY-RT1		
LS-7	5	See Below	REJECTED	RT 020317SY-RT2 VIEW 1-2	
LS-7 R1	5	See Below	REJECTED	RT 020517-JB02 VIEW 1-2	View 1-2

UOP RUSSELL LLC
42" ID X 60" ID X 98'-0" SM/SM
DEMETHANIZER
ITEM: T-501
JOB # 2132

Weld Matrix

Weld #	Welder	Final PT / MT	RT	NDE Reject	Comments
LS-7 R2	EE, E	PT062617EDS3	021217SY-RT9		43076 PT CAVITY
LS-8	H61	42833 PT	020317SY-RT3		
LS-8A	H61	42833 PT	020317SY-RT3		
LS-8B	H61	42833 PT	020317SY-RT3		
LS-9	H61	N/A	020317SY-RT4		
LS-10	5	N/A	020317SY-RT5		
LS-11	H61	N/A	020317SY-RT5		
A-1	M1	N/A	020417-JB06		
A-2	H72	N/A	N/A		
A-3	H72	N/A	N/A		
A-4	H72	N/A	N/A		
B -1	QL, H51	N/A	061517-JB04		
B -2	H25	N/A	N/A		
B -3	H25	N/A	N/A		
B -4	H25	N/A	N/A		
C-1	E	N/A	020217SY-RT4		
C-2	H61, H25	PT 39123	N/A		
C-3	N/A	N/A	N/A		
C-3 RW	R0	39210	N/A		
C-4	N/A	N/A	N/A		
C-4 RW	R0	39210	N/A		
D-1	M1	N/A	020417-JB06		

UOP RUSSELL LLC
42" ID X 60" ID X 98'-0" SM/SM
DEMETHANIZER
ITEM: T-501
JOB # 2132

Weld Matrix

Weld #	Welder	Final PT / MT	RT	NDE Reject	Comments
D-2	7	N/A	N/A		
D-3	7	N/A	N/A		
D-4	7	N/A	N/A		
E-1	H51	N/A	022517-JB02		
E-2	H72	N/A	N/A		
E-3	H72	N/A	N/A		
E-4	H72	N/A	N/A		
F-1	H51	N/A	022317-JB03		
F-2	H25, H72	N/A	N/A		
F-3	H25, H72	N/A	N/A		
F-4	H25, H72	N/A	N/A		
G-1	H51	N/A	022317-JB03		
G-2	H25, H72	N/A	N/A		
G-3	H25, H72	N/A	N/A		
G-4	H25, H72	N/A	N/A		
H-1	H51	N/A	022317-JB03		
H-2	H25, H72	N/A	N/A		
H-3	H25, H72	N/A	N/A		
H-4	H25, H72	N/A	N/A		
J-1	M1	N/A	020417-JB05		
J-2	H72	N/A	N/A		
J-3	H72	N/A	N/A		

UOP RUSSELL LLC
42" ID X 60" ID X 98'-0" SM/SM
DEMETHANIZER
ITEM: T-501
JOB # 2132

Weld Matrix

Weld #	Welder	Final PT / MT	RT	NDE Reject	Comments
J-4	H72	N/A	N/A		
K1-1	E	N/A	020417-JB04		
K1-2	E	N/A	N/A		
K1-3	H72	N/A	N/A		
K1-4	H72	N/A	N/A		
K2-1	E	N/A	020417-JB04		
K2-2	H25, H72	N/A	N/A		
K2-3	H25, H72	N/A	N/A		
K2-4	H25, H72	N/A	N/A		
K3-1	E	N/A	020217SY-RT4		
K3-2	H25, H72	N/A	N/A		
K3-3	H25, H72	N/A	N/A		
K3-4	H25, H72	N/A	N/A		
K4-1	E	N/A	020217SY-RT4		
K4-2	E	N/A	N/A		
K4-3	H72	N/A	N/A		
K4-4	H72	N/A	N/A		
K5-1	E	N/A	020217SY-RT4		
K5-2	E	N/A	N/A		
K5-3	H72	N/A	N/A		
K5-4	H72	N/A	N/A		
K6-1	E	N/A	020417-JB04		

UOP RUSSELL LLC
42" ID X 60" ID X 98'-0" SM/SM
DEMETHANIZER
ITEM: T-501
JOB # 2132

Weld Matrix

Weld #	Welder	Final PT / MT	RT	NDE Reject	Comments
K6-2	H25, H72	N/A	N/A		
K6-3	H25, H72	N/A	N/A		
K6-4	H25, H72	N/A	N/A		
K7-1	E	N/A	020417-JB04		
K7-2	H92	N/A	N/A		
K7-3	R0, H82	N/A	N/A		
K7-4	R0, H82	N/A	N/A		
K8-1	E	N/A	020217SY-RT4		
K8-2	E	N/A	N/A		
K8-3	H72	N/A	N/A		
K8-4	H72	N/A	N/A		
L-1	H51	N/A	040417SY-RT4		
L-2	H51	N/A	040417SY-RT4		
L-3	H51	See Below	REJECT 040517SY-RT4 *	040417SY-RT4 * View 1-2	* View 4-1 Re-Shoot
L-3R1	H51	N/A	040517SY-RT3 * 040617SY-RT3 **		*View 1-2 ** View 4-1
L-4	E	N/A	N/A		
L-5	E	N/A	N/A		
L-6	E	N/A	N/A		
M-1	H51	N/A	022517-JB02		
M-2	H72	N/A	N/A		
M-3	H72	N/A	N/A		
M-4	H72	N/A	N/A		

UOP RUSSELL LLC
42" ID X 60" ID X 98'-0" SM/SM
DEMETHANIZER
ITEM: T-501
JOB # 2132

Weld Matrix

Weld #	Welder	Final PT / MT	RT	NDE Reject	Comments
N1-1	E	N/A	020417-JB01		
N1-2	E	N/A	020417-JB05		
N1-3	H61	N/A	N/A		
N1-4	H61	N/A	N/A		
N1-5	H61	N/A	N/A		
N2-1	E	N/A	020417-JB01		
N2-2	E	N/A	020417-JB05		
N2-3	H61, H25	PT - 39032	N/A		
N2-4	II, 00	39056	N/A		
N2-4 RW	R0	39210	N/A		
N2-5	II, 00	39056	N/A		
N2-5 RW	R0	39210	N/A		
N3-1	E	N/A	020217SY-RT4		
N3-2	E	N/A	020417-JB03		
N3-3	H92, H82	N/A	N/A		
N3-4	H92, H82	N/A	N/A		
N3-5	H92, H82	N/A	N/A		
N4-1	E	N/A	020417-JB01		
N4-2	E	N/A	020417-JB05		
N4-3	H92, H82	N/A	N/A		
N4-4	H92, H82	N/A	N/A		
N4-5	H92, H82	N/A	N/A		

UOP RUSSELL LLC
42" ID X 60" ID X 98'-0" SM/SM
DEMETHANIZER
ITEM: T-501
JOB # 2132

Weld Matrix

Weld #	Welder	Final PT / MT	RT	NDE Reject	Comments
P-1	H72	N/A	N/A		
Q1-1	H82	N/A	N/A		
Q2-1	7	N/A	N/A		
Q3-1	7	N/A	N/A		
Q4-1	H87	N/A	N/A		
Lifting Lug	H82	47370 PT	N/A		
Tailing Lug	H6	47375 MT	N/A		
Lifting Lug Plate Material	N/A	N/A	N/A		030217OM1 UT Lamscan
Shell Area Under Lifting Lugs	N/A	N/A	N/A		030217OM1 UT Lamscan
Lifting Lug Pads	H82	43484 PT	N/A		
Temp Attachments	N/A	PT - 062517AP3 ID/OD	N/A		

UOP RUSSELL
DEMETHANIZER
TAG# T-501 JOB # 2132

Weld Matrix

Weld #	Welder	RT	NDE Reject	Comments
P1	H51	N/A		
P2	H51	N/A		
P3	H51	062717-JB08		
P4	H51	N/A		
P5	H51	N/A		
P6	H51	N/A		
P7	H51	N/A		
P8	H51	N/A		
P9	H51	N/A		
P10	H51	N/A		
P11	H51	N/A		
P12	H51	062717-JB08		
P13	H51	N/A		
P14	H51	N/A		
P15	H51	062717-JB06		
P16	H51	N/A		
P17	H92	N/A		
P18	H51	062717-JB06		
P19	H51	N/A		
P20	H51	N/A		
P21	H51	N/A		

UOP RUSSELL
DEMETHANIZER
TAG# T-501 JOB # 2132

Weld Matrix

Weld #	Welder	RT	NDE Reject	Comments
P22	H51	N/A		
P23	H92	N/A		
P24	H92	062717-JB06		
P25	H92	N/A		
P26	H51	N/A		
P27	H51	N/A		
P28	H51	N/A		
P29	H51	062717-JB07		
P30	H51	N/A		
P31	H51	N/A		
P32	H51	N/A		
P33	H51	N/A		
P34	H92	N/A		
P35	H92	N/A		
P36	H92	062717-JB07		
P37	H51	N/A		
P38	H51	N/A		
P39	H51	062717-JB11		
P40	H51	N/A		
P41	H51	N/A		
P42	H51	N/A		

UOP RUSSELL
DEMETHANIZER
TAG# T-501 JOB # 2132

Weld Matrix

Weld #	Welder	RT	NDE Reject	Comments
P43	H51	N/A		
P44	H92	062717-JB09		
P45	H92	062717-JB09		
P46	H51	N/A		
P47	H51	062717-JB10		
P48	H92	N/A		
P49	H92	N/A		
P50	H51, QL	062717-JB10		

Spitzer INDUSTRIES

REPORT NO.: 39032

NON-DESTRUCTIVE EXAMINATION REPORT

JOB NO.: 2132 DATE: 06-13-17 FACILITY: ☐ TANNER ☒ HEAVY FAB. ☒ CK ☐ ORIZON

T NO.: — SERIAL NO.: — PART DESCRIPTION: NOZZLE BEFORE PWHT

EXAMINATION PERFORMED: ☐ MT ☒ PT ☐ UT ☐ VT PROCEDURE NO.: PT-03.01 Rev 1 Addendum PT-03.02 REV. NO.: 0

CODE/ACCEPT CRITERIA: ASME SECT. VIII ☒ DIV. 1, ☐ DIV. 2, ASME B31.3, ☐ SERVICE —, B31.4 ☐ B31.8 ☐ API-1104 ☐

AWS D1.1 ☐ CONNECTION TYPE ☐ STAT. LOADED NT ☐ CYCL. LOADED NT ☐ TUBULAR CONN. OTHER ☐: —

MATERIAL: CS ☐ SS ☒ OTHER: ☐ — SURFACE COND.: AS WELDED ☐ GROUND ☒ CLEANED

EQUIPMENT

EQUIP. DESC.	MANUFACTURER	MODEL NO.:	SERIAL NO.:	CAL.DUE DATE
YOKE	N/A	N/A	N/A	N/A
LIGHT METER	MAGNAFLUX	W2W	100901H5H	11-16-13
BLACKLIGHT	N/A	N/A	N/A	N/A
UT SCOPE				
TRANSDUCERS				
CABLES				
CAL. BLOCKS				

CONSUMABLES

	CLEANER	PENETRANT	DEVELOPER	MAG. PARTICLES	CONTRAST PAINT	COUPLANT
MANUFACTURER	Magnaflux	Magnaflux	Magnaflux	N/A	N/A	N/A
BRAND/TYPE	SKC-S	SKL-WP2	SKD-S2			
BATCH NO.	16F-24K	11H-103	17B-11K			

TECHNIQUE

MT ☐ AC YOKE ☐ WET ☐ DRY ☐ FLUORESCENT ☐ COLOR CONTRAST, LIGHT INTENSITY — fc, SURFACE TEMP — °F

PT ☐ TYPE I FLUORESCENT ☐ TYPE II VISIBLE ☐ A WATER WASH, ☐ B LIPOPHILIC, ☐ C SOLVENT ☐ D HYDROPHILIC
DWELL TIME 15 min., DEVELOP TIME 10 min., LIGHT INTENSITY +100 fc, SURFACE TEMP AMB °F

UT ☐ ST. BEAM ☐ ANGLE BEAM ☐ 45° ☐ 60° ☐ 70° TRANSDUCER SIZE & FREQUENCY —

VT ☐ DIRECT, ☐ REMOTE BORE SCOPE, ☐ REMOTE VIDEO, LIGHT INTENSITY — fc

EXAMINATION RESULTS

INDICATION CODES: NR = NO RECORDABLE INDICATION, L = LINEAR INDICATIONS, C = CRACK, NI = NO INDICATIONS

IDENTIFICATION	SIZE/THICKNESS	ACC. /REJ.	IND.CODE	WS REMARKS
N2-3	N/A	ACC	NI	H-61 PT BEFORE PWHT
				H-25
				REQ # 158072

CERTIFICATION

TECHNICIAN SIGNATURE	LEVEL	DATE	JOB HOURS
Vitor Vitor VV	II	06-13-17	1.5

TECHNICIAN SIGNATURE — LEVEL — DATE — JOB HOURS

CLIENT SIGNATURE — DATE

Spitzer INDUSTRIES

REPORT NO.: 39056

NON-DESTRUCTIVE EXAMINATION REPORT

JOB NO.: 2132 DATE: 06-16-17 FACILITY: ☐ TANNER ☐ HEAVY FAB. ☑ CK ☐ ORIZON

T NO.: — SERIAL NO.: — PART DESCRIPTION: NOZZLE

EXAMINATION PERFORMED: ☐ MT ☑ PT ☐ UT ☐ VT PROCEDURE NO.: PT-03-01 Rev 1 addendum PT-03-02 REV. NO.: 0

CODE/ACCEPT CRITERIA: ASME SECT. VIII ☑ DIV. 1, ☐ DIV. 2, ASME B31.3, ☐ SERVICE —, B31.4 ☐ B31.8 ☐ API-1104 ☐

AWS D1.1 ☐ CONNECTION TYPE ☐ STAT. LOADED NT ☐ CYCL. LOADED NT ☐ TUBULAR CONN. OTHER ☐: —

MATERIAL: CS ☐ SS ☑ OTHER: ☐ — SURFACE COND.: AS WELDED ☑ GROUND ☐ CLEANED

EQUIPMENT

EQUIP. DESC.	MANUFACTURER	MODEL NO.:	SERIAL NO.:	CAL.DUE DATE
YOKE	NA	NA	NA	NA
LIGHT METER	MAGNAFLUX	W2M	10090145H	11-16-17
BLACKLIGHT	NA	NA	NA	NA
UT SCOPE				
TRANSDUCERS				
CABLES				
CAL. BLOCKS				

CONSUMABLES

	CLEANER	PENETRANT	DEVELOPER	MAG. PARTICLES	CONTRAST PAINT	COUPLANT
MANUFACTURER	Magnaflux	Magnaflux	Magnaflux	NA	NA	NA
BRAND/TYPE	SKC-S	SKL-NP2	SKD-S2			
BATCH NO.	16F24K	11H-103	17B-11K			

TECHNIQUE

MT ☐ AC YOKE ☐ WET ☐ DRY ☐ FLUORESCENT ☐ COLOR CONTRAST, LIGHT INTENSITY — fc, SURFACE TEMP — °F

PT ☐ TYPE I FLUORESCENT ☐ TYPE II VISIBLE ☐ A WATER WASH, ☐ B LIPOPHILIC, ☐ C SOLVENT ☐ D HYDROPHILIC
DWELL TIME 15 min., DEVELOP TIME 10 min., LIGHT INTENSITY +100 fc, SURFACE TEMP AMB °F

☐ ST. BEAM ☐ ANGLE BEAM ☐ 45° ☐ 60° ☐ 70° TRANSDUCER SIZE & FREQUENCY —

VT ☐ DIRECT, ☐ REMOTE BORE SCOPE, ☐ REMOTE VIDEO, LIGHT INTENSITY — fc

EXAMINATION RESULTS

INDICATION CODES: NR = NO RECORDABLE INDICATION, L = LINEAR INDICATIONS, C = CRACK, NI = NO INDICATIONS

IDENTIFICATION	SIZE/THICKNESS	ACC. /REJ.	IND.CODE	W.S	REMARKS
N2-4	NA	ACC	NI	II,00	FINAL AFTER PWHT
N2-5	NA	ACC	NI	II,00	FINAL AFTER PWHT

REQ # 158205

CERTIFICATION

Vasi Vijay VV — TECHNICIAN SIGNATURE | II — LEVEL | 06-16-17 — DATE | 1.5 — JOB HOURS

— TECHNICIAN SIGNATURE | — LEVEL | — DATE | — JOB HOURS

— CLIENT SIGNATURE | — DATE

Spitzer INDUSTRIES

REPORT NO.: 39123

NON-DESTRUCTIVE EXAMINATION REPORT

JOB NO.: 2132 DATE: 6-11-17 FACILITY: ☐ TANNER ☐ HEAVY FAB. ☑ CK ☐ ORIZON

.T NO.: — SERIAL NO.: — PART DESCRIPTION: Nozzle before Pad

EXAMINATION PERFORMED: ☐ MT ☑ PT ☐ UT ☐ VT PROCEDURE NO.: PT-03.01 Rev. 1/addendum PT-03.02 REV. NO.: 0

CODE/ACCEPT CRITERIA: ASME SECT. VIII ☑ DIV. 1, ☐ DIV. 2, ASME B31.3, ☐ SERVICE —, B31.4 ☐ B31.8 ☐ API-1104 ☐

AWS D1.1 ☐ CONNECTION TYPE ☐ STAT. LOADED NT ☐ CYCL. LOADED NT ☐ TUBULAR CONN. OTHER ☐: —

MATERIAL: CS ☐ SS ☑ OTHER: ☐ — SURFACE COND.: AS WELDED ☑ GROUND ☐ CLEANED

EQUIPMENT

EQUIP. DESC.	MANUFACTURER	MODEL NO.:	SERIAL NO.:	CAL.DUE DATE
YOKE	NA	NA	NA	NA
LIGHT METER	Magnaflux	WLM	100 901 454	11-16-17
BLACKLIGHT	NA	NA	NA	NA
UT SCOPE				
TRANSDUCERS				
CABLES				
CAL. BLOCKS				

CONSUMABLES

	CLEANER	PENETRANT	DEVELOPER	MAG. PARTICLES	CONTRAST PAINT	COUPLANT
MANUFACTURER	Magnaflux	Magnaflux	Magnaflux	NA	NA	NA
BRAND/TYPE	SKC-S	SKL-WP2	SKD-S2			
BATCH NO.	16J-05K	11H-103	16K-16K			

TECHNIQUE

MT ☐ AC YOKE ☐ WET ☐ DRY ☐ FLUORESCENT ☐ COLOR CONTRAST, LIGHT INTENSITY — fc, SURFACE TEMP — °F

PT ☐ TYPE I FLUORESCENT ☐ TYPE II VISIBLE ☐ A WATER WASH, ☐ B LIPOPHILIC, ☑ C SOLVENT ☐ D HYDROPHILIC
DWELL TIME 15 min., DEVELOP TIME 10 min., LIGHT INTENSITY +100 fc, SURFACE TEMP AMB °F

UT ☐ ST. BEAM ☐ ANGLE BEAM ☐ 45° ☐ 60° ☐ 70° TRANSDUCER SIZE & FREQUENCY —

VT ☐ DIRECT, ☐ REMOTE BORE SCOPE, ☐ REMOTE VIDEO, LIGHT INTENSITY — fc

EXAMINATION RESULTS

INDICATION CODES: NR = NO RECORDABLE INDICATION, L = LINEAR INDICATIONS, C = CRACK, NI = NO INDICATIONS

IDENTIFICATION	SIZE/THICKNESS	ACC. /REJ.	IND.CODE	WS REMARKS
C-2	NA	ACC	NI	H61, A25
				Req #158068

CERTIFICATION

Juan Garcia JG	II	6-11-17	1.0	
TECHNICIAN SIGNATURE	LEVEL	DATE	JOB HOURS	
TECHNICIAN SIGNATURE	LEVEL	DATE	JOB HOURS	
CLIENT SIGNATURE	DATE			

Spitzer INDUSTRIES

REPORT NO.: 39128

NON-DESTRUCTIVE EXAMINATION REPORT

JOB NO.: 2132 DATE: 6-12-17 FACILITY: ☐ TANNER ☐ HEAVY FAB. ☐ CK ☐ ORIZON

P.O. NO.: — SERIAL NO.: — PART DESCRIPTION: Circle Seam ID & OD

EXAMINATION PERFORMED: ☐ MT ☑ PT ☐ UT ☐ VT PROCEDURE NO.: PT-03.01 Rev 1/addendum PT-03.02 REV. NO.: 0

CODE/ACCEPT CRITERIA: ASME SECT. VIII ☑ DIV. 1, ☐ DIV. 2, ASME B31.3, ☐ SERVICE —, B31.4 ☐ B31.8 ☐ API-1104 ☐

AWS D1.1 ☐ CONNECTION TYPE ☐ STAT. LOADED NT ☐ CYCL. LOADED NT ☐ TUBULAR CONN. OTHER ☐: —

MATERIAL: CS ☐ SS ☑ OTHER: ☐ — SURFACE COND.: AS WELDED ☑ GROUND ☐ CLEANED

EQUIPMENT

EQUIP. DESC.	MANUFACTURER	MODEL NO.:	SERIAL NO.:	CAL.DUE DATE
YOKE	NA	NA	NA	NA
LIGHT METER	Magnaflux	WLM	100 901 454	11-16-17
BLACKLIGHT	NA	NA	NA	NA
UT SCOPE				
TRANSDUCERS				
CABLES				
CAL. BLOCKS				

CONSUMABLES

	CLEANER	PENETRANT	DEVELOPER	MAG. PARTICLES	CONTRAST PAINT	COUPLANT
MANUFACTURER	Magnaflux	Magnaflux	Magnaflux	NA	NA	NA
BRAND/TYPE	SKC-S	SKL-WP2	SKD-S2			
BATCH NO.	16J-05K	11H-103	16K-16K			

TECHNIQUE

MT: ☐ AC YOKE ☐ WET ☐ DRY ☐ FLUORESCENT ☐ COLOR CONTRAST, LIGHT INTENSITY — fc, SURFACE TEMP — °F

PT: ☐ TYPE I FLUORESCENT ☐ TYPE II VISIBLE ☐ A WATER WASH, ☐ B LIPOPHILIC, ☑ C SOLVENT ☐ D HYDROPHILIC
DWELL TIME 15 min., DEVELOP TIME 10 min., LIGHT INTENSITY +100 fc, SURFACE TEMP AMB °F

UT: ☐ ST. BEAM ☐ ANGLE BEAM ☐ 45° ☐ 60° ☐ 70° TRANSDUCER SIZE & FREQUENCY —

VT: ☐ DIRECT, ☐ REMOTE BORE SCOPE, ☐ REMOTE VIDEO, LIGHT INTENSITY — fc

EXAMINATION RESULTS

INDICATION CODES: NR = NO RECORDABLE INDICATION, L = LINEAR INDICATIONS, C = CRACK, NI = NO INDICATIONS

IDENTIFICATION	SIZE/THICKNESS	ACC. /REJ.	IND.CODE	WS REMARKS
CS-8	NA	ACC	NI	H61, H25
				Note: ID & OD
				Req#158064

CERTIFICATION

Juan Garcia JG	II	6-12-17	2.0	
TECHNICIAN SIGNATURE	LEVEL	DATE	JOB HOURS	
TECHNICIAN SIGNATURE	LEVEL	DATE	JOB HOURS	
CLIENT SIGNATURE	DATE			

Spitzer INDUSTRIES

REPORT NO.: 39210

NON-DESTRUCTIVE EXAMINATION REPORT

JOB NO.: 2132 DATE: 6-27-17 FACILITY: ☐ TANNER ☐ HEAVY FAB. ☑ CK ☐ ORIZON

PART NO.: — SERIAL NO.: — PART DESCRIPTION: PT Final Rework

EXAMINATION PERFORMED: ☐ MT ☑ PT ☐ UT ☐ VT PROCEDURE NO.: PT-03.01 Rev 1/addendum PT-03.02 REV. NO.: 0

CODE/ACCEPT CRITERIA: ASME SECT. VIII ☑ DIV. 1, ☐ DIV. 2, ASME B31.3, ☐ SERVICE —, B31.4 ☐ B31.8 ☐ API-1104 ☐

AWS D1.1 ☐ CONNECTION TYPE ☐ STAT. LOADED NT ☐ CYCL. LOADED NT ☐ TUBULAR CONN. OTHER ☐: —

MATERIAL: CS ☐ SS ☑ OTHER: ☐ — SURFACE COND.: AS WELDED ☑ GROUND ☐ CLEANED

EQUIPMENT

EQUIP. DESC.	MANUFACTURER	MODEL NO.:	SERIAL NO.:	CAL.DUE DATE
YOKE	NA	NA	NA	NA
LIGHT METER	Magnaflux	WLM	100 901 454	11-16-17
BLACKLIGHT	NA	NA	NA	NA
UT SCOPE				
TRANSDUCERS				
CABLES				
CAL. BLOCKS				

CONSUMABLES

	CLEANER	PENETRANT	DEVELOPER	MAG. PARTICLES	CONTRAST PAINT	COUPLANT
MANUFACTURER	Magnaflux	Magnaflux	Magnaflux	NA	NA	NA
BRAND/TYPE	SKL-S	SKL-WP2	SKD-S2			
BATCH NO.	16J-05K	11H-103	16K-16K			

TECHNIQUE

MT ☐ AC YOKE ☐ WET ☐ DRY ☐ FLUORESCENT ☐ COLOR CONTRAST, LIGHT INTENSITY — fc, SURFACE TEMP — °F

PT ☐ TYPE I FLUORESCENT ☐ TYPE II VISIBLE ☐ A WATER WASH, ☐ B LIPOPHILIC, ☑ C SOLVENT ☐ D HYDROPHILIC
DWELL TIME 15 min., DEVELOP TIME 10 min., LIGHT INTENSITY +100 fc, SURFACE TEMP AMB °F

UT ☐ ST. BEAM ☐ ANGLE BEAM ☐ 45° ☐ 60° ☐ 70° TRANSDUCER SIZE & FREQUENCY —

VT ☐ DIRECT, ☐ REMOTE BORE SCOPE, ☐ REMOTE VIDEO, LIGHT INTENSITY — fc

EXAMINATION RESULTS

INDICATION CODES: NR = NO RECORDABLE INDICATION, L = LINEAR INDICATIONS, C = CRACK, NI = NO INDICATIONS

IDENTIFICATION	SIZE/THICKNESS	ACC. /REJ.	IND.CODE	WS	REMARKS
C-3 RW	NA	ACC	NI	RO	
C-4 RW	↓	↓	↓	↓	
N2-4 RW					
N2-5 RW					
					Req#158412

CERTIFICATION

Juan Garcia JG	II	6-27-17	2.0	
TECHNICIAN SIGNATURE	LEVEL	DATE	JOB HOURS	
TECHNICIAN SIGNATURE	LEVEL	DATE	JOB HOURS	
CLIENT SIGNATURE	DATE			

Spitzer INDUSTRIES

REPORT NO.: 42833

NON-DESTRUCTIVE EXAMINATION REPORT

JOB NO.: 82132 MR 3/3/17 DATE: 3-2-17 FACILITY: ☐ TANNER ☐ HEAVY FAB. ☑ CK ☐ ORIZON

T NO.: — SERIAL NO.: — PART DESCRIPTION: long seam

EXAMINATION PERFORMED: ☐ MT ☑ PT ☐ UT ☐ VT PROCEDURE NO.: PT-03-01 Rev 1 / addendum PT-03-02 REV. NO.: 0

CODE/ACCEPT CRITERIA: ASME SECT. VIII ☑ DIV. 1, ☐ DIV. 2, ASME B31.3, ☐ SERVICE —, B31.4 ☐ B31.8 ☐ API-1104 ☐

AWS D1.1 ☐ CONNECTION TYPE ☐ STAT. LOADED NT ☐ CYCL. LOADED NT ☐ TUBULAR CONN. OTHER ☐: —

MATERIAL: CS ☐ SS ☐ OTHER: ☐ — SURFACE COND.: AS WELDED ☑ GROUND ☐ CLEANED

EQUIPMENT

EQUIP. DESC.	MANUFACTURER	MODEL NO.:	SERIAL NO.:	CAL.DUE DATE
YOKE	NA	NA	NA	NA
LIGHT METER	MAGNAFLUX FCWP	W2M	100901454	11-16-17
BLACKLIGHT	NA	NA	NA	NA
UT SCOPE				
TRANSDUCERS				
CABLES				
CAL. BLOCKS				

CONSUMABLES

	CLEANER	PENETRANT	DEVELOPER	MAG. PARTICLES	CONTRAST PAINT	COUPLANT
MANUFACTURER	Magnaflux	Magnaflux	Magnaflux	NA	NA	NA
BRAND/TYPE	SKD-S	SKL-WP2	SKD-S2			
BATCH NO.	16J-04K	11H-103	15A-08K			

TECHNIQUE

MT ☐ AC YOKE ☐ WET ☐ DRY ☐ FLUORESCENT ☐ COLOR CONTRAST, LIGHT INTENSITY — fc, SURFACE TEMP — °F

PT ☐ TYPE I FLUORESCENT ☐ TYPE II VISIBLE ☐ A WATER WASH, ☐ B LIPOPHILIC, ☑ C SOLVENT ☐ D HYDROPHILIC
DWELL TIME 15 min., DEVELOP TIME 10 min., LIGHT INTENSITY +100 fc, SURFACE TEMP AMB °F

☐ ST. BEAM ☐ ANGLE BEAM ☐ 45° ☐ 60° ☐ 70° TRANSDUCER SIZE & FREQUENCY —

VT ☐ DIRECT, ☐ REMOTE BORE SCOPE, ☐ REMOTE VIDEO, LIGHT INTENSITY — fc

EXAMINATION RESULTS

INDICATION CODES: NR = NO RECORDABLE INDICATION, L = LINEAR INDICATIONS, C = CRACK, NI = NO INDICATIONS

IDENTIFICATION	SIZE/THICKNESS	ACC. /REJ.	IND.CODE	WS REMARKS
LS-B	NA	ACC	NI	H-61
LS-BA				
LS-BB				
				REQ # 124332

CERTIFICATION

Vasi Votau VV	II	3-2-17	1.5
TECHNICIAN SIGNATURE	LEVEL	DATE	JOB HOURS
Juan Garcia JG	I	3-2-17	—
TECHNICIAN SIGNATURE	LEVEL	DATE	JOB HOURS
CLIENT SIGNATURE	DATE		

Spitzer INDUSTRIES

REPORT NO.: 43076

NON-DESTRUCTIVE EXAMINATION REPORT

JOB NO.: 2132 DATE: 2-11-17 FACILITY: ☐ TANNER ☑ HEAVY FAB. ☑ CK ☐ ORIZON

PART NO.: — SERIAL NO.: — PART DESCRIPTION: Long Seam Cavity

EXAMINATION PERFORMED: ☐ MT ☑ PT ☐ UT ☐ VT PROCEDURE NO.: PT-03.01 Rev 1/addendum PT-03.02 REV. NO.: 0

CODE/ACCEPT CRITERIA: ASME SECT. VIII ☑ DIV. 1, ☐ DIV. 2, ASME B31.3, ☐ SERVICE —, B31.4 ☐ B31.8 ☐ API-1104 ☐

AWS D1.1 ☐ CONNECTION TYPE ☐ STAT. LOADED NT ☐ CYCL. LOADED NT ☐ TUBULAR CONN. OTHER ☐: —

MATERIAL: CS ☐ SS ☑ OTHER: ☐ — SURFACE COND.: AS WELDED ☐ GROUND ☑ CLEANED

EQUIPMENT

EQUIP. DESC.	MANUFACTURER	MODEL NO.:	SERIAL NO.:	CAL.DUE DATE
YOKE	NA	NA	NA	NA
LIGHT METER	Magnaflux	WLM	100 901 454	11-16-17
BLACKLIGHT	NA	NA	NA	NA
UT SCOPE				
TRANSDUCERS				
CABLES				
CAL. BLOCKS				

CONSUMABLES

	CLEANER	PENETRANT	DEVELOPER	MAG. PARTICLES	CONTRAST PAINT	COUPLANT
MANUFACTURER	Magnaflux	Magnaflux	Magnaflux	NA	NA	NA
BRAND/TYPE	SKC-S	SKL-WP2	SKD-S2			
BATCH NO.	16J-05K	11H-103	15K-08K			

TECHNIQUE

MT ☐ AC YOKE ☐ WET ☐ DRY ☐ FLUORESCENT ☐ COLOR CONTRAST, LIGHT INTENSITY — fc, SURFACE TEMP — °F

PT ☐ TYPE I FLUORESCENT ☐ TYPE II VISIBLE ☐ A WATER WASH, ☐ B LIPOPHILIC, ☐ C SOLVENT ☐ D HYDROPHILIC
DWELL TIME 15 min., DEVELOP TIME 10 min., LIGHT INTENSITY +100 fc, SURFACE TEMP AMB °F

UT ☐ ST. BEAM ☐ ANGLE BEAM ☐ 45° ☐ 60° ☐ 70° TRANSDUCER SIZE & FREQUENCY —

VT ☐ DIRECT, ☐ REMOTE BORE SCOPE, ☐ REMOTE VIDEO, LIGHT INTENSITY — fc

EXAMINATION RESULTS

INDICATION CODES: NR = NO RECORDABLE INDICATION, L = LINEAR INDICATIONS, C = CRACK, NI = NO INDICATIONS

IDENTIFICATION	SIZE/THICKNESS	ACC. /REJ.	IND.CODE	REMARKS
LS-7 R2	NA	ACC	NI	View 1-2
				Reg # 124207

CERTIFICATION

Nikki Vitacy NV — II — 02-11-17 — 1.5
TECHNICIAN SIGNATURE — LEVEL — DATE — JOB HOURS

Juan Garcia JG — I — 2-11-17 — —
TECHNICIAN SIGNATURE — LEVEL — DATE — JOB HOURS

CLIENT SIGNATURE — DATE

Spitzer INDUSTRIES

REPORT NO.: 43462

NON-DESTRUCTIVE EXAMINATION REPORT

JOB NO.: 2132 DATE: 3-6-17 FACILITY: ☐ TANNER ☐ HEAVY FAB. ☑ CK ☐ ORIZON

P NO.: — SERIAL NO.: — PART DESCRIPTION: Circle Seam

EXAMINATION PERFORMED: ☐ MT ☑ PT ☐ UT ☐ VT PROCEDURE NO.: PT-03.01 Rev. 1/addendum PT-03.02 REV. NO.: 0

CODE/ACCEPT CRITERIA: ASME SECT. VIII ☑ DIV. 1, ☐ DIV. 2, ASME B31.3, ☐ SERVICE —, B31.4 ☐ B31.8 ☐ API-1104 ☐

AWS D1.1 ☐ CONNECTION TYPE ☐ STAT. LOADED NT ☐ CYCL. LOADED NT ☐ TUBULAR CONN. OTHER ☐: —

MATERIAL: CS ☐ SS ☑ OTHER: ☑ — SURFACE COND.: AS WELDED ☑ GROUND ☐ CLEANED

EQUIPMENT

EQUIP. DESC.	MANUFACTURER	MODEL NO.:	SERIAL NO.:	CAL.DUE DATE
YOKE	NA	NA	NA	NA
LIGHT METER	Magnaflux	WLM	100 901 454	11-16-17
BLACKLIGHT	NA	NA	NA	NA
UT SCOPE				
TRANSDUCERS				
CABLES				
CAL. BLOCKS				

CONSUMABLES

	CLEANER	PENETRANT	DEVELOPER	MAG. PARTICLES	CONTRAST PAINT	COUPLANT
MANUFACTURER	Magnaflux	Magnaflux	Magnaflux	NA	NA	NA
BRAND/TYPE	SKC-S	SKC-WP2	SKD-S2			
BATCH NO.	16J-05K	11H-103	15K-08K			

TECHNIQUE

~~MT~~ ☐ AC YOKE ☐ WET ☐ DRY ☐ FLUORESCENT ☐ COLOR CONTRAST, LIGHT INTENSITY — fc, SURFACE TEMP — °F

PT ☐ TYPE I FLUORESCENT ☐ TYPE II VISIBLE ☐ A WATER WASH, ☐ B LIPOPHILIC, ☑ C SOLVENT ☐ D HYDROPHILIC
DWELL TIME 15 min., DEVELOP TIME 10 min., LIGHT INTENSITY +100 fc, SURFACE TEMP AMB °F

~~UT~~ ☐ ST. BEAM ☐ ANGLE BEAM ☐ 45° ☐ 60° ☐ 70° TRANSDUCER SIZE & FREQUENCY —

~~VT~~ ☐ DIRECT, ☐ REMOTE BORE SCOPE, ☐ REMOTE VIDEO, LIGHT INTENSITY — fc

EXAMINATION RESULTS

INDICATION CODES: NR = NO RECORDABLE INDICATION, L = LINEAR INDICATIONS, C = CRACK, NI = NO INDICATIONS

IDENTIFICATION	SIZE/THICKNESS	ACC. /REJ.	IND.CODE	WS	REMARKS
CS-9	NA	ACC	NI	HG1, T	PT FINAL ID + OD
					Req# 124348

CERTIFICATION

Vitas Vitau	VV	II	03-06-17	1.0
TECHNICIAN SIGNATURE		LEVEL	DATE	JOB HOURS
Juan Garcia	JG	I	3-6-17	—
TECHNICIAN SIGNATURE		LEVEL	DATE	JOB HOURS
CLIENT SIGNATURE		DATE		

Spitzer INDUSTRIES

REPORT NO.: 43484

NON-DESTRUCTIVE EXAMINATION REPORT

JOB NO.: 2132 DATE: 3-8-17 FACILITY: ☐ TANNER ☐ HEAVY FAB. ☑ CK ☐ ORIZON

PART NO.: — SERIAL NO.: — PART DESCRIPTION: Lifting Lug Pads

EXAMINATION PERFORMED: ☐ MT ☑ PT ☐ UT ☐ VT PROCEDURE NO.: MT-02.01 Rev. 1/addendum MT-02.02 REV. NO.: 0

CODE/ACCEPT CRITERIA: ASME SECT. VIII ☑ DIV. 1, ☐ DIV. 2, ASME B31.3, ☐ SERVICE —, B31.4 ☐ B31.8 ☐ API-1104 ☐

AWS D1.1 ☐ CONNECTION TYPE ☐ STAT. LOADED NT ☐ CYCL. LOADED NT ☐ TUBULAR CONN. OTHER ☐: —

MATERIAL: CS ☐ SS ☑ OTHER: ☐ — SURFACE COND.: AS WELDED ☑ GROUND ☐ CLEANED

EQUIPMENT

EQUIP. DESC.	MANUFACTURER	MODEL NO.:	SERIAL NO.:	CAL.DUE DATE
YOKE	NA	NA	NA	NA
LIGHT METER	Magnaflux	WLM	100 901 454	11-16-17
BLACKLIGHT	NA	NA	NA	NA
UT SCOPE				
TRANSDUCERS				
CABLES				
CAL. BLOCKS				

CONSUMABLES

	CLEANER	PENETRANT	DEVELOPER	MAG. PARTICLES	CONTRAST PAINT	COUPLANT
MANUFACTURER	Magnaflux	Magnaflux	Magnaflux	NA	NA	NA
BRAND/TYPE	SKC-S	SKL-WP2	SKD-S2			
BATCH NO.	16J-05K	11H-103	15K-08K			

TECHNIQUE

MT ☐ AC YOKE ☐ WET ☐ DRY ☐ FLUORESCENT ☐ COLOR CONTRAST, LIGHT INTENSITY — fc, SURFACE TEMP — °F

PT ☐ TYPE I FLUORESCENT ☐ TYPE II VISIBLE ☐ A WATER WASH, ☐ B LIPOPHILIC, ☑ C SOLVENT ☐ D HYDROPHILIC
DWELL TIME 15 min., DEVELOP TIME 10 min., LIGHT INTENSITY +100 fc, SURFACE TEMP AMB °F

☐ ST. BEAM ☐ ANGLE BEAM ☐ 45° ☐ 60° ☐ 70° TRANSDUCER SIZE & FREQUENCY —

VT ☐ DIRECT, ☐ REMOTE BORE SCOPE, ☐ REMOTE VIDEO, LIGHT INTENSITY — fc

EXAMINATION RESULTS

INDICATION CODES: NR = NO RECORDABLE INDICATION, L = LINEAR INDICATIONS, C = CRACK, NI = NO INDICATIONS

IDENTIFICATION	SIZE/THICKNESS	ACC. /REJ.	IND.CODE	WS REMARKS
Lifting Lug Pads 5	NA	ACC	NI	H82
				Req #143093

CERTIFICATION

Vasi Vijay VV	II	03-08-17	1.5
TECHNICIAN SIGNATURE	LEVEL	DATE	JOB HOURS
Juan Garcia JG	I	3-8-17	—
TECHNICIAN SIGNATURE	LEVEL	DATE	JOB HOURS
CLIENT SIGNATURE	DATE		

Spitzer INDUSTRIES

REPORT NO.: 47367

NON-DESTRUCTIVE EXAMINATION REPORT

JOB NO.: 2132 DATE: 3-16-17 FACILITY: ☐ TANNER ☐ HEAVY FAB. ☑ CK ☐ ORIZON

T NO.: — SERIAL NO.: — PART DESCRIPTION: Circle Seam Cavity

EXAMINATION PERFORMED: ☐ MT ☑ PT ☐ UT ☐ VT PROCEDURE NO.: PT-03.01 Rev. 1/addendum PT-03.02 REV. NO.: 0

CODE/ACCEPT CRITERIA: ASME SECT. VIII ☑ DIV. 1, ☐ DIV. 2, ASME B31.3, ☐ SERVICE —, B31.4 ☐ B31.8 ☐ API-1104 ☐

AWS D1.1 ☐ CONNECTION TYPE ☐ STAT. LOADED NT ☐ CYCL. LOADED NT ☐ TUBULAR CONN. OTHER ☐: —

MATERIAL: CS ☐ SS ☑ OTHER: ☐ — SURFACE COND.: AS WELDED ☐ GROUND ☑ CLEANED

EQUIPMENT

EQUIP. DESC.	MANUFACTURER	MODEL NO.:	SERIAL NO.:	CAL.DUE DATE
YOKE	NA	NA	NA	NA
LIGHT METER	Magnaflux	WLM	100 901 454	11-16-17
BLACKLIGHT	NA	NA	NA	NA
UT SCOPE				
TRANSDUCERS				
CABLES				
CAL. BLOCKS				

CONSUMABLES

	CLEANER	PENETRANT	DEVELOPER	MAG. PARTICLES	CONTRAST PAINT	COUPLANT
MANUFACTURER	Magnaflux	Magnaflux	Magnaflux	NA	NA	NA
BRAND/TYPE	SKC-S	SKL-WP2	SKD-S2			
BATCH NO.	16J-05K	11H-103	15K-08K			

TECHNIQUE

MT ☐ AC YOKE ☐ WET ☐ DRY ☐ FLUORESCENT ☐ COLOR CONTRAST, LIGHT INTENSITY — fc, SURFACE TEMP — °F

PT ☐ TYPE I FLUORESCENT ☐ TYPE II VISIBLE ☐ A WATER WASH, ☐ B LIPOPHILIC, ☑ C SOLVENT ☐ D HYDROPHILIC
DWELL TIME 15 min., DEVELOP TIME 10 min., LIGHT INTENSITY +100 fc, SURFACE TEMP AMB °F

☐ ST. BEAM ☐ ANGLE BEAM ☐ 45° ☐ 60° ☐ 70° TRANSDUCER SIZE & FREQUENCY —

VT ☐ DIRECT, ☐ REMOTE BORE SCOPE, ☐ REMOTE VIDEO, LIGHT INTENSITY — fc

EXAMINATION RESULTS

INDICATION CODES: NR = NO RECORDABLE INDICATION, L = LINEAR INDICATIONS, C = CRACK, NI = NO INDICATIONS

IDENTIFICATION	SIZE/THICKNESS	ACC. /REJ.	IND.CODE	REMARKS
CS-1R1	NA	ACC	NI	Cavity View: 4-5, 7-8, 8-9
				Req # 143111

CERTIFICATION

Jesus Vitad VV	II	03-16-17	1.0
TECHNICIAN SIGNATURE	LEVEL	DATE	JOB HOURS
Juan Garcia JG	I	3-16-17	—
TECHNICIAN SIGNATURE	LEVEL	DATE	JOB HOURS
CLIENT SIGNATURE	DATE		

Spitzer INDUSTRIES

REPORT NO.: 47370

NON-DESTRUCTIVE EXAMINATION REPORT

JOB NO.: 2132 DATE: 3-19-17 FACILITY: ☐ TANNER ☐ HEAVY FAB. ☑ CK ☐ ORIZON

P.O. NO.: — SERIAL NO.: — PART DESCRIPTION: Lifting Lug

EXAMINATION PERFORMED: ☐ MT ☑ PT ☐ UT ☐ VT PROCEDURE NO.: PT-03.01 Rev 1/Addendum PT-03.02 REV. NO.: 0

CODE/ACCEPT CRITERIA: ASME SECT. VIII ☑ DIV. 1, ☐ DIV. 2, ASME B31.3, ☐ SERVICE —, B31.4 ☐ B31.8 ☐ API-1104 ☐

AWS D1.1 ☐ CONNECTION TYPE ☐ STAT. LOADED NT ☐ CYCL. LOADED NT ☐ TUBULAR CONN. OTHER ☐: —

MATERIAL: CS ☐ SS ☑ OTHER: ☐ — SURFACE COND.: AS WELDED ☑ GROUND ☐ CLEANED

EQUIPMENT

EQUIP. DESC.	MANUFACTURER	MODEL NO.:	SERIAL NO.:	CAL.DUE DATE
YOKE	NA	NA	NA	NA
LIGHT METER	Magnaflux	WLM	100 901 454	11-16-17
BLACKLIGHT	NA	NA	NA	NA
UT SCOPE				
TRANSDUCERS				
CABLES				
CAL. BLOCKS				

CONSUMABLES

	CLEANER	PENETRANT	DEVELOPER	MAG. PARTICLES	CONTRAST PAINT	COUPLANT
MANUFACTURER	Magnaflux	Magnaflux	Magnaflux	NA	NA	NA
BRAND/TYPE	SKC-S	SKL-WP2	SKD-S2			
BATCH NO.	16J-05K	11H-103	15K-08K			

TECHNIQUE

MT ☐ AC YOKE ☐ WET ☐ DRY ☐ FLUORESCENT ☐ COLOR CONTRAST, LIGHT INTENSITY — fc, SURFACE TEMP — °F

PT ☐ TYPE I FLUORESCENT ☐ TYPE II VISIBLE ☐ A WATER WASH, ☐ B LIPOPHILIC, ☐ C SOLVENT ☐ D HYDROPHILIC
DWELL TIME 15 min., DEVELOP TIME 10 min., LIGHT INTENSITY +100 fc, SURFACE TEMP AMB °F

UT ☐ ST. BEAM ☐ ANGLE BEAM ☐ 45° ☐ 60° ☐ 70° TRANSDUCER SIZE & FREQUENCY —

VT ☐ DIRECT, ☐ REMOTE BORE SCOPE, ☐ REMOTE VIDEO, LIGHT INTENSITY — fc

EXAMINATION RESULTS

INDICATION CODES: NR = NO RECORDABLE INDICATION, L = LINEAR INDICATIONS, C = CRACK, NI = NO INDICATIONS

IDENTIFICATION	SIZE/THICKNESS	ACC. /REJ.	IND.CODE	WS REMARKS
Lifting Lug	NA	ACC	NI	H82
				Req#143120

CERTIFICATION

Vasa Vijay VV	II	3-19-17	1.5
TECHNICIAN SIGNATURE	LEVEL	DATE	JOB HOURS
Juan Garcia JG	I		—
TECHNICIAN SIGNATURE	LEVEL	DATE	JOB HOURS
CLIENT SIGNATURE	DATE		

Spitzer INDUSTRIES

REPORT NO.: 47375

NON-DESTRUCTIVE EXAMINATION REPORT

JOB NO.: 2132 DATE: 03-19-17 FACILITY: ☐ TANNER ☐ HEAVY FAB. ☑ CK ☐ ORIZON

PART NO.: — SERIAL NO.: — PART DESCRIPTION: Lifting

EXAMINATION PERFORMED: ☑ MT ☐ PT ☐ UT ☐ VT PROCEDURE NO.: MT-02.01 Rev 1/addendum MT-02.02 REV. NO.: 0

CODE/ACCEPT CRITERIA: ASME SECT. VIII ☑ DIV. 1, ☐ DIV. 2, ASME B31.3, ☐ SERVICE —, B31.4 ☐ B31.8 ☐ API-1104 ☐

AWS D1.1 ☐ CONNECTION TYPE ☐ STAT. LOADED NT ☐ CYCL. LOADED NT ☐ TUBULAR CONN. OTHER ☐: —

MATERIAL: CS ☐ SS ☐ OTHER: ☐ _____ SURFACE COND.: AS WELDED ☑ GROUND ☐ CLEANED

EQUIPMENT

EQUIP. DESC.	MANUFACTURER	MODEL NO.:	SERIAL NO.:	CAL.DUE DATE
YOKE	Contoure Probe	B100	6663	7-22-17
LIGHT METER	Magnaflux	WLM	100 901 454	11-16-17
BLACKLIGHT	NA	NA	NA	NA
UT SCOPE				
TRANSDUCERS				
CABLES				
CAL. BLOCKS	Electro-Spect	WT-10	2182	Daily

CONSUMABLES

	CLEANER	PENETRANT	DEVELOPER	MAG. PARTICLES	CONTRAST PAINT	COUPLANT
MANUFACTURER	NA	NA	NA	Magnaflux	Magnaflux	NA
BRAND/TYPE				7HF	WCP-2	
BATCH NO.				16F-06K	16J-04K	

TECHNIQUE

MT: ☑ AC YOKE ☑ WET ☐ DRY ☐ FLUORESCENT ☑ COLOR CONTRAST, LIGHT INTENSITY +100 fc, SURFACE TEMP AMB °F

PT: ☐ TYPE I FLUORESCENT ☐ TYPE II VISIBLE ☐ A WATER WASH, ☐ B LIPOPHILIC, ☐ C SOLVENT ☐ D HYDROPHILIC
DWELL TIME — min., DEVELOP TIME — min., LIGHT INTENSITY — fc, SURFACE TEMP — °F

UT: ☐ ST. BEAM ☐ ANGLE BEAM ☐ 45° ☐ 60° ☐ 70° TRANSDUCER SIZE & FREQUENCY —

VT: ☐ DIRECT, ☐ REMOTE BORE SCOPE, ☐ REMOTE VIDEO, LIGHT INTENSITY — fc

EXAMINATION RESULTS

INDICATION CODES: NR = NO RECORDABLE INDICATION, L = LINEAR INDICATIONS, C = CRACK, NI = NO INDICATIONS

IDENTIFICATION	SIZE/THICKNESS	ACC. /REJ.	IND.CODE	WS REMARKS
Tailing Lug	NA	ACC	NI	H6
				Req#143121

CERTIFICATION

VASA Vitaly VV (TECHNICIAN SIGNATURE)	II (LEVEL)	03-19-17 (DATE)	1.0 (JOB HOURS)
Juan Garcia JG (TECHNICIAN SIGNATURE)	I (LEVEL)	03-19-17 (DATE)	— (JOB HOURS)
_____ (CLIENT SIGNATURE)	_____ (DATE)		

Spitzer INDUSTRIES

REPORT NO.: 47408

NON-DESTRUCTIVE EXAMINATION REPORT

JOB NO.: 2132 DATE: 3-21-17 FACILITY: ☐ TANNER ☐ HEAVY FAB. ☑ CK ☐ ORIZON

P.O. NO.: — SERIAL NO.: — PART DESCRIPTION: Cavity O.D

EXAMINATION PERFORMED: ☐ MT ☑ PT ☐ UT ☐ VT PROCEDURE NO.: PT-03.01 Rev.1/addendum PT-03.02 REV. NO.: 0

CODE/ACCEPT CRITERIA: ASME SECT. VIII ☑ DIV. 1, ☐ DIV. 2, ASME B31.3, ☐ SERVICE —, B31.4 ☐ B31.8 ☐ API-1104 ☐

AWS D1.1 ☐ CONNECTION TYPE ☐ STAT. LOADED NT ☐ CYCL. LOADED NT ☐ TUBULAR CONN. OTHER ☐: —

MATERIAL: CS ☐ SS ☑ OTHER: ☐ — SURFACE COND.: AS WELDED ☐ GROUND ☑ CLEANED

EQUIPMENT

EQUIP. DESC.	MANUFACTURER	MODEL NO.:	SERIAL NO.:	CAL.DUE DATE
YOKE	NA	NA	NA	NA
LIGHT METER	Magnaflux	WLM	100 901 454	11-15-16
BLACKLIGHT	NA	NA	NA	NA
UT SCOPE				
TRANSDUCERS				
CABLES				
CAL. BLOCKS				

CONSUMABLES

	CLEANER	PENETRANT	DEVELOPER	MAG. PARTICLES	CONTRAST PAINT	COUPLANT
MANUFACTURER	Magnaflux	Magnaflux	Magnaflux	NA	NA	NA
BRAND/TYPE	SKC-S	SKL-WP2	SKD-S2			
BATCH NO.	16J-05K	11H-103	15K-08K			

TECHNIQUE

MT ☐ AC YOKE ☐ WET ☐ DRY ☐ FLUORESCENT ☐ COLOR CONTRAST, LIGHT INTENSITY — fc, SURFACE TEMP — °F

PT ☐ TYPE I FLUORESCENT ☐ TYPE II VISIBLE ☐ A WATER WASH, ☐ B LIPOPHILIC, ☑ C SOLVENT ☐ D HYDROPHILIC
DWELL TIME 15 min., DEVELOP TIME 10 min., LIGHT INTENSITY +100 fc, SURFACE TEMP AMB °F

UT ☐ ST. BEAM ☐ ANGLE BEAM ☐ 45° ☐ 60° ☐ 70° TRANSDUCER SIZE & FREQUENCY —

VT ☐ DIRECT, ☐ REMOTE BORE SCOPE, ☐ REMOTE VIDEO, LIGHT INTENSITY — fc

EXAMINATION RESULTS

INDICATION CODES: NR = NO RECORDABLE INDICATION, L = LINEAR INDICATIONS, C = CRACK, NI = NO INDICATIONS

IDENTIFICATION	SIZE/THICKNESS	ACC. /REJ.	IND.CODE	REMARKS
CS-1 R2	NA	ACC	NI	Cavity View-4-5
				Req # 143138

CERTIFICATION

Vasi Jotay VJ	II	03-21-17	1.0
TECHNICIAN SIGNATURE	LEVEL	DATE	JOB HOURS
Juan Garcia JG	I	3-21-17	—
TECHNICIAN SIGNATURE	LEVEL	DATE	JOB HOURS
CLIENT SIGNATURE	DATE		

AGD INSPECTION SERVICES, INC.
335 STAFFORDSHIRE #6, STAFFORD, TEXAS 77477
OFFICE TEL.: 281-208-0600; FAX: 281-208-2038

Report no.: 062517AP3

DAILY EXAMINATION REPORT
PENETRANT TESTING

CUSTOMER : **SPITZER**			SPEC./CODE : ASME SECTION VIII DIV. 1	
LOCATION : INDUSTRIAL RD			PROCEDURE : PT03.01 REV 1 W/ADDENDUM 03.02 REV 0	
HOUSTON,TX			JOB NUMBER : 2132	
DATE : 06-25-17			P.O. NUMBER :	
HOURS : 6 HRS.			DRAWING NO:	
CONSUMABLES : 3 CANS			PART NO. :	
REQUEST NO. : 158370			SERIAL NO. :	
	MANUFACTURER	BATCH NO.	TYPE	DWELL TIME
PENETRANT	SPOTCHECK	13C02K	SKL-WP2	15 MINS.
REMOVER	WATER			10 MINS.
DEVELOPER	SPOTCHECK	14J08K	SKD-S2	15 MINS.

EXAMINATION TECHNIQUE

( ) SOLVENT REMOVAL | (X) WATER WASHABLE | ( ) FLUORESCENT

DESCRIPTION: **2132 VESSEL,** TEMPORARY ATTACHMENT

REMARKS : NO RELEVANT INDICATIONS FOUND AT THE TIME OF INSPECTION

TEST RESULTS	TOTAL WELD :	NO. ACCEPTED:	NO. REJECTED: 0

TEMPORARY ATTACHMENT (ID / OD)

AREAS WHERE TEMPORARY ATTACHMENTS
WERE REMOVED - **ACCEPTED**

TECHNICIAN: AVELINO (John) PERTEZ JR. AGD1785 LEVEL: II LEVEL:	CLIENT SIGNATURE: DATE: 6/28/17

ISO 9001:2008 CERTIFIED

AGD INSPECTION SERVICES, INC.
335 STAFFORDSHIRE #6, STAFFORD, TEXAS 77477
OFFICE TEL.: 281-208-0600; FAX: 281-208-2038

Report no.: PT062617EDS3

DAILY EXAMINATION REPORT
PENETRANT TESTING

CUSTOMER : **SPITZER**			SPEC./CODE : AWS D1.1 STATIC	
LOCATION : INDUSTRIAL RD			PROCEDURE : PT03.01 REV 3 w/ ADDENDUM PT 03.03 REV 0	
HOUSTON,TX			JOB NUMBER : 2132	
DATE : 06-26-17			P.O. NUMBER :	
HOURS : 2 HRS.			DRAWING NO: N/A	
CONSUMABLES: 2 CANS			PART NO: 2132	
	MANUFACTURER	BATCH NO.	TYPE	DWELL TIME
PENETRANT	SPOTCHECK	13K05K	SKL-WP2	15 MINS.
REMOVER	WATER			10 MINS.
DEVELOPER	SPOTCHECK	13C15K	SK-S2	15 MINS.

EXAMINATION TECHNIQUE

( ) SOLVENT REMOVAL	(X) WATER WASHABLE	( ) FLUORESCENT

DESCRIPTION: 2132 CIRCLE SEAM / LONG SEAM FINAL PT

REMARKS : INDICATIONS FOUND AT THE TIME OF INSPECTION. REMOVED BY GRINDING.

TEST RESULTS	TOTAL WELD : 2	NO. ACCEPTED: 2	NO. REJECTED:

CS-1 R2 VIEW 4-5, VIEW 7-8, VIEW 8-9	H-92
LS-7 R2 VIEW 1-2	E

REQ# 158367

TECHNICIAN: EMMANUEL SZEPIENIEC	CLIENT SIGNATURE:
LEVEL: II LEVEL:	DATE: 6/30/17

ISO 9001:2008 CERTIFIED

AGD INSPECTION SERVICES, INC.
13820 Stafford Rd., Stafford, TX 77477
Tel.: 281-208-0600 * Fax: 281-208-2038
e-mail: agdoffice@agdndt.com * website: www.agdndt.com

Report No.: 030217OM1

DAILY EXAMINATION REPORT

UT LAMSCAN/THICKNESS

CUSTOMER : **CK/SPITZER**	SPEC./CODE : ASME SEC.VIII, DIV.1
LOCATION : 13863 INDUSTRIAL RD	PROCEDURE : UT-05.01 Rev.0 (SII)
HOUSTON TX	JOB NUMBER : 2132
DATE : 03/02/2017	DRAWING NO. :
TOTAL HOURS : 2.0 hr (plus 1 hr travel)	PART NUMBER:
CONSUMABLES : 20 oz	P.O. NUMBER :
REQUEST NO. : **124338**	SERIAL NO. :

MANUFACTURER	MODEL	SERIAL NO.	CAL. DUE DATE	COUPLANT
OLYMPUS	EPOCH 600	100011707	10-07-17	ULTRAGEL

Calibration Blocks	Serial No.	Reflector	Longitudinal	Frequency	Size
IIW Block	15-2104	1/16" DH	0°	2.25MHz	1.0"

LAM. SCAN ☒ THICKNESS ☐ Surface conditions: SMOOTH

DESCRIPTION: **UT LAMSCAN "LIFTING PLATE MATERIAL"**

REMARKS : NO RELEVANT INDICATION DETECTED AT THE TIME OF EXAMINATION.

Welds ☐ Plates ☒ Pipes ☐	Nominal Thickness	Material Thickness Minimum	Material Thickness Maximum	Acc.	Rej.	Type of Indications
LIFTING LUG PLATE MATERIAL				√		
SHELL AREA UNDER LIFTING LUGS				√		

TECHNICIAN: OLIGARDO (DODDIE) MILANCO
LEVEL: II EMPLOYEE ID #: AGD4982

CLIENT SIGNATURE:
DATE: 3/4/17

AGD INSPECTION SERVICES, INC.
13820 Stafford Rd., Stafford, TX 77477
Tel.: 281-208-0600 * Fax:281-208-2038
e-mail: agdoffice@agdndt.com * website: www.agdndt.com

Report No.: 020217SY-RT2

DAILY EXAMINATION REPORT
RADIOGRAPHIC TESTING

CUSTOMER : CURTIS KELLY	SPEC./CODE : ASME SEC. VIII DIV. 1
LOCATION : 13863 INDUSTRIAL RD., HOUSTON, TX	PROCEDURE : RT-04.01 REV. 0
	JOB NUMBER : **2132**
DATE : **2/2/2017**	P.O. NUMBER :
HOURS : **3.5**	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO. : **124168**	PART NO. :
PART DESCRIPTION:	

SOURCE TYPE: **IR-192**	CURIES: **75**	SOURCE SIZE: **0.124**	PENETRAMETER: **ASTM 1B / 0.016**
FILM TYPE: ☐ AGFA ☐ D8 ☐ D7 ☒ D5 ☐ D4 ☐ D3 ☐ D2 OTHERS:			
FILM SIZE: **4 ½ X 10"**	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☒
MATERIAL TYPE: **CARBON ST.**	☐ DWE/SWV ☒ SWE/SWV ☐ DWE/DWV		FILM SIDE ☐
NO. OF FILM USED: **20**	TOTAL WELDS: **1**		
	EXPOSURE TIME: **3:30 MIN**	LEAD SIZE: 0.010"	UG: 0.01"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
LS-1		42" ID X 0.500" WT	2.0	4.0	24"			
WS: "E"	1-2					✓		
	2-3					✓		F/A
	3-4					✓		
	4-5					✓		
	5-6					✓		
	6-7					✓		
	7-8					✓		
	8-9					✓		
	9-10					✓		
	10-11					✓		surface
LS-2		42" ID X 0.500" WT	2.0	4.0	24"			
WS: "E"	1-2					✓		F/A
	2-3					✓		
	3-4					✓		
	4-5					✓		
	5-6					✓		
	6-7					✓		Reshoot clear 2/4/17
	7-8					✓		
	8-9					✓		
	9-10					✓		
	10-11					✓		Reshoot clear 2/4/17

RADIOGRAPHER: S. YOUNG

LEVEL: **II** Employee ID #AGD4620

ASSISTANTS: R. MOHUMMED

CLIENT SIGNATURE: Ramon Flores

DATE: 2/3/17

NOTES
CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low Crown, SM - Surface Marks, LF - Lack of Fusion, AR - Artifact, PO - Porosity, HB - Hollow Bead, IC - Internal Concavity, WC - Within Code, NC - No Comment

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Report No.: 020217SY-RT3

DAILY EXAMINATION REPORT
RADIOGRAPHIC TESTING

CUSTOMER : CURTIS KELLY	SPEC./CODE : ASME SEC. VIII DIV. 1
LOCATION : 13863 INDUSTRIAL RD., HOUSTON, TX	PROCEDURE : RT-04.01 REV. 0
	JOB NUMBER : **2132**
DATE : **2/2/2017**	P.O. NUMBER :
HOURS : **3.5**	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO. : **124168** / 124170	PART NO. :
PART DESCRIPTION:	

SOURCE TYPE: **IR-192**	CURIES: **75**	SOURCE SIZE: **0.124**	PENETRAMETER: **ASTM 1B / 0.016**
FILM TYPE: ☐ AGFA ☐ D8 ☐ D7 ☒ D5 ☐ D4 ☐ D3 ☐ D2 OTHERS:			
FILM SIZE: **4 ½ X 10"**	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☒
MATERIAL TYPE: **CARBON ST.**	☐ DWE/SWV ☒ SWE/SWV ☐ DWE/DWV		FILM SIDE ☐
NO. OF FILM USED: **20**	TOTAL WELDS: **1**		
	EXPOSURE TIME: **3:30 MIN**	LEAD SIZE: 0.010"	UG: 0.01"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
LS-3		42" ID X 0.500" WT	2.0	4.0	24"			
WS: "E"	1-2					✓		
Request-(124168)	2-3					✓		
	3-4					✓		
	4-5					✓		
	5-6					✓		
	6-7					✓		
	7-8					✓		
	8-9					✓		
	9-10					✓		
	10-11					✓		
LS-4		42" ID X 0.500" WT	2.0	4.0	24"			
WS: "H-61"	1-2					✓		FLA
Request-(124170)	2-3					✓		
	3-4					✓		
	4-5					✓		
	5-6					✓		
	6-7					✓		
	7-8					✓		
	8-9					✓		
	9-10					✓		
	10-11					✓		Reshoot A Flores clear 2/4/17

RADIOGRAPHER: S. YOUNG	ASSISTANTS: R. MOHUMMED	CLIENT SIGNATURE: R Flores
LEVEL: II Employee ID #AGD4620		DATE: 2/3/17

NOTES
CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low Crown, SM - Surface Marks, LF - Lack of Fusion, AR - Artifact, PO - Porosity, HB - Hollow Bead, IC - Internal Concavity, WC - Within Code, NC - No Comment

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Report No.: 020217SY-RT4

DAILY EXAMINATION REPORT
RADIOGRAPHIC TESTING

CUSTOMER : CURTIS KELLY	SPEC./CODE : ASME SEC. VIII DIV. 1
LOCATION : 13863 INDUSTRIAL RD., HOUSTON, TX	PROCEDURE : RT-04.01 REV. 0
	JOB NUMBER : **2132**
DATE : **2/2/2017**	P.O. NUMBER :
HOURS : **2**	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO. : **124168**	PART NO. :
PART DESCRIPTION:	

SOURCE TYPE: **IR-192**	CURIES: **75**	SOURCE SIZE: **0.124**	PENETRAMETER: **ASTM 1B / 0.013**
FILM TYPE: ☐ AGFA ☐ D8 ☐ D7 ☒ D5 ☐ D4 ☐ D3 ☐ D2 OTHERS:			
FILM SIZE: **4 ½ X 10"**	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☒
MATERIAL TYPE: **CARBON ST.**	☐ DWE/SWV ☒ SWE/SWV ☐ DWE/DWV		FILM SIDE ☐
NO. OF FILM USED: **20**	TOTAL WELDS: **6**		
	EXPOSURE TIME: **25 S / 45 S**	LEAD SIZE: 0.010"	UG: 0.01"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
K3-1	1-2	12.75" OD X 0.375" WT	2.0	4.0	6.37"	✓		
WS: "E"	2-3					✓		
	3-1					✓		
K4-1	1-2	12.75" OD X 0.375" WT	2.0	4.0	6.37"	✓		
WS: "E"	2-3					✓		F/A
	3-1					✓		
K5-1	1-2	12.75" OD X 0.375" WT	2.0	4.0	6.37"	✓		
WS: "E"	2-3					✓		
	3-1					✓		
K8-1	1-2	12.75" OD X 0.375" WT	2.0	4.0	6.37"	✓		
WS: "E"	2-3					✓		
	3-1					✓		
C-1	1-2	12.75" OD X 0.375" WT	2.0	4.0	6.37"	✓		
WS: "E"	2-3					✓		
	3-1					✓		
N3-1	1-2	20" OD X 0.375" WT	2.0	4.0	10"	✓		
WS: "E"	2-3					✓		
	3-4					✓		
	4-5					✓		
	5-1					✓		
FILM GRADED BY CLIENT								

RADIOGRAPHER: S. YOUNG	ASSISTANTS: R. MOHUMMED	CLIENT SIGNATURE: 2/3/17
LEVEL: **II** Employee ID #AGD4620		DATE:

NOTES
CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low Crown, SM - Surface Marks, LF - Lack of Fusion, AR - Artifact, PO - Porosity, HB - Hollow Bead, IC - Internal Concavity, WC - Within Code, NC - No Comment

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Report No.: 020317SY-RT1

DAILY EXAMINATION REPORT
RADIOGRAPHIC TESTING

CUSTOMER : CURTIS KELLY	SPEC./CODE : ASME SEC. VIII DIV. 1
LOCATION : 13863 INDUSTRIAL RD., HOUSTON, TX	PROCEDURE : RT-04.01 REV. 0
	JOB NUMBER : **2132**
DATE : **2/3/2017**	P.O. NUMBER :
HOURS : **3.5 + 1 HR TRAVEL**	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO. : **124226**	PART NO. :
PART DESCRIPTION:	

SOURCE TYPE: **IR-192**	CURIES: **75**	SOURCE SIZE: **0.124**	PENETRAMETER: **ASTM 1B / 0.016**
FILM TYPE: ☐ AGFA ☐ D8 ☐ D7 ☒ D5 ☐ D4 ☐ D3 ☐ D2 OTHERS:			
FILM SIZE: **4 ½ X 10"**	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☒
MATERIAL TYPE: **CARBON ST.**	☐ DWE/SWV ☒ SWE/SWV ☐ DWE/DWV		FILM SIDE ☐
NO. OF FILM USED: **20**	TOTAL WELDS: **2**		
	EXPOSURE TIME: **3:30 MIN**	LEAD SIZE: 0.010"	UG: 0.01"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
LS-5		42" ID X 0.500" WT	2.0	4.0	24"			
WS: "H-61"	1-2					✓		
	2-3					✓		
	3-4					✓		
	4-5					✓		
	5-6					✓		
	6-7					✓		
	7-8					✓		
	8-9					✓		PO. OK
	9-10					✓		
	10-11					✓		
LS-6		42" ID X 0.500" WT	2.0	4.0	24"			
WS: "H-61"	1-2					✓		
	2-3					✓		
	3-4					✓		F/A
	4-5					✓		PO OK
	5-6					✓		
	6-7					✓		
	7-8					✓		
	8-9					✓		
	9-10					✓		
	10-11					✓		

RADIOGRAPHER: S. YOUNG	ASSISTANTS: R. MOHUMMED	CLIENT SIGNATURE: Ramon Flores
LEVEL: **II** Employee ID #AGD4620		DATE: 2/4/17

NOTES
CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low Crown, SM - Surface Marks, LF - Lack of Fusion, AR - Artifact, PO - Porosity, HB - Hollow Bead, IC - Internal Concavity, WC - Within Code, NC - No Comment

2/4/17

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Report No.: 020317SY-RT2

DAILY EXAMINATION REPORT
RADIOGRAPHIC TESTING

CUSTOMER : CURTIS KELLY	SPEC./CODE : ASME SEC. VIII DIV. 1
LOCATION : 13863 INDUSTRIAL RD., HOUSTON, TX	PROCEDURE : RT-04.01 REV. 0
	JOB NUMBER : **2132**
DATE : **2/3/2017**	P.O. NUMBER :
HOURS : **1.5**	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO. : **124226**	PART NO. :
PART DESCRIPTION:	

SOURCE TYPE: **IR-192**	CURIES: **75**	SOURCE SIZE: **0.124**	PENETRAMETER: **ASTM 1B / 0.016**
FILM TYPE: ☐ AGFA ☐ D8 ☐ D7 ☒ D5 ☐ D4 ☐ D3 ☐ D2 OTHERS:			
FILM SIZE: **4 ½ X 10"**	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☒
MATERIAL TYPE: **CARBON ST.**	☐ DWE/SWV ☒ SWE/SWV ☐ DWE/DWV		FILM SIDE ☐
NO. OF FILM USED: **7**	TOTAL WELDS: **1**		
	EXPOSURE TIME: **3:30 MIN**	LEAD SIZE: 0.010"	UG: 0.01"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
LS-7		42" ID X 0.500" WT	2.0	4.0	24"			
WS: "5"	1-2						X	SL. C.250")
	2-3					✓		
	3-4					✓		
	4-5					✓		
	5-6					✓		
	6-7					✓		
	7-8					✓		

RADIOGRAPHER: S. YOUNG

LEVEL: **II** Employee ID: AGD4620

ASSISTANTS: R. MOHUMMED

CLIENT SIGNATURE: Ramon Flores

DATE: 2/3/17

NOTES
CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low Crown, SM - Surface Marks, LF - Lack of Fusion, AR - Artifact, PO - Porosity, HB - Hollow Bead, IC - Internal Concavity, WC - Within Code, NC - No Comment

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Report No.: 020317SY-RT3

DAILY EXAMINATION REPORT

RADIOGRAPHIC TESTING

CUSTOMER : CURTIS KELLY	SPEC./CODE : ASME SEC. VIII DIV. 1
LOCATION : 13863 INDUSTRIAL RD., HOUSTON, TX	PROCEDURE : RT-04.01 REV. 0
	JOB NUMBER : **2132**
DATE : **2/3/2017**	P.O. NUMBER :
HOURS : **1.5**	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO. : **124226**	PART NO. :
PART DESCRIPTION:	

SOURCE TYPE: **IR-192**	CURIES: **75**	SOURCE SIZE: **0.124**	PENETRAMETER: **ASTM 1B / 0.020**
FILM TYPE: ☐ AGFA ☐ D8 ☐ D7 ☒ D5 ☐ D4 ☐ D3 ☐ D2 OTHERS:			
FILM SIZE: **4 ½ X 10"**	EXPOSURE TECHNIQUE(S): ☐ DWE/SWV ☒ SWE/SWV ☐ DWE/DWV		SOURCE SIDE ☒ FILM SIDE ☐
MATERIAL TYPE: **CARBON ST.**			
NO. OF FILM USED: **9**	TOTAL WELDS: **3**		
	EXPOSURE TIME: **4:45 MIN**	LEAD SIZE: 0.010"	UG: 0.01"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
LS-8		CONE X 0.750" WT	2.0	4.0	24"			
WS: "H-61"	1-2					✓		
	2-3					✓		
	3-4					✓		
LS-8A		CONE X 0.750" WT	2.0	4.0	24"			
WS: "H-61"	1-2					✓		
	2-3					✓		
	3-4					✓		
LS-8B		CONE X 0.750" WT	2.0	4.0	24"			
WS: "H-61"	1-2					✓		
	2-3					✓		
	3-4					✓		

RADIOGRAPHER: S. YOUNG

LEVEL: **II** Employee ID #AGD4620

ASSISTANTS: R. MOHUMMED

CLIENT SIGNATURE: Ramon Flores

DATE: 2/4/17

NOTES

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Report No.: 020317SY-RT4

DAILY EXAMINATION REPORT

RADIOGRAPHIC TESTING

CUSTOMER : CURTIS KELLY	SPEC./CODE : ASME SEC. VIII DIV. 1
LOCATION : 13863 INDUSTRIAL RD., HOUSTON, TX	PROCEDURE : RT-04.01 REV. 0
	JOB NUMBER : **2132**
DATE : **2/3/2017**	P.O. NUMBER :
HOURS : **1.5**	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO. : **124226**	PART NO. :
PART DESCRIPTION:	

SOURCE TYPE: **IR-192**	CURIES: **75**	SOURCE SIZE: **0.124**	PENETRAMETER: **ASTM 1B / 0.016**
FILM TYPE: ☐ AGFA ☐ D8 ☐ D7 ☒ D5 ☐ D4 ☐ D3 ☐ D2 OTHERS:			
FILM SIZE: **4 ½ X 10"**	EXPOSURE TECHNIQUE(S): ☐ DWE/SWV ☒ SWE/SWV ☐ DWE/DWV		SOURCE SIDE ☒ FILM SIDE ☐
MATERIAL TYPE: **CARBON ST.**			
NO. OF FILM USED: **8**	TOTAL WELDS: **1**		
	EXPOSURE TIME: **4 MIN**	LEAD SIZE: 0.010"	UG: 0.01"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
LS-9		60" ID X 0.625" WT	2.0	4.0	24"			
WS: "H-61"	1-2					✓		
	2-3					✓		
	3-4					✓		
	4-5					✓		
	5-6					✓		
	6-7					✓		
	7-8					✓		
	8-9					✓		SL. OK

RADIOGRAPHER: S. YOUNG

LEVEL: **II** Employee ID#AGD4620

ASSISTANTS: R. MOHUMMED

CLIENT SIGNATURE: Ramon P

DATE: 2/4/17

NOTES

CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low Crown, SM - Surface Marks, LF - Lack of Fusion, AR - Artifact, PO - Porosity, HB - Hollow Bead, IC - Internal Concavity, WC - Within Code, NC - No Comment

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Report No.: 020317SY-RT5

DAILY EXAMINATION REPORT

RADIOGRAPHIC TESTING

CUSTOMER : CURTIS KELLY	SPEC./CODE : ASME SEC. VIII DIV. 1
LOCATION : 13863 INDUSTRIAL RD., HOUSTON, TX	PROCEDURE : RT-04.01 REV. 0
	JOB NUMBER : **2132**
DATE : **2/3/2017**	P.O. NUMBER :
HOURS : **4**	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO. : **124226**	PART NO. :
PART DESCRIPTION:	

SOURCE TYPE: **IR-192**	CURIES: **75**	SOURCE SIZE: **0.124**	PENETRAMETER: **ASTM 1B / 0.016**
FILM TYPE: ☐ AGFA ☐ D8 ☐ D7 ☒ D5 ☐ D4 ☐ D3 ☐ D2 OTHERS:			
FILM SIZE: **4 ½ X 10"**	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☒
MATERIAL TYPE: **CARBON ST.**	☐ DWE/SWV ☒ SWE/SWV ☐ DWE/DWV		FILM SIDE ☐
NO. OF FILM USED: **20**	TOTAL WELDS: **2**		
	EXPOSURE TIME: **4 MIN**	LEAD SIZE: 0.010"	UG: 0.01"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
LS-10		60" ID X 0.625" WT	2.0	4.0	24"			
WS: "5"	1-2					✓		
	2-3					✓		F/A
	3-4					✓		
	4-5					✓		
	5-6					✓		
	6-7					✓		F/A
	7-8					✓		
	8-9					✓		
	9-10					✓		
	10-11					✓		
LS-11		60" ID X 0.625" WT	2.0	4.0	24"			
WS: "H-61"	1-2					✓		F/A
	2-3					✓		
	3-4					✓		
	4-5					✓		
	5-6					✓		
	6-7					✓		
	7-8					✓		
	8-9					✓		
	9-10					✓		
	10-11					✓		

RADIOGRAPHER: S. YOUNG	ASSISTANTS: R. MOHUMMED	CLIENT SIGNATURE: Rana Flores
LEVEL: **II** Employee ID #AGD4620		DATE: 2/4/17

NOTES

CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low Crown, SM - Surface Marks, LF - Lack of Fusion, AR - Artifact, PO - Porosity, HB - Hollow Bead, IC - Internal Concavity, WC - Within Code, NC - No Comment

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Report No.: 020417-JB01

DAILY EXAMINATION REPORT
RADIOGRAPHIC TESTING

CUSTOMER : CURTIS KELLY INC.	SPEC./CODE : ASME SEC. VIII, DIV.1
LOCATION : 13863 INDUSTRIAL RD.	PROCEDURE : RT-04.01, REV. 0
HOUSTON, TX	JOB NUMBER : 2132
DATE : **2/4/2017**	P.O. NUMBER :
HOURS : 1.5 hr + 1 hr travel	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO.: 124170	PART NO. :
PART DESCRIPTION:	

SOURCE TYPE: Ir ^{192}	CURIES: 75	SOURCE SIZE: .124	PENETRAMETER: ASTM 1B / 0.013
FILM TYPE: ☐ AGFA ☐D8 ☐D7 ☒ D5 ☐D4 ☐ D3 ☐D2 OTHERS:			
FILM SIZE: 4 ½" x 17"	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☒
MATERIAL TYPE: STAINLESS STEEL	☐ DWE/SWV ☒ SWE/SWV ☐DWE/DWV		FILM SIDE ☐
NO. OF FILM USED: 15	TOTAL WELDS: 3		
	EXPOSURE TIME: 0:30 secs	LEAD SIZE: 0.010"	UG: 0.006"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
NOZZ. N1-1	1-2	20" OD x 0.375" WT	2.0	3.3	10.13"	✓		
W/S: "E"	2-3					✓		
	3-4					✓		
	4-5					✓		
	5-1					✓		
NOZZ. N4-1	1-2	20" OD x 0.375" WT	2.0	3.3	10.13"	✓		
W/S: "E"	2-3					✓		
	3-4					✓		
	4-5					✓		surface
	5-1					✓		
NOZZ. N2-1	1-2	20" OD x 0.375" WT	2.0	3.3	10.13"	✓		
W/S: "E"	2-3					✓		
	3-4					✓		
	4-5					✓		
	5-1					✓		F/A

RADIOGRAPHER: JOHANN V. BALDOVINO	ASSISTANTS: JESSIE BALBOA	CLIENT SIGNATURE:
LEVEL: II AGD0050		DATE: 2/5/17

NOTES
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Report No.: 020417-JB02

DAILY EXAMINATION REPORT
RADIOGRAPHIC TESTING

JSTOMER : CURTIS KELLY INC.	SPEC./CODE : ASME SEC. VIII, DIV.1
LOCATION : 13863 INDUSTRIAL RD.	PROCEDURE : RT-04.01, REV. 0
HOUSTON, TX	JOB NUMBER : 2132
DATE : **2/4/2017**	P.O. NUMBER :
HOURS : 1hr	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO.: 124170	PART NO. :
PART DESCRIPTION:	

SOURCE TYPE: Ir^{192}	CURIES: 75	SOURCE SIZE: .124	PENETRAMETER: ASTM 1B / 0.013
FILM TYPE: ☐ AGFA ☐D8 ☐D7 ☒ D5 ☐D4 ☐ D3 ☐D2 OTHERS:			
FILM SIZE: 4 ½" x 17"	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☒
MATERIAL TYPE: STAINLESS STEEL	☐ DWE/SWV ☒ SWE/SWV ☐DWE/DWV		FILM SIDE ☐
NO. OF FILM USED: 4	TOTAL WELDS: 3		
	EXPOSURE TIME: 1:30 minutes	LEAD SIZE: 0.010"	UG: 0.003"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
NOZZ. N1-2	1-2	20" OD x 0.375" WT	2.0	3.3	20.13"	✓		
W/S: "E"								
NOZZ. N4-2	1-2	20" OD x 0.375" WT	2.0	3.3	20.13"	✓		
W/S: "E"								
NOZZ. N2-2	1-2	20" OD x 0.375" WT	2.0	3.3	20.13"	✓		
W/S: "E"	2-3					✓		

RADIOGRAPHER: JOHANN V. BALDOVINO	ASSISTANTS: JESSIE BALBOA	CLIENT SIGNATURE: Ramon Flores
LEVEL: II AGD9050		DATE: 2/4/17

NOTES
CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low Crown, SM - Surface Marks, LF - Lack of Fusion, AR - Artifact, PO - Porosity, HB - Hollow Bead, IC - Internal Concavity, WC - Within Code, NC - No Comment

ISO 9001:2008 CERTIFIED

AGD INSPECTION SERVICES, INC.
13820 Stafford Rd., Stafford, TX 77477
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e-mail: agdoffice@agdndt.com * website: www.agdndt.com

Report No.: 020417-JB03

DAILY EXAMINATION REPORT
RADIOGRAPHIC TESTING

USTOMER : CURTIS KELLY INC.	SPEC./CODE : ASME SEC. VIII, DIV.1
LOCATION : 13863 INDUSTRIAL RD.	PROCEDURE : RT-04.01, REV. 0
HOUSTON, TX	JOB NUMBER : 2132
DATE : **2/4/2017**	P.O. NUMBER :
HOURS : 0.5hr	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO.: 124168	PART NO. :
PART DESCRIPTION:	

SOURCE TYPE: Ir ^{192}	CURIES: 75	SOURCE SIZE: .124	PENETRAMETER: ASTM 1B / 0.013
FILM TYPE: ☐ AGFA ☐D8 ☐D7 ☒ D5 ☐D4 ☐ D3 ☐D2 OTHERS:			
FILM SIZE: 4 ½" x 17"	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☒
MATERIAL TYPE: STAINLESS STEEL	☐ DWE/SWV ☒ SWE/SWV ☐DWE/DWV		FILM SIDE ☐
NO. OF FILM USED: 1	TOTAL WELDS: 1		
	EXPOSURE TIME: 1:30 minutes	LEAD SIZE: 0.010"	UG: 0.003"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
NOZZ. N3-2	1-2	20" OD x 0.375" WT	2.0	3.3	20.13"	✓		
W/S: "E"								

RADIOGRAPHER: JOHANN V. BALDOVINO	ASSISTANTS: JESSIE BALBOA	CLIENT SIGNATURE: Ramon Flores
LEVEL: II AGD9050		DATE: 2/5/17

NOTES
CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low Crown, SM - Surface Marks, LF - Lack of Fusion, AR - Artifact, PO - Porosity, HB - Hollow Bead, IC - Internal Concavity, WC - Within Code, NC - No Comment

ISO 9001:2008 CERTIFIED

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e-mail: agdoffice@agdndt.com * website: www.agdndt.com

Report No.: 020417-JB04

DAILY EXAMINATION REPORT
RADIOGRAPHIC TESTING

JSTOMER : CURTIS KELLY INC.	SPEC./CODE : ASME SEC. VIII, DIV.1
LOCATION : 13863 INDUSTRIAL RD.	PROCEDURE : RT-04.01, REV. 0
HOUSTON, TX	JOB NUMBER : 2132
DATE : 2/4/2017	P.O. NUMBER :
HOURS : 1.5hr	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO.: 124169	PART NO. :
PART DESCRIPTION:	

SOURCE TYPE: Ir 192	CURIES: 75	SOURCE SIZE: .124	PENETRAMETER: ASTM 1B / 0.013
FILM TYPE: ☐ AGFA ☐D8 ☐D7 ☒ D5 ☐D4 ☐ D3 ☐D2 OTHERS:			
FILM SIZE: 4 ½" x 17"	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☒
MATERIAL TYPE: STAINLESS STEEL	☐ DWE/SWV ☒ SWE/SWV ☐DWE/DWV		FILM SIDE ☐
NO. OF FILM USED: 16	TOTAL WELDS: 4		
	EXPOSURE TIME: 0:10 seconds	LEAD SIZE: 0.010"	UG: 0.010"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
NOZZ. K1-1	1-2	12.75" OD x 0.375" WT	2.0	3.3	6.5"	✓		
W/S: "E"	2-3					✓		
	3-4					✓		
	4-1					✓		
NOZZ. K2-1	1-2	12.75" OD x 0.375" WT	2.0	3.3	6.5"	✓		
W/S: "E"	2-3					✓		
	3-4					✓		
	4-1					✓		
NOZZ. K6-1	1-2	12.75" OD x 0.375" WT	2.0	3.3	6.5"	✓		
W/S: "E"	2-3					✓		
	3-4					✓		
	4-1					✓		
NOZZ. K7-1	1-2	12.75" OD x 0.375" WT	2.0	3.3	6.5"	✓		
W/S: "E"	2-3					✓		
	3-4					✓		
	4-1					✓		

RADIOGRAPHER: JOHANN V. BALDOVINO	ASSISTANTS: JESSIE BALBOA	CLIENT SIGNATURE:
LEVEL: II AGD9050		DATE: 2/5/17

NOTES
CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low Crown, SM - Surface Marks, LF - Lack of Fusion, AR - Artifact, PO - Porosity, HB - Hollow Bead, IC - Internal Concavity, WC - Within Code, NC - No Comment

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Report No.: 020417-JB05

DAILY EXAMINATION REPORT
RADIOGRAPHIC TESTING

JSTOMER : CURTIS KELLY INC.	SPEC./CODE : ASME SEC. VIII, DIV.1
LOCATION : 13863 INDUSTRIAL RD.	PROCEDURE : RT-04.01, REV. 0
HOUSTON, TX	JOB NUMBER : 2132
DATE : 2/4/2017	P.O. NUMBER :
HOURS : 0.5hr	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO.: 124170	PART NO. :
PART DESCRIPTION:	

SOURCE TYPE: Ir 192	CURIES: 75	SOURCE SIZE: .124	PENETRAMETER: ASTM 1B / 0.010
FILM TYPE: ☐ AGFA ☐D8 ☐D7 ☒ D5 ☐D4 ☐ D3 ☐D2 OTHERS:			
FILM SIZE: 4 ½" x 10"	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☐
MATERIAL TYPE: STAINLESS STEEL	☒ DWE/SWV ☐ SWE/SWV ☐DWE/DWV		FILM SIDE ☒
NO. OF FILM USED: 4	TOTAL WELDS: 1		
	EXPOSURE TIME: 0:20 seconds	LEAD SIZE: 0.010"	UG: 0.007"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
NOZZ. J-1	1-2	6.625" OD x 0.280" WT	2.0	3.3	7.25"	✓		
W/S: "M1"	2-3					✓		
	3-4					✓		
	4-1					✓		

RADIOGRAPHER: JOHANN V. BALDOVINO	ASSISTANTS: JESSIE BALBOA	CLIENT SIGNATURE: Ramon Flores
LEVEL: II AGD9050		DATE: 2/5/17

NOTES
CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low Crown, SM - Surface Marks, LF - Lack of Fusion, AR - Artifact, PO - Porosity, HB - Hollow Bead, IC - Internal Concavity, WC - Within Code, NC - No Comment

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Report No.: 020417-JB06

DAILY EXAMINATION REPORT
RADIOGRAPHIC TESTING

CUSTOMER : CURTIS KELLY INC.	SPEC./CODE : ASME SEC. VIII, DIV.1
LOCATION : 13863 INDUSTRIAL RD.	PROCEDURE : RT-04.01, REV. 0
HOUSTON, TX	JOB NUMBER : 2132
DATE : **2/4/2017**	P.O. NUMBER :
HOURS : 1hr	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO.: 124170	PART NO. :
PART DESCRIPTION:	

SOURCE TYPE: Ir ^{192}	CURIES: 75	SOURCE SIZE: .124	PENETRAMETER: ASTM 1B / 0.010
FILM TYPE: ☐ AGFA ☐D8 ☐D7 ☒ D5 ☐D4 ☐ D3 ☐D2 OTHERS:			
FILM SIZE: 4 ½" x 10"	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☐
MATERIAL TYPE: STAINLESS STEEL	☒ DWE/SWV ☐ SWE/SWV ☐DWE/DWV		FILM SIDE ☒
NO. OF FILM USED: 8	TOTAL WELDS: 2		
	EXPOSURE TIME: 0:10 seconds	LEAD SIZE: 0.010"	UG: 0.008"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
NOZZ. A-1	1-2	4.500" OD x 0.237" WT	2.0	3.3	5.5"	✓		
W/S: "M1"	2-3					✓		
	3-4					✓		
	4-1					✓		
NOZZ. D-1	1-2	4.500" OD x 0.237" WT	2.0	3.3	5.5"	✓		
W/S: "M1"	2-3					✓		
	3-4					✓		
	4-1					✓		

RADIOGRAPHER: JOHANN V. BALDOVINO	ASSISTANTS: JESSIE BALBOA	CLIENT SIGNATURE: 2/5/17
LEVEL: II AGD9050		DATE:

NOTES
CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low Crown, SM - Surface Marks, LF - Lack of Fusion, AR - Artifact, PO - Porosity, HB - Hollow Bead, IC - Internal Concavity, WC - Within Code, NC - No Comment

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Report No.: 020517-JB02

DAILY EXAMINATION REPORT
RADIOGRAPHIC TESTING

USTOMER : CURTIS KELLY INC.	SPEC./CODE : ASME SEC. VIII, DIV. 1
LOCATION : 13863 INDUSTRIAL RD.	PROCEDURE : RT-3, REV. 6
HOUSTON, TX	JOB NUMBER : 2132
DATE : **2/5/2017**	P.O. NUMBER :
HOURS : **0.5 hrs**	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO.: **124228**	PART NO. :
PART DESCRIPTION:	

SOURCE TYPE: Ir ^{192}	CURIES: 74	SOURCE SIZE: .124	PENETRAMETER: ASTM 1B / 0.013
FILM TYPE: ☐ AGFA ☐D8 ☐D7 ☒ D5 ☐D4 ☐ D3 ☐D2 OTHERS:			
FILM SIZE: 4 ½" x 17"	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☒
MATERIAL TYPE: STAINLESS STEEL	☐ DWE/SWV ☒ SWE/SWV ☐DWE/DWV		FILM SIDE ☐
NO. OF FILM USED: 1	TOTAL WELDS: 1		
	EXPOSURE TIME: 2:00 minutes	LEAD SIZE: 0.010"	UG: 0.003"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
LS-7 R1	1-2	42" ID x 0.500" WT	2.0	3.3	24.63"		X	PO. w/trail
W/S: "5"								

RADIOGRAPHER:	ASSISTANTS:	CLIENT SIGNATURE:
JOHANN V. BALDOVINO	JESSIE BALBOA	
LEVEL: II AGD9050		DATE: 2/6/17

NOTES
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Report No.: 021217SY-RT1

DAILY EXAMINATION REPORT

RADIOGRAPHIC TESTING

CUSTOMER : CURTIS KELLY	SPEC./CODE : ASME SEC. VIII DIV. 1
LOCATION : 13863 INDUSTRIAL RD., HOUSTON, TX	PROCEDURE : RT-04.01 REV. 0
	JOB NUMBER : **2132**
DATE : **2/12/2017**	P.O. NUMBER :
HOURS : **3 + 1 HR TRAVEL**	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO. : **124260**	PART NO. :
PART DESCRIPTION:	

SOURCE TYPE: **IR-192**	CURIES: **67**	SOURCE SIZE: **0.124**	PENETRAMETER: **ASTM 1B / 0.016**
FILM TYPE: ☒ AGFA ☐ D8 ☐ D7 ☒ D5 ☐ D4 ☐ D3 ☐ D2 OTHERS:			
FILM SIZE: **4 ½ X 17"**	EXPOSURE TECHNIQUE(S): ☐ DWE/SWV ☒ SWE/SWV ☐ DWE/DWV		SOURCE SIDE ☒ FILM SIDE ☐
MATERIAL TYPE: **STAINLESS ST.**			
NO. OF FILM USED: **24**	TOTAL WELDS: **2**		
	EXPOSURE TIME: **3:10 MIN**	LEAD SIZE: 0.010"	UG: 0.01"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
CS-2	1-2	42" ID X 0.500" WT	2.0	4.0	21"	/		
WS: "5 / EE "	2-3					/		
	3-4					/		
	4-5					/		
	5-6					/		
	6-7					/		
	7-8					/		
	8-9					/		
	9-10					/		FILM ARTIFACT
	10-11					/		
	11-12					/		FILM ARTIFACT
	12-1					/		FILM ARTIFACT
CS-3	1-2	42" ID X 0.500" WT	2.0	4.0	21"	/		
WS: "5 / H-61 "	2-3					/		
	3-4					/		
	4-5					/		FILM ARTIFACT
	5-6					/		
	6-7					/		
	7-8					/		FILM ARTIFACT
	8-9					/		
	9-10					/		
	10-11					/		
	11-12					/		
	12-1					/		ID WELD CONTOUR

RADIOGRAPHER: ~~S. YOUNG~~

LEVEL: **II** Employee ID #AGD4620

ASSISTANTS: R. MOHUMMED

CLIENT SIGNATURE: Ronald Gates

DATE: 2/13/17

NOTES

CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low

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Report No.: 021217SY-RT2

DAILY EXAMINATION REPORT

RADIOGRAPHIC TESTING

CUSTOMER : CURTIS KELLY	SPEC./CODE : ASME SEC. VIII DIV. 1
LOCATION : 13863 INDUSTRIAL RD., HOUSTON, TX	PROCEDURE : RT-04.01 REV. 0
	JOB NUMBER : **2132**
DATE : **2/12/2017**	P.O. NUMBER :
HOURS : **1.5**	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO. : **124260**	PART NO. :
PART DESCRIPTION:	

SOURCE TYPE: **IR-192**	CURIES: **67**	SOURCE SIZE: **0.124**	PENETRAMETER: **ASTM 1B / 0.016**
FILM TYPE: ☒ AGFA ☐ D8 ☐ D7 ☒ D5 ☐ D4 ☐ D3 ☐ D2 OTHERS:			
FILM SIZE: **4 ½ X 17"**	EXPOSURE TECHNIQUE(S): ☐ DWE/SWV ☒ SWE/SWV ☐ DWE/DWV		SOURCE SIDE ☒ FILM SIDE ☐
MATERIAL TYPE: **STAINLESS ST.**			
NO. OF FILM USED: **24**	TOTAL WELDS: **2**		
	EXPOSURE TIME: **3:10 MIN**	LEAD SIZE: 0.010"	UG: 0.01"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
CS-4	1-2	42" ID X 0.500" WT	2.0	4.0	21"	/		FILM ARTIFACT
WS: "5 / EE "	2-3					/		OD SURCFACE
	3-4					/		
	4-5					/		
	5-6					/		
	6-7					/		
	7-8					/		
	8-9					/		
	9-10					/		
	10-11					/		
	11-12					/		
	12-1					/		

RADIOGRAPHER: S. YOUNG	ASSISTANTS: R. MOHUMMED	CLIENT SIGNATURE: 2/13/17
LEVEL: **II** Employee ID # AGD4620		DATE:

NOTES
CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low

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Report No.: 021217SY-RT3

DAILY EXAMINATION REPORT
RADIOGRAPHIC TESTING

CUSTOMER : CURTIS KELLY	SPEC./CODE : ASME SEC. VIII DIV. 1
LOCATION : 13863 INDUSTRIAL RD., HOUSTON, TX	PROCEDURE : RT-04.01 REV. 0
	JOB NUMBER : **2132**
DATE : **2/12/2017**	P.O. NUMBER :
HOURS : **3**	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO. : **124260**	PART NO. :
PART DESCRIPTION:	

SOURCE TYPE: **IR-192**	CURIES: **67**	SOURCE SIZE: **0.124**	PENETRAMETER: **ASTM 1B / 0.016**
FILM TYPE: ☒ AGFA ☐ D8 ☐ D7 ☒ D5 ☐ D4 ☐ D3 ☐ D2 OTHERS:			
FILM SIZE: **4 ½ X 17"**	EXPOSURE TECHNIQUE(S): ☐ DWE/SWV ☒ SWE/SWV ☐ DWE/DWV		SOURCE SIDE ☒ FILM SIDE ☐
MATERIAL TYPE: **STAINLESS ST.**			
NO. OF FILM USED: **24**	TOTAL WELDS: **2**		
	EXPOSURE TIME: **3:10 MIN**	LEAD SIZE: 0.010"	UG: 0.01"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
CS-6	1-2	42" ID X 0.500" WT	2.0	4.0	21"	/		
WS: "H-61 / EE "	2-3					/		FA / OD SURFACE
	3-4					/		PO < .156"
	4-5					/		PO < .156"
	5-6					/		
	6-7					/		ID WELD CONTOUR
	7-8					/		Film Artifact
	8-9					/		FILM ARTIFACT
	9-10					/		FILM ARTIFACT
	10-11					/		
	11-12					/		FILM ARTIFACT
	12-1					/		
CS-7	1-2	42" ID X 0.500" WT	2.0	4.0	21"	/		
WS: "EE / H-61 "	2-3					/		
	3-4					/		PO < .156"
	4-5					/		
	5-6					/		
	6-7					/		PO < .156"
	7-8					/		
	8-9					/		FA / PO < .156"
	9-10					/		FILM ARTIFACT
	10-11					/		FILM ARTIFACT
	11-12					/		
	12-1					/		PO < .156" / ELONG < .250"

RADIOGRAPHER: S. YOUNG — ASSISTANTS: R. MOHUMMED — CLIENT SIGNATURE: Ramon Ro

LEVEL: II Employee ID # AGD4620 — DATE: 2/13/17

NOTES

CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low

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Report No.: 021217SY-RT4

DAILY EXAMINATION REPORT

RADIOGRAPHIC TESTING

CUSTOMER : CURTIS KELLY	SPEC./CODE : ASME SEC. VIII DIV. 1
LOCATION : 13863 INDUSTRIAL RD., HOUSTON, TX	PROCEDURE : RT-04.01 REV. 0
	JOB NUMBER : **2132**
DATE : **2/12/2017**	P.O. NUMBER :
HOURS : **1.5**	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO. : **124260**	PART NO. :
PART DESCRIPTION:	

SOURCE TYPE: **IR-192**	CURIES: **67**	SOURCE SIZE: **0.124**	PENETRAMETER: **ASTM 1B / 0.016**
FILM TYPE: ☒ AGFA ☐ D8 ☐ D7 ☒ D5 ☐ D4 ☐ D3 ☐ D2 OTHERS:			
FILM SIZE: **4 ½ X 17"**	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☒
MATERIAL TYPE: **STAINLESS ST.**	☐ DWE/SWV ☒ SWE/SWV ☐ DWE/DWV		FILM SIDE ☐
NO. OF FILM USED: **16**	TOTAL WELDS: **2**		
	EXPOSURE TIME: **8:30 MIN**	LEAD SIZE: 0.010"	UG: 0.01"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
CS-10	1-2	60" ID X 0.625" WT	2.0	4.0	30.7"	/		FILM ARTIFACT
WS: "H-61 / 5 "	2-3					/		
	3-4					/		FILM ARTIFACT
	4-5					/		PO < .156"
	5-6					/		
	6-7					/		
	7-8					/		FILM ARTIFACT
	8-9					/		
	9-10					/		
	10-11					/		FILM ARTIFACT
	11-12					/		
	12-13					/		
	13-14					/		
	14-15					/		
	15-16					/		FILM ARTIFACT
	16-1					/		FILM ARTIFACT

RADIOGRAPHER: ~~S. YOUNG~~	ASSISTANTS: R. MOHUMMED	CLIENT SIGNATURE:
LEVEL: **II** Employee ID: **AGD4620**		DATE: 2/13/17

NOTES
CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low

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Report No.: 021217SY-RT4

DAILY EXAMINATION REPORT

RADIOGRAPHIC TESTING

CUSTOMER : CURTIS KELLY	SPEC./CODE : ASME SEC. VIII DIV. 1
LOCATION : 13863 INDUSTRIAL RD., HOUSTON, TX	PROCEDURE : RT-04.01 REV. 0
	JOB NUMBER : 2132
DATE : 2/12/2017	P.O. NUMBER :
HOURS : 1.5	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO. : 124260	PART NO. :
PART DESCRIPTION:	

SOURCE TYPE: IR-192	CURIES: 67	SOURCE SIZE: 0.124	PENETRAMETER: ASTM 1B / 0.016
FILM TYPE: ☒ AGFA ☐ D8 ☐ D7 ☒ D5 ☐ D4 ☐ D3 ☐ D2 OTHERS:			
FILM SIZE: 4 ½ X 17"	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☒
MATERIAL TYPE: STAINLESS ST.	☐ DWE/SWV ☒ SWE/SWV ☐ DWE/DWV		FILM SIDE ☐
NO. OF FILM USED: 16	TOTAL WELDS: 2		
	EXPOSURE TIME: 8:30 MIN	LEAD SIZE: 0.010"	UG: 0.01"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
CS-10	1-2	60" ID X 0.625" WT	2.0	4.0	30.7"	/		FILM ARTIFACT
WS: "H-61 / 5 "	2-3					/		
	3-4					/		FILM ARTIFACT
	4-5					/		PO < .156"
	5-6					/		
	6-7					/		
	7-8					/		FILM ARTIFACT
	8-9					/		
	9-10					/		
	10-11					/		FILM ARTIFACT
	11-12					/		
	12-13					/		
	13-14					/		
	14-15					/		
	15-16					/		FILM ARTIFACT
	16-1					/		FILM ARTIFACT

RADIOGRAPHER: ~~S. YOUNG~~	ASSISTANTS: R. MOHUMMED	CLIENT SIGNATURE:
LEVEL: II Employee ID#AGD4620		DATE: 2/13/17

NOTES

CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low

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Report No.: 021217SY-RT9

DAILY EXAMINATION REPORT

RADIOGRAPHIC TESTING

CUSTOMER : CURTIS KELLY	SPEC./CODE : ASME SEC. VIII DIV. 1
LOCATION : 13863 INDUSTRIAL RD., HOUSTON, TX	PROCEDURE : RT-04.01 REV. 0
	JOB NUMBER : **2132**
DATE : **2/12/2017**	P.O. NUMBER :
HOURS : **0.5**	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO. : **124259**	PART NO. :

PART DESCRIPTION:

SOURCE TYPE: **IR-192**	CURIES: **67**	SOURCE SIZE: **0.124**	PENETRAMETER: **ASTM 1B / 0.016**
FILM TYPE: ☒ AGFA ☐ D8 ☐ D7 ☒ D5 ☐ D4 ☐ D3 ☐ D2 OTHERS:			
FILM SIZE: **4 ½ X 17"**	EXPOSURE TECHNIQUE(S): ☐ DWE/SWV ☒ SWE/SWV ☐ DWE/DWV		SOURCE SIDE ☒ FILM SIDE ☐
MATERIAL TYPE: **STAINLESS ST.**			
NO. OF FILM USED: **1**	TOTAL WELDS: **1**		
	EXPOSURE TIME: **3:55 MIN**	LEAD SIZE: 0.010"	UG: 0.01"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
LS-7 R2		42" ID X 0.500" WT	2.0	4.0	24"			
WS: "EE"	1-2					/		

RADIOGRAPHER: S. YOUNG

LEVEL: **II** Employee ID: #AGD4620

ASSISTANTS: R. MOHUMMED

CLIENT SIGNATURE: Ramiro Flores

DATE: 2/13/17

NOTES
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Report No.: 022317-JB03

DAILY EXAMINATION REPORT
RADIOGRAPHIC TESTING

CUSTOMER : CURTIS KELLY INC.	SPEC./CODE : ASME SEC. VIII, DIV. 1
LOCATION : 13863 INDUSTRIAL RD.	PROCEDURE : RT-3, REV. 6
HOUSTON, TX	JOB NUMBER : 2132
DATE : **2/23/2017**	P.O. NUMBER :
HOURS : **2 hr**	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO.: **124246**	PART NO. :
PART DESCRIPTION:	

SOURCE TYPE: Ir ^{192}	CURIES: 94	SOURCE SIZE: .124	PENETRAMETER: ASTM 1B / 0.010
FILM TYPE: ☐ AGFA ☐D8 ☐D7 ☒ D5 ☐D4 ☐ D3 ☐D2 OTHERS:			
FILM SIZE: 4 ½" x 10"	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☐
MATERIAL TYPE: STAINLESS STEEL	☒ DWE/SWV ☐ SWE/SWV ☐DWE/DWV		FILM SIDE ☒
NO. OF FILM USED: 12	TOTAL WELDS: 3		
	EXPOSURE TIME: 1:00 minute	LEAD SIZE: 0.010"	UG: 0.007"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
NOZZ F-1	1-2	8.625" OD x 0.322" WT	2.0	3.3	9.25"	✓		
W/S: "H51"	2-3					✓		
	3-4					✓		
	4-1					✓		
NOZZ H-1	1-2	8.625" OD x 0.322" WT	2.0	3.3	9.25"	✓		
W/S: "H51"	2-3					✓		
	3-4					✓		
	4-1					✓		
NOZZ G-1	1-2	8.625" OD x 0.322" WT	2.0	3.3	9.25"	✓		
W/S: "H51"	2-3					✓		F/A
	3-4					✓		
	4-1					✓		

RADIOGRAPHER: JOHANN V. BALDOVINO	ASSISTANTS: JESSIE BALBOA	CLIENT SIGNATURE: Ramon Flores 2/24/17
LEVEL: II AGD9050		DATE:

NOTES
CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low Crown, SM - Surface Marks, LF - Lack of Fusion, AR - Artifact, PO - Porosity, HB - Hollow Bead, IC - Internal Concavity, WC - Within Code, NC - No Comment

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Report No.: 022517-JB02

DAILY EXAMINATION REPORT
RADIOGRAPHIC TESTING

USTOMER : CURTIS KELLY INC.	SPEC./CODE : ASME SEC. VIII, DIV. 1
LOCATION : 13863 INDUSTRIAL RD.	PROCEDURE : RT-3, REV. 6
HOUSTON, TX	JOB NUMBER : 2132
DATE : **2/25/2017**	P.O. NUMBER :
HOURS : **1.5 hr**	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO.: **122448**	PART NO. :
PART DESCRIPTION:	

SOURCE TYPE: Ir ^{192}	CURIES: 93	SOURCE SIZE: .124	PENETRAMETER: ASTM 1B / 0.010
FILM TYPE: ☐ AGFA ☐D8 ☐D7 ☒ D5 ☐D4 ☐ D3 ☐D2 OTHERS:			
FILM SIZE: 4 ½" x 10"	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☐
MATERIAL TYPE: STAINLESS STEEL	☒ DWE/SWV ☐ SWE/SWV ☐DWE/DWV		FILM SIDE ☒
NO. OF FILM USED: 8	TOTAL WELDS: 2		
	EXPOSURE TIME: 1:00 minute	LEAD SIZE: 0.010"	UG: 0.007"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
NOZZ M-1	1-2	6.625" OD x 0.280" WT	2.0	3.3	7.25"	/		
W/S: "H51"	2-3					/		
	3-4					/		
	4-1					/		
NOZZ E-1	1-2	8.625" OD x 0.322" WT	2.0	3.3	9.25"	/		
W/S: "H51"	2-3					/		
	3-4					/		
	4-1					/		F/A

RADIOGRAPHER: JOHANN V. BALDOVINO	ASSISTANTS: JESSIE BALBOA	CLIENT SIGNATURE: 2/27/17
EVEL: II AGD9050		DATE:

NOTES
CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low Crown, SM - Surface Marks, LF - Lack of Fusion, AR - Artifact, PO - Porosity, HB - Hollow Bead, IC - Internal Concavity, WC - Within Code, NC - No Comment

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Report No.: 030217SY-RT3

DAILY EXAMINATION REPORT
RADIOGRAPHIC TESTING

CUSTOMER : CURTIS KELLY	SPEC./CODE : ASME SEC. VIII DIV. 1
LOCATION : 13863 INDUSTRIAL RD., HOUSTON, TX	PROCEDURE : RT-04.01 REV. 0
	JOB NUMBER : **2132**
DATE : **3/2/2017**	P.O. NUMBER :
HOURS : 1.5	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO. : **124346**	PART NO. :
PART DESCRIPTION:	

SOURCE TYPE: **IR-192**	CURIES: 127	SOURCE SIZE: **0.124**	PENETRAMETER: **ASTM 1B / 0.016**
FILM TYPE: ☒ AGFA ☐ D8 ☐ D7 ☒ D5 ☐ D4 ☐ D3 ☐ D2 OTHERS:			
FILM SIZE: **4 ½ X 17"**	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☒
MATERIAL TYPE: **STAINLESS ST.**	☐ DWE/SWV ☒ SWE/SWV ☐ DWE/DWV		FILM SIDE ☐
NO. OF FILM USED: **16**	TOTAL WELDS: **1**		
	EXPOSURE TIME: **4 MIN**	LEAD SIZE: 0.010"	UG: 0.01"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
CS-9		CONE X 0.625" / 0.750" WT	2.0	4.0	30.62"			
WS: "H-61 / T"	1-2					/		
	2-3					/		FILM ARTIFACT
	3-4					/		FILM ARTIFACT
	4-5					/		PO < .156"
	5-6					/		
	6-7					/		FILM ARTIFACT
	7-8					/		PO < .156"
	8-9					/		
	9-10					/		
	10-11					/		PO < .156
	11-12					/		PO < .156"
	12-13					/		
	13-14					/		
	14-15					/		
	15-16					/		
	16-1					/		

RADIOGRAPHER: S. YOUNG	ASSISTANTS: A. CASTILLO	CLIENT SIGNATURE: Ronny Flores 3/3/17
LEVEL: **II** Employee ID #AGD4620		DATE:

NOTES
CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low Crown, SM - Surface Marks, LF - Lack of Fusion, AR - Artifact, PO - Porosity, HB - Hollow Bead, IC - Internal Concavity, WC - Within Code, NC - No Comment

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Report No.: 030217SY-RT4

DAILY EXAMINATION REPORT
RADIOGRAPHIC TESTING

CUSTOMER : CURTIS KELLY	SPEC./CODE : ASME SEC. VIII DIV. 1
LOCATION : 13863 INDUSTRIAL RD., HOUSTON, TX	PROCEDURE : RT-04.01 REV. 0
	JOB NUMBER : **2132**
DATE : **3/2/2017**	P.O. NUMBER :
HOURS : 1.5	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO. : **124346**	PART NO. :
PART DESCRIPTION:	

SOURCE TYPE: **IR-192**	CURIES: 127	SOURCE SIZE: **0.124**	PENETRAMETER: **ASTM 1B / 0.016**
FILM TYPE: ☒ AGFA ☐ D8 ☐ D7 ☒ D5 ☐ D4 ☐ D3 ☐ D2 OTHERS:			
FILM SIZE: **4 ½ X 17"**	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☒
MATERIAL TYPE: **STAINLESS ST.**	☐ DWE/SWV ☒ SWE/SWV ☐ DWE/DWV		FILM SIDE ☐
NO. OF FILM USED: **16**	TOTAL WELDS: **1**		
	EXPOSURE TIME: **4 MIN**	LEAD SIZE: 0.010"	UG: 0.01"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
CS-12		60" ID X 0.625" WT	2.0	4.0	30.62"			
WS: "H-61"	1-2					/		
	2-3					/		
	3-4					/		
	4-5					/		
	5-6					/		
	6-7					/		FILM ARTIFACT
	7-8							Blend / Reshoot
	8-9							Blend / Reshoot
	9-10							Blend / Reshoot
	10-11					/		
	11-12					/		
	12-13					/		FILM ARTIFACT
	13-14					/		FILM ARTIFACT
	14-15					/		
	15-16					/		FILM ARTIFACT
	16-1					/		

RADIOGRAPHER: S. YOUNG	ASSISTANTS: A. CASTILLO	CLIENT SIGNATURE:
LEVEL: **II** Employee ID #AGD4620		DATE: 3/3/17

NOTES
CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low Crown, SM - Surface Marks, LF - Lack of Fusion, AR - Artifact, PO - Porosity, HB - Hollow Bead, IC - Internal Concavity, WC - Within Code, NC - No Comment

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Report No.: 030317-JB04

DAILY EXAMINATION REPORT
RADIOGRAPHIC TESTING

CUSTOMER : CURTIS KELLY INC.	SPEC./CODE : ASME SEC. VIII, DIV. 1
LOCATION : 13863 INDUSTRIAL RD.	PROCEDURE : RT-3, REV. 6
HOUSTON, TX	JOB NUMBER : 2132
DATE : **3/3/2017**	P.O. NUMBER :
HOURS : **0.5 hrs**	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO.: ~~122446~~ 124346	PART NO. :
PART DESCRIPTION:	

SOURCE TYPE: Ir 192	CURIES: 57	SOURCE SIZE: .124	PENETRAMETER: ASTM 1B / 0.016
FILM TYPE: ☐ AGFA ☐ D8 ☐ D7 ☒ D5 ☐ D4 ☐ D3 ☐ D2 OTHERS:			
FILM SIZE: 4 ½" x 17"	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☒
MATERIAL TYPE: STAINLESS STEEL	☐ DWE/SWV ☒ SWE/SWV ☐ DWE/DWV		FILM SIDE ☐
NO. OF FILM USED: 3	TOTAL WELDS: 1		
	EXPOSURE TIME: 6:45 minutes	LEAD SIZE: 0.010"	UG: 0.003"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
CS-12	7-8	60" ID x 0.625" WT	2.0	3.3	30.75"	✓		
W/S: "H61"	8-9					✓		
	9-10					✓		

RADIOGRAPHER: JOHANN V. BALDOVINO	ASSISTANTS: JESSIE BALBOA	CLIENT SIGNATURE:
LEVEL: II AGD9050		DATE: 3/4/17

NOTES
CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low Crown, SM - Surface Marks, LF - Lack of Fusion, AR - Artifact, PO - Porosity, HB - Hollow Bead, IC - Internal Concavity, WC - Within Code, NC - No Comment

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Report No.: 031217SY-RT4

DAILY EXAMINATION REPORT
RADIOGRAPHIC TESTING

CUSTOMER : CURTIS KELLY	SPEC./CODE : ASME SEC. VIII DIV. 1
LOCATION : 13863 INDUSTRIAL RD., HOUSTON, TX	PROCEDURE : RT-3 REV. 6
	JOB NUMBER : **2132**
DATE : **3/12/2017**	P.O. NUMBER :
HOURS : 3	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO. : **143014**	PART NO. :

PART DESCRIPTION: **CIRCLE SEAMS**

SOURCE TYPE: **IR-192**	CURIES: 115	SOURCE SIZE: **0.124**	PENETRAMETER: **ASTM 1B / 0.016**
FILM TYPE: ☒ AGFA ☐ D8 ☐ D7 ☒ D5 ☐ D4 ☐ D3 ☐ D2 OTHERS:			
FILM SIZE: **4 ½ X 17"**	EXPOSURE TECHNIQUE(S): ☐ DWE/SWV ☒ SWE/SWV ☐ DWE/DWV		SOURCE SIDE ☒ FILM SIDE ☐
MATERIAL TYPE: **STAINLES ST.**			
NO. OF FILM USED: **22**	TOTAL WELDS: **2**		
	EXPOSURE TIME: **2:05 MIN**	LEAD SIZE: 0.010"	UG: 0.01"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
CS-1		42" ID X 0.500" WT	2.0	4.0	21.6"			
WS: "H-82 / M1"	1-2					/		PO < .125"
	2-3					/		
	3-4					/		
	4-5						X	ELONG > .250"
	5-6					/		FILM ARTIFACT / SL OK
	6-7					/		FILM ARTIFACT
	7-8						X	ELONG > .250"
	8-9					~~/~~	X	~~FILM ARTIFACT~~ SL. 3/13/17 RF
	9-10					/		
	10-11					/		
	11-1					/		FILM ARTIFACT
CS-5		42" ID X 0.500" WT	2.0	4.0	21.6"			
WS: "E / M1"	1-2					/		FILM ARTIFACT
	2-3					/		FILM ARTIFACT
	3-4					/		PO < .125"
	4-5					/		
	5-6					/		
	6-7					/		
	7-8					/		PO < .125"
	8-9					/		
	9-10					/		
	10-11					/		
	11-1					/		

RADIOGRAPHER: S. YOUNG	ASSISTANTS: A. CASTILLO	CLIENT SIGNATURE: Ramon Flores
LEVEL: **II** Employee NO #AGD4620		DATE: 3/13/17

NOTES
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Report No.: 031617SY-RT4

DAILY EXAMINATION REPORT
RADIOGRAPHIC TESTING

CUSTOMER : CURTIS KELLY	SPEC./CODE : ASME SEC. VIII DIV. 1
LOCATION : 13863 INDUSTRIAL RD., HOUSTON, TX	PROCEDURE : RT-3 REV. 6
	JOB NUMBER : **2132**
DATE : **3/16/2017**	P.O. NUMBER :
HOURS : 1	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO. : ~~143014~~ 143119	PART NO. :

PART DESCRIPTION: **CIRCLE SEAMS**

SOURCE TYPE: **IR-192**	CURIES: 113	SOURCE SIZE: **0.124**	PENETRAMETER: **ASTM 1B / 0.016**
FILM TYPE: ☒ AGFA ☐ D8 ☐ D7 ☒ D5 ☐ D4 ☐ D3 ☐ D2 OTHERS:			
FILM SIZE: **4 ½ X 17"**	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☒
MATERIAL TYPE: **STAINLES ST.**	☐ DWE/SWV ☒ SWE/SWV ☐ DWE/DWV		FILM SIDE ☐
NO. OF FILM USED: **3**	TOTAL WELDS: **1**		
	EXPOSURE TIME: **2:05 MIN**	LEAD SIZE: 0.010"	UG: 0.01"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
CS-1 R1		42" ID X 0.500" WT	2.0	4.0	21.6"			
WS: "H-92"	4-5						X	ELONG > .250"
	7-8					/		PO < .125" / FA
	8-9						X	ELONG > .250"

RADIOGRAPHER: S. YOUNG
LEVEL: II Employee ID #AGD4620

ASSISTANTS: A. CASTILLO

CLIENT SIGNATURE:
3/20/17
DATE:

NOTES
CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low Crown, SM - Surface Marks, LF - Lack of Fusion, AR - Artifact, PO - Porosity, HB - Hollow Bead, IC - Internal Concavity, WC - Within Code, NC - No Comment

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Report No.: 032317-JB04

DAILY EXAMINATION REPORT
RADIOGRAPHIC TESTING

USTOMER : CURTIS KELLY INC.	SPEC./CODE : ASME SEC. VIII, DIV. 1
LOCATION : 13863 INDUSTRIAL RD.	PROCEDURE : RT-3, REV. 6
HOUSTON, TX	JOB NUMBER : 2132
DATE : **3/23/2017**	P.O. NUMBER :
HOURS : **0.5 hrs**	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO.: **143145**	PART NO. :
PART DESCRIPTION:	

SOURCE TYPE: Ir^{192}	CURIES: 105	SOURCE SIZE: .124	PENETRAMETER: ASTM 1B / 0.013
FILM TYPE: ☐ AGFA ☐ D8 ☐ D7 ☒ D5 ☐ D4 ☐ D3 ☐ D2 OTHERS:			
FILM SIZE: 4 ½" x 17"	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☒
MATERIAL TYPE: STAINLESS STEEL	☐ DWE/SWV ☒ SWE/SWV ☐ DWE/DWV		FILM SIDE ☐
NO. OF FILM USED: 2	TOTAL WELDS: 1		
	EXPOSURE TIME: 2:00 minutes	LEAD SIZE: 0.010"	UG: 0.004"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
CS-1 R2	4-5	42" ID x 0.500" WT	2.0	3.3	21.63"	✓		PO ok
W/S: "H51"	8-9					✓		SM ID

RADIOGRAPHER: JOHANN V. BALDOVINO
LEVEL: II AGD9050

ASSISTANTS: JESSIE BALBOA

CLIENT SIGNATURE:
DATE: 3/24/17

NOTES
CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low Crown, SM - Surface Marks, LF - Lack of Fusion, AR - Artifact, PO - Porosity, HB - Hollow Bead, IC - Internal Concavity, WC - Within Code, NC - No Comment

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Report No.: 032217-JB02

DAILY EXAMINATION REPORT
RADIOGRAPHIC TESTING

CUSTOMER : CURTIS KELLY INC.	SPEC./CODE : ASME SEC. VIII, DIV.1
LOCATION : 13863 INDUSTRIAL RD.	PROCEDURE : RT-04.01, REV. 0
HOUSTON, TX	JOB NUMBER : 2134
DATE : 3/22/2017	P.O. NUMBER :
HOURS : 2 hrs total (0.5 hr standby)	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO.: 143130	PART NO. :
PART DESCRIPTION: Circle Seams	

SOURCE TYPE: Ir 192	CURIES: 106	SOURCE SIZE: .124	PENETRAMETER: ASTM 1B / 0.013
FILM TYPE: ☐ AGFA ☐ D8 ☐ D7 ☒ D5 ☐ D4 ☐ D3 ☐ D2 OTHERS:			
FILM SIZE: 4 ½" x 17"	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☒
MATERIAL TYPE: STAINLESS STEEL	☐ DWE/SWV ☒ SWE/SWV ☐ DWE/DWV		FILM SIDE ☐
NO. OF FILM USED: 7	TOTAL WELDS: 2		
	EXPOSURE TIME: 2:00 minutes	LEAD SIZE: 0.010"	UG: 0.003"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
CS-2	1A-2	144" OD x 0.375" WT	2.0	3.3	23.13"	✓		F/A
W/S: "E/T/H92"	1B-2					✓		
	1C-2					✓		
CS-4	1A-2	144" OD x 0.375" WT	2.0	3.3	23.13"	✓		
W/S: "E/T/H51"	1B-2					✓		
	1C-2					✓		
	1D-2					✓		

RADIOGRAPHER:	ASSISTANTS:	CLIENT SIGNATURES:
JOHANN V. BALDOVINO	JESSIE BALBOA	3/23/17
LEVEL: II AGD9050		DATE:

NOTES
CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low Crown, SM - Surface Marks, LF - Lack of Fusion, AR - Artifact, PO - Porosity, HB - Hollow Bead, IC - Internal Concavity, WC - Within Code, NC - No Comment

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Report No.: 032417-JB03

DAILY EXAMINATION REPORT
RADIOGRAPHIC TESTING

CUSTOMER : CURTIS KELLY INC.	SPEC./CODE : ASME SEC. VIII, DIV. 1
LOCATION : 13863 INDUSTRIAL RD.	PROCEDURE : RT-3, REV. 6
HOUSTON, TX	JOB NUMBER : 2139
DATE : **3/24/2017**	P.O. NUMBER :
HOURS : **3.5 hrs**	SERIAL NO. :
MILEAGE : MR 3/27/17	DRAWING NO.:
REQUEST NO.: ~~124160~~ 143148	PART NO. :
PART DESCRIPTION: LONG SEAMS	

SOURCE TYPE: Ir 192	CURIES: 104	SOURCE SIZE: .124	PENETRAMETER: ASTM 1B / 0.025
FILM TYPE: ☐ AGFA ☐ D8 ☐ D7 ☒ D5 ☐ D4 ☐ D3 ☐ D2 OTHERS:			
FILM SIZE: 4 ½" x 17"	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☒
MATERIAL TYPE: STAINLESS STEEL	☐ DWE/SWV ☒ SWE/SWV ☐ DWE/DWV		FILM SIDE ☐
NO. OF FILM USED: 12	TOTAL WELDS: 3		
	EXPOSURE TIME: 6:30 minutes	LEAD SIZE: 0.010"	UG: 0.007"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
LS-8	1-2	108" ID x 78" ID	2.0	3.3	26.4"		x	SI (1")
W/S: "H72/H51"	2-3	x 2.500" WT				✓		PO ok
	3-4					✓		PO ok
	4-5					✓		SM OD
LS-8A	1-2	108" ID x 78" ID	2.0	3.3	26.4"	✓	X	PO ok, F/A, SL. (.750
W/S: "H72/H51"	2-3	x 2.500" WT				✓	X	SL. (.675")
	3-4					✓		SM OD
	4-5					✓		
LS-8B	1-2	108" ID x 78" ID	2.0	3.3	26.4"	✓		
W/S: "H72/H51"	2-3	x 2.500" WT				✓		
	3-4					✓		
	4-5					✓		

RADIOGRAPHER:	ASSISTANTS:	CLIENT SIGNATURE:
JOHANN V. BALDOVINO	JESSIE BALBOA	Raul Flores 3/25/17
LEVEL: II AGD9050		DATE:

NOTES
CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low Crown, SM - Surface Marks, LF - Lack of Fusion, AR - Artifact, PO - Porosity, HB - Hollow Bead, IC - Internal Concavity, WC - Within Code, NC - No Comment

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Report No.: 040417SY-RT4

DAILY EXAMINATION REPORT

RADIOGRAPHIC TESTING

CUSTOMER : CURTIS KELLY	SPEC./CODE : ASME SEC. VIII DIV. 1
LOCATION : 13863 INDUSTRIAL RD., HOUSTON, TX	PROCEDURE : RT-3 REV. 6
	JOB NUMBER : **2132**
DATE : **4/4/2017**	P.O. NUMBER :
HOURS : 1	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO. : **143342**	PART NO. :

PART DESCRIPTION: **NOZZLE L**

SOURCE TYPE: **IR-192**	CURIES: 117	SOURCE SIZE: **0.124**	PENETRAMETER: **ASTM 1B / 0.010**
FILM TYPE: ☒ AGFA ☐ D8 ☐ D7 ☒ D5 ☐ D4 ☐ D3 ☐ D2 OTHERS:			
FILM SIZE: **4 ½ X 10"**	EXPOSURE TECHNIQUE(S): ☐ DWE/SWV ☐ SWE/SWV ☒ DWE/DWV		SOURCE SIDE ☐ FILM SIDE ☒
MATERIAL TYPE: **STAINLES ST.**			
NO. OF FILM USED: **12**	TOTAL WELDS: **3**		
	EXPOSURE TIME: **16 SEC**	LEAD SIZE: 0.010"	UG: 0.01"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
L-1		6.625" OD X 0.280" WT	2.0	4.0	7.25"			
WS: "H-51"	1-2					/		
	2-3					/		TI OK
	3-4					/		
	4-1					/		
L-2		6.625" OD X 0.280" WT	2.0	4.0	7.25"			
WS: "H-51"	1-2					/		
	2-3					/		
	3-4					/		
	4-1					/		
L-3		6.625" OD X 0.280" WT	2.0	4.0	7.25"			
WS: "H-51"	1-2						X	TI / ROUND > .105"
	2-3					/		
	3-4					/		
	4-1							DEBRIS IN PIPE

RADIOGRAPHER: S. YOUNG

LEVEL: **II** Employee ID#AGD4620

ASSISTANTS: A. CASTILLO

CLIENT SIGNATURE:

DATE: 4/5/17

NOTES

CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low Crown, SM - Surface Marks, LF - Lack of Fusion, AR - Artifact, PO - Porosity, HB - Hollow Bead, IC - Internal Concavity, WC - Within Code, NC - No Comment

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Report No.: 040517SY-RT3

DAILY EXAMINATION REPORT
RADIOGRAPHIC TESTING

CUSTOMER : CURTIS KELLY	SPEC./CODE : ASME SEC. VIII DIV. 1
LOCATION : 13863 INDUSTRIAL RD., HOUSTON, TX	PROCEDURE : RT-3 REV. 6
	JOB NUMBER : **2132**
DATE : **4/5/2017**	P.O. NUMBER :
HOURS : 0.5	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO. : **143152**	PART NO. :
PART DESCRIPTION: **NOZZLE L**	

SOURCE TYPE: **IR-192**	CURIES: 116	SOURCE SIZE: **0.124**	PENETRAMETER: **ASTM 1B / 0.010**
FILM TYPE: ☒ AGFA ☐ D8 ☐ D7 ☒ D5 ☐ D4 ☐ D3 ☐ D2 OTHERS:			
FILM SIZE: **4 ½ X 10"**	EXPOSURE TECHNIQUE(S): ☐ DWE/SWV ☐ SWE/SWV ☒ DWE/DWV		SOURCE SIDE ☐ FILM SIDE ☒
MATERIAL TYPE: **STAINLES ST.**			
NO. OF FILM USED: **1**	TOTAL WELDS: **1**		
	EXPOSURE TIME: **16 SEC**	LEAD SIZE: 0.010"	UG: 0.01"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
L-3 R1		6.625" OD X 0.280" WT	2.0	4.0	7.25"			Surface OK
WS: "H-51"	1-2					✓		[redacted]

RADIOGRAPHER: S. YOUNG

LEVEL: II Employee ID #AGD4620

ASSISTANTS: A. CASTILLO

CLIENT SIGNATURE: Ramon Flores

DATE: 4/6/17

NOTES
CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low Crown, SM - Surface Marks, LF - Lack of Fusion, AR - Artifact, PO - Porosity, HB - Hollow Bead, IC - Internal Concavity, WC - Within Code, NC - No Comment

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Report No.: 040517SY-RT4

DAILY EXAMINATION REPORT
RADIOGRAPHIC TESTING

CUSTOMER : CURTIS KELLY	SPEC./CODE : ASME SEC. VIII DIV. 1
LOCATION : 13863 INDUSTRIAL RD., HOUSTON, TX	PROCEDURE : RT-3 REV. 6
	JOB NUMBER : **2132**
DATE : **4/5/2017**	P.O. NUMBER :
HOURS : 0.5	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO. : **143342**	PART NO. :

PART DESCRIPTION: **NOZZLE L**

SOURCE TYPE: **IR-192**	CURIES: 116	SOURCE SIZE: **0.124**	PENETRAMETER: **ASTM 1B / 0.010**
FILM TYPE: ☒ AGFA ☐ D8 ☐ D7 ☒ D5 ☐ D4 ☐ D3 ☐ D2 OTHERS:			
FILM SIZE: **4 ½ X 10"**	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☐
MATERIAL TYPE: **STAINLES ST.**	☐ DWE/SWV ☐ SWE/SWV ☒ DWE/DWV		FILM SIDE ☒
NO. OF FILM USED: **1**	TOTAL WELDS: **1**		
	EXPOSURE TIME: **16 SEC**	LEAD SIZE: 0.010"	UG: 0.01"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	A C C.	R E J.	TYPE OF DEFECTS
L-3		6.625" OD X 0.280" WT	2.0	4.0	7.25"			
WS: "H-51"	4-1					—		DEBRIS IN PIPE/Reshoot

RADIOGRAPHER: S. YOUNG

LEVEL: II Employee ID #AGD4620

ASSISTANTS: A. CASTILLO

CLIENT SIGNATURE:

DATE: 4/6/17

NOTES
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Report No.: 040617SY-RT3

DAILY EXAMINATION REPORT

RADIOGRAPHIC TESTING

CUSTOMER : CURTIS KELLY	SPEC./CODE : ASME SEC. VIII DIV. 1
LOCATION : 13863 INDUSTRIAL RD., HOUSTON, TX	PROCEDURE : RT-3 REV. 6
	JOB NUMBER : **2132**
DATE : **4/6/2017**	P.O. NUMBER :
HOURS : 0.5	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO. : **143342**	PART NO. :
PART DESCRIPTION: **NOZZLE L**	

SOURCE TYPE: **IR-192**	CURIES: 116	SOURCE SIZE: **0.124**	PENETRAMETER: **ASTM 1B / 0.010**
FILM TYPE: ☒ AGFA ☐ D8 ☐ D7 ☒ D5 ☐ D4 ☐ D3 ☐ D2 OTHERS:			
FILM SIZE: **4 ½ X 10"**	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☐
MATERIAL TYPE: **STAINLES ST.**	☐ DWE/SWV ☐ SWE/SWV ☒ DWE/DWV		FILM SIDE ☒
NO. OF FILM USED: **1**	TOTAL WELDS: **1**		
	EXPOSURE TIME: **16 SEC**	LEAD SIZE: 0.010"	UG: 0.01"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
L-3		6.625" OD X 0.280" WT	2.0	4.0	7.25"			
WS: "H-51"	4-1					/		OD SURFACE

RADIOGRAPHER: S. YOUNG

LEVEL: II Employee ID #AGD4620

ASSISTANTS: A. CASTILLO

CLIENT SIGNATURE:

DATE: 4/7/17

NOTES

CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low Crown, SM - Surface Marks, LF - Lack of Fusion, AR - Artifact, PO - Porosity, HB - Hollow Bead, IC - Internal Concavity, WC - Within Code, NC - No Comment

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Report No.: 061117-JB01

DAILY EXAMINATION REPORT
RADIOGRAPHIC TESTING

CUSTOMER: CURTIS KELLY INC.	SPEC./CODE : ASME SEC. VIII, DIV. 1
LOCATION : 13863 INDUSTRIAL RD.	PROCEDURE : RT-3, REV. 6
HOUSTON, TX	JOB NUMBER : 2132
DATE : **6/11/2017**	P.O. NUMBER :
HOURS : **1.5 hrs + 1 hr travel**	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO.: **158063**	PART NO. :
PART DESCRIPTION: CIRCLE SEAMS	

SOURCE TYPE: Ir^{192}	CURIES: 89	SOURCE SIZE: .124	PENETRAMETER: ASTM 1B / 0.016
FILM TYPE: ☑AGFA ☐ D8 ☐ D7 ☑D5 ☐ D4 D3 ☐ D2 OTHERS:			
FILM SIZE: 4 ½" x 17"	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☑
MATERIAL TYPE: STAINLESS STEEL	☐DWE/SWV ☑ SWE/SWV ☐ DWE/DWV		FILM SIDE ☐
NO. OF FILM USED: 12	TOTAL WELDS: 1		
	EXPOSURE TIME: 3:00 minutes	LEAD SIZE: 0.010"	UG: 0.005"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
CS-8	1-2	60" to 42" ID	2.0	3.3	21.88"	✓		
W/S "H61/H25"	2-3	x 0.750" WT				✓		
	3-4					✓		
	4-5					✓		
	5-6					✓		
	6-7					✓		
	7-8					✓		
	8-9					✓		
	9-10					✓		
	10-11					✓		
	11-12					✓		
	12-1					✓		

RADIOGRAPHER:	ASSISTANTS:	CLIENT SIGNATURE:
JOHANN V. BALDOVINO	JESSIE BALBOA	
LEVEL: II AGD9050		DATE: 6/12/17

NOTES
CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low Crown, SM - Surface Marks, LF - Lack of Fusion, AR - Artifact, PO - Porosity, HB - Hollow Bead, IC - Internal Concavity, WC - Within Code, NC - No Comment

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Report No.: 061517-JB04

DAILY EXAMINATION REPORT
RADIOGRAPHIC TESTING

CUSTOMER: CURTIS KELLY INC.	SPEC./CODE : ASME SEC. VIII, DIV. 1
LOCATION : 13863 INDUSTRIAL RD.	PROCEDURE : RT-3, REV. 6
HOUSTON, TX	JOB NUMBER : 2132
DATE : **6/15/2017**	P.O. NUMBER :
HOURS : **1 hr**	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO.: **158204**	PART NO. :
PART DESCRIPTION: NOZZLE	

SOURCE TYPE: Ir^{192}	CURIES: 36	SOURCE SIZE: .124	PENETRAMETER: ASTM 1B / 0.013
FILM TYPE: ☐ AGFA ☐ D8 ☐ D7 ☐ D5 ☐ D4 ☑ D3 ☐ D2 OTHERS:			
FILM SIZE: 4 ½" x 17"	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☑
MATERIAL TYPE: STAINLESS STEEL	☐ DWE/SWV ☑ SWE/SWV ☐ DWE/DWV		FILM SIDE ☐
NO. OF FILM USED: 3	TOTAL WELDS: 1		
	EXPOSURE TIME: 0:15 seconds	LEAD SIZE: 0.010"	UG: 0.012"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
NOZZ. B-1	1-2	10.75" OD x 0.365" WT	2.0	3.3	5.5"	✓		
W/S: "QL/H51"	2-3					✓		
	3-1					✓		WELD CONTOUR

RADIOGRAPHER: JOHANN V. BALDOVINO
LEVEL: II AGD9030

ASSISTANTS: ADAM HERRERA

CLIENT SIGNATURE:
DATE: 6/16/17

NOTES
CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low Crown, SM - Surface Marks, LF - Lack of Fusion, AR - Artifact, PO - Porosity, HB - Hollow Bead, IC - Internal Concavity, WC - Within Code, NC - No Comment

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Report No.: 062717-JB06

DAILY EXAMINATION REPORT
RADIOGRAPHIC TESTING

STOMER: CURTIS KELLY INC.	SPEC./CODE : ASME B31.3
LOCATION : 13863 INDUSTRIAL RD.	PROCEDURE : RT-3, REV. 6
HOUSTON, TX	JOB NUMBER : 2132
DATE : **6/27/2017**	P.O. NUMBER :
HOURS : **1.5 hr**	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO.: **158371**	PART NO. :
PART DESCRIPTION: DOWNCOMER B	

SOURCE TYPE: Ir^{192}	CURIES: 32	SOURCE SIZE: .124	PENETRAMETER: ASTM 1B / 0.016
FILM TYPE: ☐ AGFA ☐ D8 ☐ D7 ☐D5 ☑D4 ☐ D3 ☐ D2 OTHERS:			
FILM SIZE: 4 ½" x 17"	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☐
MATERIAL TYPE: STAINLESS STEEL	☑DWE/SWV ☐SWE/SWV ☐ DWE/DWV		FILM SIDE ☑
NO. OF FILM USED: 9	TOTAL WELDS: 3		
	EXPOSURE TIME: 4 minutes	LEAD SIZE: 0.010"	UG: 0.016"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
P-15	1-2	10.75" OD x 0.365" WT	2.0	3.3	11.4"	✓		
W/S: "H51"	2-3					✓		
	3-1					✓		
P-18	1-2	10.75" OD x 0.365" WT	2.0	3.3	11.4"	✓		
W/S: "H51"	2-3					✓		
	3-1					✓		
P-24	1-2	10.75" OD x 0.365" WT	2.0	3.3	11.4"	✓		
W/S: "H92"	2-3					✓		
	3-1					✓		

RADIOGRAPHER: JOHANN V. BALDOVINO	ASSISTANTS: JESSIE BALBOA	CLIENT SIGNATURE:
LEVEL: II AGD9050		DATE: 6/28/17

NOTES
CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low Crown, SM - Surface Marks, LF - Lack of Fusion, AR - Artifact, PO - Porosity, HB - Hollow Bead, IC - Internal Concavity, WC - Within Code, NC - No Comment

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Report No.: 062717-JB07

DAILY EXAMINATION REPORT
RADIOGRAPHIC TESTING

CUSTOMER: CURTIS KELLY INC.	SPEC./CODE : ASME B31.3
LOCATION : 13863 INDUSTRIAL RD.	PROCEDURE : RT-3, REV. 6
HOUSTON, TX	JOB NUMBER : 2132
DATE : **6/27/2017**	P.O. NUMBER :
HOURS : **1 hr**	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO.: **158371**	PART NO. :

PART DESCRIPTION: DOWNCOMER C

SOURCE TYPE: Ir^{192}	CURIES: 32	SOURCE SIZE: .124	PENETRAMETER: ASTM 1B / 0.016
FILM TYPE: ☐ AGFA ☐ D8 ☐ D7 ☐D5 ☑D4 ☐ D3 ☐ D2 OTHERS:			
FILM SIZE: 4 ½" x 17"	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☐
MATERIAL TYPE: STAINLESS STEEL	☑DWE/SWV ☐SWE/SWV ☐ DWE/DWV		FILM SIDE ☑
NO. OF FILM USED: 6	TOTAL WELDS: 2		
	EXPOSURE TIME: 4 minutes	LEAD SIZE: 0.010"	UG: 0.016"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
P-29	1-2	10.75" OD x 0.365" WT	2.0	3.3	11.4"	✓		
W/S: "H51"	2-3					✓		
	3-1					✓		
P-36	1-2	10.75" OD x 0.365" WT	2.0	3.3	11.4"	✓		
W/S: "H92"	2-3					✓		PO
	3-1					✓		PO

RADIOGRAPHER: JOHANN V. BALDOVINO
LEVEL: II AGD9050

ASSISTANTS: JESSIE BALBOA

CLIENT SIGNATURE:

DATE: 6/28/17

NOTES
CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low Crown, SM - Surface Marks, LF - Lack of Fusion, AR - Artifact, PO - Porosity, HB - Hollow Bead, IC - Internal Concavity, WC - Within Code, NC - No Comment

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Report No.: 062717-JB08

DAILY EXAMINATION REPORT
RADIOGRAPHIC TESTING

CUSTOMER : CURTIS KELLY INC.	SPEC./CODE : ASME B31.3
LOCATION : 13863 INDUSTRIAL RD.	PROCEDURE : RT-3, REV. 6
HOUSTON, TX	JOB NUMBER : 2132
DATE : **6/27/2017**	P.O. NUMBER :
HOURS : **0.5 hr**	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO.: **158371**	PART NO. :
PART DESCRIPTION: DOWNCOMER A	

SOURCE TYPE: Ir^{192}	CURIES: 32	SOURCE SIZE: .124	PENETRAMETER: ASTM 1A / 0.008
FILM TYPE: ☐ AGFA ☐ D8 ☐ D7 ☐ D5 ☑ D4 ☐ D3 ☐ D2 OTHERS:			
FILM SIZE: 4 ½" x 10"	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☐
MATERIAL TYPE: STAINLESS STEEL	☑ DWE/SWV ☐ SWE/SWV ☐ DWE/DWV		FILM SIDE ☑
NO. OF FILM USED: 8	TOTAL WELDS: 2		
	EXPOSURE TIME: 25 seconds	LEAD SIZE: 0.010"	UG: 0.009"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
P-3	1-2	3.500" OD x 0.216" WT	2.0	3.3	5"	✓		
W/S: "H51"	2-3					✓		
	3-4					✓		
	4-1					✓		PO ok
P-12	1-2	3.500" OD x 0.216" WT	2.0	3.3	5"	✓		
W/S: "H51"	2-3					✓		
	3-4					✓		
	4-1					✓		

RADIOGRAPHER:	ASSISTANTS:	CLIENT SIGNATURE:
JOHANNY BALDOVINO	JESSIE BALBOA	Ramon Flores 6/28/17
LEVEL: II AGD9050		DATE:

NOTES
CR- Crack, LF- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low

AGD INSPECTION SERVICES, INC.
13820 Stafford Rd., Stafford, TX 77477
Tel.: 281-208-0600 * Fax:281-208-2038
e-mail: agdoffice@agdndt.com * website: www.agdndt.com

Report No.: 062717-JB09

DAILY EXAMINATION REPORT
RADIOGRAPHIC TESTING

CUSTOMER: CURTIS KELLY INC.	SPEC./CODE : ASME B31.3
LOCATION : 13863 INDUSTRIAL RD.	PROCEDURE : RT-3, REV. 6
HOUSTON, TX	JOB NUMBER : 2132
DATE : **6/27/2017**	P.O. NUMBER :
HOURS : **0.5 hr**	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO.: **158371**	PART NO. :
PART DESCRIPTION: DOWNCOMER E	

SOURCE TYPE: Ir^{192}	CURIES: 32	SOURCE SIZE: .124	PENETRAMETER: ASTM 1B / 0.010
FILM TYPE: ☐ AGFA ☐ D8 ☐ D7 ☐D5 ☑D4 ☐ D3 ☐ D2 OTHERS:			
FILM SIZE: 4 ½" x 10"	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☐
MATERIAL TYPE: STAINLESS STEEL	☑DWE/SWV ☐SWE/SWV ☐ DWE/DWV		FILM SIDE ☑
NO. OF FILM USED: 8	TOTAL WELDS: 2		
	EXPOSURE TIME: 1:40 minutes	LEAD SIZE: 0.010"	UG: 0.007"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
P-44	1-2	8.625" OD x 0.322" WT	2.0	3.3	9.25"	✓		
W/S: "H92"	2-3					✓		
	3-4					✓		
	4-1					✓		
P-45	1-2	8.625" OD x 0.322 WT	2.0	3.3	9.25"	✓		
W/S: "H92"	2-3					✓		
	3-4					✓		
	4-1					✓		PO OK

RADIOGRAPHER: JOHANN V. BALDOVINO	ASSISTANTS: JESSIE BALBOA	CLIENT SIGNATURE:
LEVEL: II AGD9050		DATE: 6/28/17

NOTES
CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low Crown, SM - Surface Marks, LF - Lack of Fusion, AR - Artifact, PO - Porosity, HB - Hollow Bead, IC - Internal Concavity, WC - Within Code, NC - No Comment

ISO 9001:2008 CERTIFIED

AGD INSPECTION SERVICES, INC.
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e-mail: agdoffice@agdndt.com * website: www.agdndt.com

Report No.: 062717-JB10

DAILY EXAMINATION REPORT
RADIOGRAPHIC TESTING

JSTOMER : CURTIS KELLY INC.	SPEC./CODE : ASME B31.3
LOCATION : 13863 INDUSTRIAL RD.	PROCEDURE : RT-3, REV. 6
HOUSTON, TX	JOB NUMBER : 2132
DATE : **6/27/2017**	P.O. NUMBER :
HOURS : **0.5 hr**	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO.: **158371**	PART NO. :
PART DESCRIPTION: DOWNCOMER F	

SOURCE TYPE: Ir^{192}	CURIES: 32	SOURCE SIZE: .124	PENETRAMETER: ASTM 1B / 0.010
FILM TYPE: ☐ AGFA ☐ D8 ☐ D7 ☐ D5 ☑ D4 ☐ D3 ☐ D2 OTHERS:			
FILM SIZE: 4 ½" x 10"	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☐
MATERIAL TYPE: STAINLESS STEEL	☑ DWE/SWV ☐ SWE/SWV ☐ DWE/DWV		FILM SIDE ☑
NO. OF FILM USED: 8	TOTAL WELDS: 2		
	EXPOSURE TIME: 1:40 minutes	LEAD SIZE: 0.010"	UG: 0.007"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
P-47	1-2	8.625" OD x 0.322" WT	2.0	3.3	9.25"	✓		
W/S: "H51"	2-3					✓		
	3-4					✓		
	4-1					✓		
P-50	1-2	8.625" OD x 0.322 WT	2.0	3.3	9.25"	✓		Surface
W/S: "H51/ql"	2-3					✓		
	3-4					✓		
	4-1					✓		

RADIOGRAPHER:	ASSISTANTS:	CLIENT SIGNATURE:
JOHANN V. BALDOVINO	JESSIE BALBOA	
LEVEL: II AGD9050		DATE: 6/28/17

NOTES
CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low Crown, SM - Surface Marks, LF - Lack of Fusion, AR - Artifact, PO - Porosity, HB - Hollow Bead, IC - Internal Concavity, WC - Within Code, NC - No Comment

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Report No.: 062717-JB11

DAILY EXAMINATION REPORT
RADIOGRAPHIC TESTING

JSTOMER: CURTIS KELLY INC.	SPEC./CODE : ASME B31.3
LOCATION : 13863 INDUSTRIAL RD.	PROCEDURE : RT-3, REV. 6
HOUSTON, TX	JOB NUMBER : 2132
DATE : **6/27/2017**	P.O. NUMBER :
HOURS : **0.5 hr**	SERIAL NO. :
MILEAGE :	DRAWING NO.:
REQUEST NO.: **158371**	PART NO. :
PART DESCRIPTION: DOWNCOMER D	

SOURCE TYPE: Ir^{192}	CURIES: 32	SOURCE SIZE: .124	PENETRAMETER: ASTM 1A / 0.008
FILM TYPE: ☐ AGFA ☐ D8 ☐ D7 ☐ D5 ☑ D4 ☐ D3 ☐ D2 OTHERS:			
FILM SIZE: 4 ½" x 10"	EXPOSURE TECHNIQUE(S):		SOURCE SIDE ☐
MATERIAL TYPE: STAINLESS STEEL	☑ DWE/SWV ☐ SWE/SWV ☐ DWE/DWV		FILM SIDE ☑
NO. OF FILM USED: 3	TOTAL WELDS: 1		
	EXPOSURE TIME: 30 seconds	LEAD SIZE: 0.010"	UG: 0.009"

WELD NO. & ID.	FILM VIEW	PIPE DIAMETER THICKNESS	DENSITY		SFD	ACC.	REJ.	TYPE OF DEFECTS
P-39	1-2	4.500" OD x 0.237" WT	2.0	3.3	5.125"	✓		NO. OK
W/S: "H51"	2-3					✓		
	3-1					✓		

RADIOGRAPHER:
JOHANN V. BALDOVINO
LEVEL: II AGD9050

ASSISTANTS:
JESSIE BALBOA

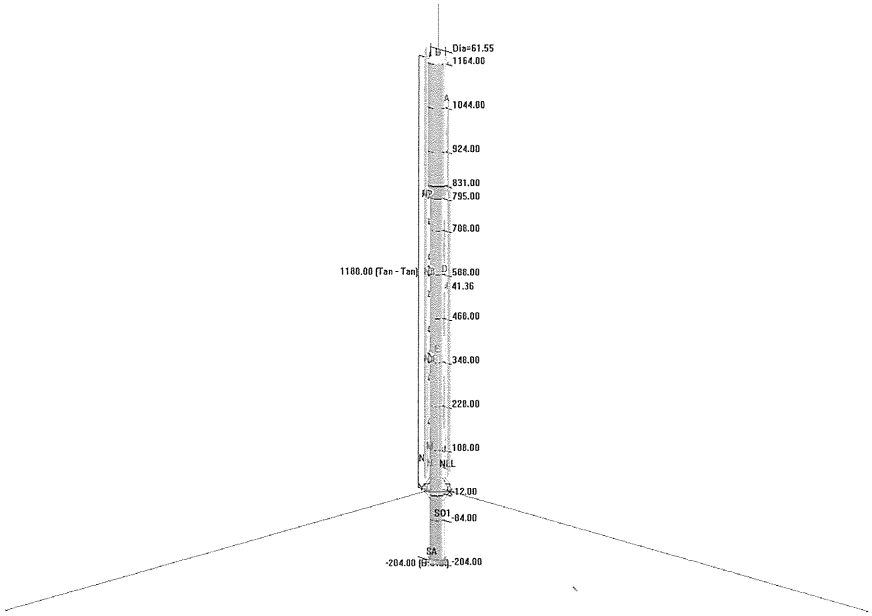
CLIENT SIGNATURE:
DATE: 6/28/17

NOTES
CR- Crack, LP- Lack of Penetration, BT- Burn Through, TG - Tungsten, EU - External Undercut, IU - Internal Undercut, SL - Slag Line, SI - Slag Inclusion, LC - Low Crown, SM - Surface Marks, LF - Lack of Fusion, AR - Artifact, PO - Porosity, HB - Hollow Bead, IC - Internal Concavity, WC - Within Code, NC - No Comment

SECTION 6
ASME CODE CALCULATIONS

CURTIS KELLY

HOUSTON, TEXAS



COMPRESS Pressure Vessel Design Calculations

Item: T-501, DEMETHANIZER

Job No.: 2132

Customer: UOP RUSSELL LLC

Designer: MAK

Date: 10/13/16, REV 0 - ISSUED FOR APPROVAL

King Design Group, Inc
14011 Park Drive #113
Tomball, Tx 77377
markkdg@sbcglobal.net

A.I: 1.17.17

APPROVED FOR CONSTRUCTION
2132
RR 11/14/16
CURTIS KELLY, INC.

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Settings Summary

COMPRESS 2016 Build 7600	
ASME Section VIII Division 1, 2015 Edition	
Units	U.S. Customary
Datum Line Location	12.00" from bottom seam
Vessel Design Mode	Get Thickness from Pressure
Minimum thickness	0.0625" per UG-16(b)
Design for cold shut down only	No
Design for lethal service (full radiography required)	No
Design nozzles for	Design P only
Corrosion weight loss	100% of theoretical loss
UG-23 Stress Increase	1.20
Skirt/legs stress increase	1.0
Minimum nozzle projection	2"
Juncture calculations for $\alpha > 30$ only	Yes
Preheat P-No 1 Materials > 1.25" and <= 1.50" thick	Yes
UG-37(a) shell tr calculation considers longitudinal stress	No
Cylindrical shells made from pipe are entered as minimum thickness	No
Nozzles made from pipe are entered as minimum thickness	No
ASME B16.9 fittings are entered as minimum thickness	No
Butt welds	Tapered per Figure UCS-66.3(a)
Disallow Appendix 1-5, 1-8 calculations under 15 psi	No
Hydro/Pneumatic Test	
Shop Hydrotest Pressure	1.3 times vessel MAWP
Test liquid specific gravity	1.00
Field Hydrotest Pressure	1.3 times vessel MAWP
Wind load present @ field	33% of design
Maximum stress during test	90% of yield
Required Marking - UG-116	
UG-116(e) Radiography	RT1 (user specified, automatic determination deactivated)
UG-116(f) Postweld heat treatment	None
Code Cases\Interpretations	
Use Code Case 2547	No
Use Code Case 2695	No

Apply interpretation VIII-1-83-66	Yes
Apply interpretation VIII-1-86-175	Yes
Apply interpretation VIII-1-01-37	No
Apply interpretation VIII-1-01-150	No
Apply interpretation VIII-1-07-50	No
No UCS-66.1 MDMT reduction	No
No UCS-68(c) MDMT reduction	No
Disallow UG-20(f) exemptions	No
UG-22 Loadings	
UG-22(a) Internal or External Design Pressure	Yes
UG-22(b) Weight of the vessel and normal contents under operating or test conditions	Yes
UG-22(c) Superimposed static reactions from weight of attached equipment (external loads)	No
UG-22(d)(2) Vessel supports such as lugs, rings, skirts, saddles and legs	Yes
UG-22(f) Wind reactions	Yes
UG-22(f) Seismic reactions	Yes
UG-22(j) Test pressure and coincident static head acting during the test:	No
Note: UG-22(b),(c) and (f) loads only considered when supports are present.	

License Information	
Company Name	King Design Group
License	Commercial
License Key ID	10013
Support Expires	April 21, 2017

Pressure Summary

Component Summary								
Identifier	P Design (psi)	T Design (°F)	MAWP (psi)	MAP (psi)	MDMT (°F)	MDMT Exemption		Impact Tested
TOP HEAD	400	200	400.53	400.53	-320	Note 1		No
Straight Flange on TOP HEAD	400	200	411.52	411.52	-320	Note 2		No
SHELL RG 11	400	200	411.52	411.52	-320	Note 2		No
SHELL RG 10	400	200	411.52	411.52	-320	Note 2		No
SHELL RG 9	400	200	411.52	411.52	-320	Note 2		No
CONE RG 8	400	200	411.52	411.52	-320	Note 2, 3, 4		No
SHELL RG 7	400	200	469.48	469.48	-320	Note 2		No
SHELL RG 6	400	200	469.48	469.48	-320	Note 2		No
SHELL RG 5	400	200	469.48	469.48	-320	Note 2		No
SHELL RG 4	400	200	469.48	469.48	-320	Note 2		No
SHELL RG 3	400	200	469.48	469.48	-320	Note 2		No
SHELL RG 2	400	200	469.48	469.48	-320	Note 2		No
SHELL RG 1	400	200	466.88	469.48	-320	Note 2		No
Straight Flange on BOTTOM HEAD	400	200	466.81	469.48	-320	Note 2		No
BOTTOM HEAD	400	200	400.89	403.94	-320	Note 5		No
REFLUX INLET (A)	400	200	411.52	411.52	-320	Nozzle	Note 6	No
						Pad	Note 2	No
VAPOR OUTLET (B)	400	200	416.01	416.01	-320	Nozzle	Note 2	No
						Pad	Note 2	No
TOP FEED (C)	400	200	444.17	444.17	-320	Nozzle	Note 2	No
						Pad	Note 2	No
BOTTOM FEED (D)	400	200	449.86	449.86	-320	Nozzle	Note 6	No
						Pad	Note 2	No
TO E-205 (E)	400	200	461.49	461.49	-320	Nozzle	Note 7	No
						Pad	Note 2	No
FROM E-205 (F)	400	200	461.49	461.49	-320	Nozzle	Note 7	No
						Pad	Note 2	No
TO E-204 / E-207 (G)	400	200	414.88	414.88	-320	Nozzle	Note 7	No
						Pad	Note 2	No
FROM E-204 / E-207 (H)	400	200	414.88	414.88	-320	Nozzle	Note 7	No
						Pad	Note 2	No
PSV (J)	400	200	434.02	434.02	-320	Nozzle	Note 8	No
						Pad	Note 2	No
HANDHOLE (K1)	400	200	409.46	409.46	-320	Nozzle	Note 2	No
						Pad	Note 2	No
HANDHOLE (K2)	400	200	445.55	445.55	-320	Nozzle	Note 2	No
						Pad	Note 2	No
HANDHOLE (K3)	400	200	445.55	445.55	-320	Nozzle	Note 2	No
						Pad	Note 2	No
HANDHOLE (K4)	400	200	415.77	415.77	-320	Nozzle	Note 2	No
						Pad	Note 2	No

HANDHOLE (K5)	400	200	411.52	411.52	-320	Nozzle	Note 2	No
						Pad	Note 2	No
HANDHOLE (K6)	400	200	445.55	445.55	-320	Nozzle	Note 2	No
						Pad	Note 2	No
HANDHOLE (K7)	400	200	445.55	445.55	-320	Nozzle	Note 2	No
						Pad	Note 2	No
HANDHOLE (K8)	400	200	415.77	415.77	-320	Nozzle	Note 2	No
						Pad	Note 2	No
BOTTOMS OUT (L)	400	200	444.84	448.72	-320	Nozzle	Note 9	No
						Pad	Note 2	No
EQUALIZATION (M)	400	200	434.02	434.02	-320	Nozzle	Note 8	No
						Pad	Note 2	No
MANWAY (N1)	400	200	411.52	411.52	-320	Nozzle	Note 2	No
						Pad	Note 2	No
MANWAY (N2)	400	200	416.04	416.04	-320	Nozzle	Note 2	No
						Pad	Note 2	No
MANWAY (N3)	400	200	423.2	423.2	-320	Nozzle	Note 2	No
						Pad	Note 2	No
MANWAY (N4)	400	200	434.9	434.9	-320	Nozzle	Note 2	No
						Pad	Note 2	No
TE/TI (P)	400	200	467.08	469.48	-320	Note 10		No
TW (Q1)	400	200	411.52	411.52	-320	Note 11		No
TW (Q2)	400	200	469.48	469.48	-320	Note 11		No
TW (Q3)	400	200	469.48	469.48	-320	Note 11		No
TW (Q4)	400	200	469.48	469.48	-320	Note 11		No

Chamber Summary	
Design MDMT	-200 °F
Rated MDMT	-320 °F @ 400.53 psi
MAWP hot & corroded	400.53 psi @ 200 °F
MAP cold & new	400.53 psi @ 70 °F
(1) This pressure chamber is not designed for external pressure.	

Notes for MDMT Rating		
Note #	Exemption	Details
1.	Straight Flange governs MDMT	
2.	Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F	
3.	MAWP is governed by cone juncture.	
4.	MAP is governed by cone juncture.	
5.	Straight Flange governs MDMT	
6.	Impact test exempt per UHA-51(g) (coincident ratio = 0.232)	
7.	Impact test exempt per UHA-51(g) (coincident ratio = 0.3385)	
8.	Impact test exempt per UHA-51(g) (coincident ratio = 0.2958)	
9.	Impact test exempt per UHA-51(g) (coincident ratio = 0.2987)	
10.	Impact test exempt per UHA-51(g) (coincident ratio = 0.0182)	
11.	Impact test exempt per UHA-51(g) (coincident ratio = 0.0181)	

Nozzle Schedule

Specifications									
Nozzle mark	Identifier	Size	Materials		Impact Tested	Normalized	Fine Grain	Flange	Blind
A	REFLUX INLET	NPS 4 Sch 40S (Std)	Nozzle	SA-312 TP304 Wld pipe	No	No	No	NPS 4 Class 300 WN A182 F304	No
			Pad	SA-240 304	No	No	No		
B	VAPOR OUTLET	NPS 10 Sch 40S (Std)	Nozzle	SA-312 TP304 Wld pipe	No	No	No	NPS 10 Class 300 WN A182 F304	No
			Pad	SA-240 304	No	No	No		
C	TOP FEED	NPS 12 Sch 40S (Std)	Nozzle	SA-312 TP304 Wld pipe	No	No	No	NPS 12 Class 300 WN A182 F304	No
			Pad	SA-240 304	No	No	No		
D	BOTTOM FEED	NPS 4 Sch 40S (Std)	Nozzle	SA-312 TP304 Wld pipe	No	No	No	NPS 4 Class 300 WN A182 F304	No
			Pad	SA-240 304	No	No	No		
E	TO E-205	NPS 8 Sch 40S (Std)	Nozzle	SA-312 TP304 Wld pipe	No	No	No	NPS 8 Class 300 WN A182 F304	No
			Pad	SA-240 304	No	No	No		
F	FROM E-205	NPS 8 Sch 40S (Std)	Nozzle	SA-312 TP304 Wld pipe	No	No	No	NPS 8 Class 300 WN A182 F304	No
			Pad	SA-240 304	No	No	No		
G	TO E-204 / E-207	NPS 8 Sch 40S (Std)	Nozzle	SA-312 TP304 Wld pipe	No	No	No	NPS 8 Class 300 WN A182 F304	No
			Pad	SA-240 304	No	No	No		
H	FROM E-204 / E-207	NPS 8 Sch 40S (Std)	Nozzle	SA-312 TP304 Wld pipe	No	No	No	NPS 8 Class 300 WN A182 F304	No
			Pad	SA-240 304	No	No	No		
J	PSV	NPS 6 Sch 40S (Std)	Nozzle	SA-312 TP304 Wld pipe	No	No	No	NPS 6 Class 300 WN A182 F304	No
			Pad	SA-240 304	No	No	No		
K1	HANDHOLE	NPS 12 Sch 40S (Std)	Nozzle	SA-312 TP304 Wld pipe	No	No	No	NPS 12 Class 300 WN A182 F304	NPS 12 Class 300 A182 F304
			Pad	SA-240 304	No	No	No		
K2	HANDHOLE	NPS 12 Sch 40S (Std)	Nozzle	SA-312 TP304 Wld pipe	No	No	No	NPS 12 Class 300 WN A182 F304	NPS 12 Class 300 A182 F304
			Pad	SA-240 304	No	No	No		
K3	HANDHOLE	NPS 12 Sch 40S (Std)	Nozzle	SA-312 TP304 Wld pipe	No	No	No	NPS 12 Class 300 WN A182 F304	NPS 12 Class 300 A182 F304
			Pad	SA-240 304	No	No	No		
K4	HANDHOLE	NPS 12 Sch 40S (Std)	Nozzle	SA-312 TP304 Wld pipe	No	No	No	NPS 12 Class 300 WN A182 F304	NPS 12 Class 300 A182 F304
			Pad	SA-240 304	No	No	No		
K5	HANDHOLE	NPS 12 Sch 40S (Std)	Nozzle	SA-312 TP304 Wld pipe	No	No	No	NPS 12 Class 300 WN A182 F304	NPS 12 Class 300 A182 F304
			Pad	SA-240 304	No	No	No		
K6	HANDHOLE	NPS 12 Sch 40S (Std)	Nozzle	SA-312 TP304 Wld pipe	No	No	No	NPS 12 Class 300 WN A182 F304	NPS 12 Class 300 A182 F304
			Pad	SA-240 304	No	No	No		
K7	HANDHOLE	NPS 12 Sch 40S (Std)	Nozzle	SA-312 TP304 Wld pipe	No	No	No	NPS 12 Class 300 WN A182 F304	NPS 12 Class 300 A182 F304
			Pad	SA-240 304	No	No	No		
K8	HANDHOLE		Nozzle		No	No	No		

		NPS 12 Sch 40S (Std)		SA-312 TP304 Wld pipe				NPS 12 Class 300 WN A182 F304	NPS 12 Class 300 A182 F304
			Pad	SA-240 304	No	No	No		
L	BOTTOMS OUT	NPS 6 Sch 40S (Std)	Nozzle	SA-312 TP304 Wld pipe	No	No	No	NPS 6 Class 300 WN A182 F304	No
			Pad	SA-240 304	No	No	No		
M	EQUALIZATION	NPS 6 Sch 40S (Std)	Nozzle	SA-312 TP304 Wld pipe	No	No	No	NPS 6 Class 300 WN A182 F304	No
			Pad	SA-240 304	No	No	No		
N1	MANWAY	20 OD x 0.375	Nozzle	SA-240 304	No	No	No	NPS 20 Class 300 WN A182 F304	NPS 20 Class 300 A182 F304
			Pad	SA-240 304	No	No	No		
N2	MANWAY	20 OD x 0.375	Nozzle	SA-240 304	No	No	No	NPS 20 Class 300 WN A182 F304	NPS 20 Class 300 A182 F304
			Pad	SA-240 304	No	No	No		
N3	MANWAY	20 OD x 0.375	Nozzle	SA-240 304	No	No	No	NPS 20 Class 300 WN A182 F304	NPS 20 Class 300 A182 F304
			Pad	SA-240 304	No	No	No		
N4	MANWAY	20 OD x 0.375	Nozzle	SA-240 304	No	No	No	NPS 20 Class 300 WN A182 F304	NPS 20 Class 300 A182 F304
			Pad	SA-240 304	No	No	No		
P	TE/TI	2.12 OD x 0.56	Nozzle	SA-182 F304 <= 5	No	No	No	NPS 1 Class 300 LWN A182 F304	No
Q1	TW	2.12 OD x 0.56	Nozzle	SA-182 F304 <= 5	No	No	No	NPS 1 Class 300 LWN A182 F304	No
Q2	TW	2.12 OD x 0.56	Nozzle	SA-182 F304 <= 5	No	No	No	NPS 1 Class 300 LWN A182 F304	No
Q3	TW	2.12 OD x 0.56	Nozzle	SA-182 F304 <= 5	No	No	No	NPS 1 Class 300 LWN A182 F304	No
Q4	TW	2.12 OD x 0.56	Nozzle	SA-182 F304 <= 5	No	No	No	NPS 1 Class 300 LWN A182 F304	No

Nozzle Summary

Dimensions												
Nozzle mark	OD (in)	t_n (in)	Req t_n (in)	A_1?	A_2?	Shell			Reinforcement Pad		Corr (in)	A_a/A_r (%)
						Nom t (in)	Design t (in)	User t (in)	Width (in)	t_{pad} (in)		
A	4.5	0.237	0.237	Yes	Yes	0.625	0.6073		2	0.625	0	119.0
B	10.75	0.365	0.365	Yes	Yes	0.602*	0.5411		4.5	0.625	0	108.3
C	12.75	0.375	0.375	Yes	Yes	0.75	0.5321		4.5	0.625	0	123.0
D	4.5	0.237	0.237	Yes	Yes	0.5	0.4251		2	0.375	0	125.9
E	8.625	0.322	0.322	Yes	Yes	0.5	0.4251		3	0.5	0	132.1
F	8.625	0.322	0.322	Yes	Yes	0.5	0.4251		3	0.5	0	132.1
G	8.625	0.322	0.322	Yes	Yes	0.5	0.4251		3	0.375	0	107.7
H	8.625	0.322	0.322	Yes	Yes	0.5	0.4251		3	0.375	0	107.7
J	6.625	0.28	0.28	Yes	Yes	0.5	0.4251		2.5	0.375	0	117.7
K1	12.75	0.375	0.1637	Yes	Yes	0.625	0.6073		5	0.625	0	104.9
K2	12.75	0.375	0.1637	Yes	Yes	0.5	0.4251		4.5	0.5	0	123.8
K3	12.75	0.375	0.1637	Yes	Yes	0.5	0.4251		4.5	0.5	0	123.8
K4	12.75	0.375	0.1637	Yes	Yes	0.5	0.4251		5	0.375	0	108.2
K5	12.75	0.375	0.1637	Yes	Yes	0.625	0.6073		5.5	0.625	0	111.6
K6	12.75	0.375	0.1637	Yes	Yes	0.5	0.4251		4.5	0.5	0	123.8
K7	12.75	0.375	0.1637	Yes	Yes	0.5	0.4251		4.5	0.5	0	123.8
K8	12.75	0.375	0.1637	Yes	Yes	0.5	0.4251		5	0.375	0	108.2
L	6.625	0.28	0.28	Yes	Yes	0.425*	0.3824		2.5	0.5	0	123.4
M	6.625	0.28	0.28	Yes	Yes	0.5	0.4251		2.5	0.375	0	117.7
N1	20	0.375	0.1948	Yes	Yes	0.625	0.6073		9	0.625	0	106.8
N2	20	0.375	0.1948	Yes	Yes	0.75	0.5321		5.5	0.75	0	108.2
N3	20	0.375	0.1948	Yes	Yes	0.5	0.4251		7	0.5	0	112.1
N4	20	0.375	0.1948	Yes	Yes	0.5	0.4251		7.5	0.5	0	118.2
P	2.12	0.56	0.1348	Yes	Yes	0.5	N/A		N/A	N/A	0	Exempt
Q1	2.12	0.56	0.1348	Yes	Yes	0.625	N/A		N/A	N/A	0	Exempt
Q2	2.12	0.56	0.1348	Yes	Yes	0.5	N/A		N/A	N/A	0	Exempt
Q3	2.12	0.56	0.1348	Yes	Yes	0.5	N/A		N/A	N/A	0	Exempt
Q4	2.12	0.56	0.1348	Yes	Yes	0.5	N/A		N/A	N/A	0	Exempt

*Head minimum thickness after forming

Definitions	
tn	Nozzle thickness
Req tn	Nozzle thickness required per UG-45/UG-16 Increased for pipe to account for 12.5% pipe thickness tolerance
Nom t	Vessel wall thickness
Design t	Required vessel wall thickness due to pressure + corrosion allowance per UG-37
User t	Local vessel wall thickness (near opening)
A_a	Area available per UG-37, governing condition
A_r	Area required per UG-37, governing condition
Corr	Corrosion allowance on nozzle wall

Thickness Summary

Component Data								
Component Identifier	Material	Diameter (in)	Length (in)	Nominal t (in)	Design t (in)	Total Corrosion (in)	Joint E	Load
TOP HEAD	SA-240 304	60 ID	15.602	0.602*	0.6013	0	1.00	Internal
Straight Flange on TOP HEAD	SA-240 304	60 ID	2	0.625	0.6073	0	1.00	Internal
SHELL RG 11	SA-240 304	60 ID	120	0.625	0.6073	0	1.00	Internal
SHELL RG 10	SA-240 304	60 ID	120	0.625	0.6073	0	1.00	Internal
SHELL RG 9	SA-240 304	60 ID	93	0.625	0.6073	0	1.00	Internal
CONE RG 8	SA-240 304	42 / 60 ID	36	0.75	0.626	0	1.00	Internal
SHELL RG 7	SA-240 304	42 ID	87	0.5	0.4252	0	1.00	Internal
SHELL RG 6	SA-240 304	42 ID	120	0.5	0.4252	0	1.00	Internal
SHELL RG 5	SA-240 304	42 ID	120	0.5	0.4252	0	1.00	Internal
SHELL RG 4	SA-240 304	42 ID	120	0.5	0.4252	0	1.00	Internal
SHELL RG 3	SA-240 304	42 ID	120	0.5	0.4252	0	1.00	Internal
SHELL RG 2	SA-240 304	42 ID	120	0.5	0.4252	0	1.00	Internal
SHELL RG 1	SA-240 304	42 ID	120	0.5	0.4925	0	1.00	Wind
Straight Flange on BOTTOM HEAD	SA-240 304	42 ID	2	0.5	0.4939	0	1.00	Wind
BOTTOM HEAD	SA-240 304	42 ID	10.925	0.425*	0.4241	0	1.00	Internal
Support Skirt #1	SA-240 304	43 OD	66.81	1	0.6173	0	0.55	Wind
Support Skirt #2	SA-516 70	43 OD	120	1	0.6261	0	0.55	Wind
*Head minimum thickness after forming								

Definitions	
Nominal t	Vessel wall nominal thickness
Design t	Required vessel thickness due to governing loading + corrosion
Joint E	Longitudinal seam joint efficiency
Load	
Internal	Circumferential stress due to internal pressure governs
External	External pressure governs
Wind	Combined longitudinal stress of pressure + weight + wind governs
Seismic	Combined longitudinal stress of pressure + weight + seismic governs

Weight Summary

Weight (lb) Contributed by Vessel Elements											
Component	Metal New*	Metal Corroded	Insulation	Insulation Supports	Lining	Piping + Liquid	Operating Liquid		Test Liquid		Surface Area ft²
							New	Corroded	New	Corroded	
TOP HEAD	795.5	795.5	150.6	150	0	161.8	0	0	1,235.5	1,235.5	34
SHELL RG 11	4,082.7	4,082.7	741.6	150	0	432.2	0	0	12,308.6	12,308.6	158
SHELL RG 10	4,118.7	4,118.7	741.6	150	0	512.1	0	0	12,267.6	12,267.6	159
SHELL RG 9	3,187.3	3,187.3	574.8	150	0	396.9	0	0	9,511.7	9,511.7	123
CONE RG 8	1,216.6	1,216.6	198.9	150	0	265.5	0	0	2,828.4	2,828.4	39
SHELL RG 7	1,665.8	1,665.8	386.1	150	0	912.2	0	0	4,370.8	4,370.8	81
SHELL RG 6	2,256.3	2,256.3	532.6	150	0	1,275.2	0	0	6,082.5	6,082.5	109
SHELL RG 5	2,304.2	2,304.2	451.6	150	0	1,365.9	0	0	6,021.4	6,021.4	112
SHELL RG 4	2,242.2	2,242.2	372.2	150	0	1,608.5	0	0	6,093.3	6,093.3	109
SHELL RG 3	2,304.2	2,304.2	372.2	150	0	2,369.9	0	0	6,021.4	6,021.4	112
SHELL RG 2	2,286.2	2,286.2	218.4	150	0	2,369.9	0	0	6,036.3	6,036.3	111
SHELL RG 1	2,314.2	2,314.2	218.4	150	0	1,420.2	3,601	3,601	6,008	6,008	112
BOTTOM HEAD	291.3	291.3	31.2	150	0	0	470.1	470.1	470.1	470.1	17
Support Skirt #1	2,556.5	2,556.5	0	0	0	0	0	0	0	0	125
Support Skirt #2	4,424.9	4,424.9	0	0	0	0	0	0	0	0	225
Skirt Base Ring #1	1,347	1,347	0	0	0	0	0	0	0	0	61
TOTAL:	**37,393.6**	**37,393.6**	**4,990.4**	**1,950**	**0**	**13,090.4**	**4,071.1**	**4,071.1**	**79,255.6**	**79,255.6**	**1,687**
*Shells with attached nozzles have weight reduced by material cut out for opening.											

Weight (lb) Contributed by Attachments											
Component	Body Flanges		Nozzles & Flanges		Packed Beds	Ladders & Platforms	Trays	Tray Supports	Rings & Clips	Vertical Loads	Surface Area ft²
	New	Corroded	New	Corroded							
TOP HEAD	0	0	146	146	0	0	0	0	0	0	4
SHELL RG 11	0	0	1,214.1	1,214.1	0	0	0	0	371.1	0	23
SHELL RG 10	0	0	450.6	450.6	1,885	0	0	0	0	0	9
SHELL RG 9	0	0	433.6	433.6	1,649.3	0	0	0	0	0	8
CONE RG 8	0	0	1,390.7	1,390.7	0	0	0	0	0	0	24
SHELL RG 7	0	0	419.2	419.2	259.8	0	0	0	0	0	8
SHELL RG 6	0	0	1,582.4	1,582.4	894.8	0	0	0	0	0	26
SHELL RG 5	0	0	429.4	429.4	663.9	0	0	0	0	0	9
SHELL RG 4	0	0	1,733.7	1,733.7	490.7	0	0	0	0	0	30
SHELL RG 3	0	0	424.4	424.4	974.1	0	0	0	0	0	9
SHELL RG 2	0	0	619.5	619.5	757.7	0	0	0	0	0	16
SHELL RG 1	0	0	100.5	100.5	0	0	0	0	0	0	3
BOTTOM HEAD	0	0	84.4	84.4	0	0	0	0	0	0	4
Support Skirt #1	0	0	33.6	33.6	0	0	0	0	0	0	0
Support Skirt #2	0	0	24.8	24.8	0	0	0	0	0	0	0
Skirt Base Ring #1	0	0	0	0	0	0	0	0	32.2	0	2
TOTAL:	**0**	**0**	**9,086.9**	**9,086.9**	**7,575.2**	**0**	**0**	**0**	**403.3**	**0**	**176**

Vessel Totals		
	New	Corroded
Operating Weight (lb)	78,561	78,561
Empty Weight (lb)	70,616	70,616
Test Weight (lb)	140,655	140,655
Surface Area (ft²)	1,863	-
Capacity** (US gal)	9,438	9,438
**The vessel capacity does not include volume of nozzle, piping or other attachments.		

Vessel Lift Condition	
Vessel Lift Weight, New (lb)	70,616
Center of Gravity from Datum (in)	541.3555

Hydrostatic Test

Horizontal shop hydrostatic test based on MAWP per UG-99(b)

Gauge pressure at 70° F =
1.3*MAWP*LSR
= 1.3*400.53*1
= 520.69 psi

Horizontal shop hydrostatic test				
Identifier	**Local test pressure (psi)**	**Test liquid static head (psi)**	**UG-99(b) stress ratio**	**UG-99(b) pressure factor**
TOP HEAD (1)	523.166	2.477	1	1.30
Straight Flange on TOP HEAD	523.166	2.477	1	1.30
SHELL RG 11	523.166	2.477	1	1.30
SHELL RG 10	523.166	2.477	1	1.30
SHELL RG 9	523.166	2.477	1	1.30
CONE RG 8	523.166	2.477	1	1.30
SHELL RG 7	522.841	2.152	1	1.30
SHELL RG 6	522.841	2.152	1	1.30
SHELL RG 5	522.841	2.152	1	1.30
SHELL RG 4	522.841	2.152	1	1.30
SHELL RG 3	522.841	2.152	1	1.30
SHELL RG 2	522.841	2.152	1	1.30
SHELL RG 1	522.841	2.152	1	1.30
Straight Flange on BOTTOM HEAD	522.841	2.152	1	1.30
BOTTOM HEAD	522.841	2.152	1	1.30
BOTTOM FEED (D)	521.307	0.618	1	1.30
BOTTOMS OUT (L)	522.192	1.504	1	1.30
EQUALIZATION (M)	522.192	1.504	1	1.30
FROM E-204 / E-207 (H)	522.227	1.538	1	1.30
FROM E-205 (F)	523.148	2.459	1	1.30
HANDHOLE (K1)	523.549	2.861	1	1.30
HANDHOLE (K2)	523.22	2.531	1	1.30
HANDHOLE (K3)	523.22	2.531	1	1.30
HANDHOLE (K4)	523.22	2.531	1	1.30
HANDHOLE (K5)	523.549	2.861	1	1.30
HANDHOLE (K6)	523.22	2.531	1	1.30
HANDHOLE (K7)	523.22	2.531	1	1.30
HANDHOLE (K8)	523.22	2.531	1	1.30
MANWAY (N1)	523.621	2.933	1	1.30
MANWAY (N2)	522.43	1.742	1	1.30
MANWAY (N3)	522.43	1.742	1	1.30

MANWAY (N4)	522.43	1.742	1	1.30
PSV (J)	521.307	0.618	1	1.30
REFLUX INLET (A)	520.977	0.289	1	1.30
TE/TI (P)	522.855	2.166	1	1.30
TO E-204 / E-207 (G)	522.227	1.538	1	1.30
TO E-205 (E)	521.636	0.947	1	1.30
TOP FEED (C)	522.299	1.611	1	1.30
TW (Q1)	523.081	2.393	1	1.30
TW (Q2)	522.848	2.16	1	1.30
TW (Q3)	522.848	2.16	1	1.30
TW (Q4)	522.848	2.16	1	1.30
VAPOR OUTLET (B)	522.264	1.575	1	1.30

(1) TOP HEAD limits the UG-99(b) stress ratio.
(2) The zero degree angular position is assumed to be up, and the test liquid height is assumed to the top-most flange.

Vertical field hydrostatic test based on MAWP per UG-99(b)

Gauge pressure at 70°F =
1.3*MAWP*LSR
= 1.3*400.53*1
= 520.69 psi

Vertical field hydrostatic test				
Identifier	**Local test pressure (psi)**	**Test liquid static head (psi)**	**UG-99(b) stress ratio**	**UG-99(b) pressure factor**
TOP HEAD (1)	521.627	0.939	1	1.30
Straight Flange on TOP HEAD	521.627	0.939	1	1.30
SHELL RG 11	525.959	5.27	1	1.30
SHELL RG 10	530.29	9.602	1	1.30
SHELL RG 9	533.647	12.959	1	1.30
CONE RG 8	534.947	14.258	1	1.30
SHELL RG 7	538.087	17.399	1	1.30
SHELL RG 6	542.419	21.731	1	1.30
SHELL RG 5	546.751	26.062	1	1.30
SHELL RG 4	551.082	30.394	1	1.30
SHELL RG 3	555.414	34.725	1	1.30
SHELL RG 2	559.746	39.057	1	1.30
SHELL RG 1	564.077	43.389	1	1.30
Straight Flange on BOTTOM HEAD	564.149	43.461	1	1.30
BOTTOM HEAD	564.528	43.84	1	1.30
BOTTOM FEED (D)	541.806	21.117	1	1.30
BOTTOMS OUT (L)	565.377	44.688	1	1.30
EQUALIZATION (M)	559.314	38.625	1	1.30
FROM E-204 / E-207 (H)	561.081	40.392	1	1.30
FROM E-205 (F)	550.613	29.924	1	1.30
HANDHOLE (K1)	532.889	12.201	1	1.30
HANDHOLE (K2)	541.228	20.539	1	1.30
HANDHOLE (K3)	548.375	27.687	1	1.30
HANDHOLE (K4)	557.471	36.783	1	1.30
HANDHOLE (K5)	527.475	6.786	1	1.30
HANDHOLE (K6)	537.762	17.074	1	1.30
HANDHOLE (K7)	544.91	24.221	1	1.30
HANDHOLE (K8)	553.14	32.451	1	1.30
MANWAY (N1)	524.826	4.138	1	1.30
MANWAY (N2)	534.644	13.956	1	1.30
MANWAY (N3)	542.333	21.645	1	1.30
MANWAY (N4)	550.924	30.236	1	1.30
PSV (J)	559.638	38.95	1	1.30

REFLUX INLET (A)	524.912	4.224	1	1.30
TE/TI (P)	563.879	43.19	1	1.30
TO E-204 / E-207 (G)	559.095	38.407	1	1.30
TO E-205 (E)	549.746	29.058	1	1.30
TOP FEED (C)	534.514	13.825	1	1.30
TW (Q1)	530.092	9.403	1	1.30
TW (Q2)	539.297	18.608	1	1.30
TW (Q3)	546.444	25.755	1	1.30
TW (Q4)	555.107	34.419	1	1.30
VAPOR OUTLET (B)	520.992	0.303	1	1.30
(1) TOP HEAD limits the UG-99(b) stress ratio.				

Wind Code

Building Code: ASCE 7-10		
Elevation of base above grade		1.00 ft
Increase effective outer diameter by		2.00 ft
Wind Force Coefficient, Cf		0.7000
Risk Category (Table 1.5-1)		III
Basic Wind Speed, V		120.00 mph
Exposure category		C
Wind Directionality Factor, Kd		0.9500
Top Deflection Limit		10.00 in. per 100 ft.
Topographic Factor, Kzt		1.0000
Enforce min. loading of 16 psf		Yes
Vessel Characteristics		
Height, h		115.4665 ft
Minimum Diameter, b	Operating, Corroded	3.8333 ft
	Empty, Corroded	3.8333 ft
	Hydrotest, New, Field	3.8333 ft
Fundamental Frequency, n_1	Operating, Corroded	0.5358 Hz
	Empty, Corroded	0.5430 Hz
	Hydrotest, New, Field	0.3555 Hz
Damping coefficient, β	Operating, Corroded	0.0257
	Empty, Corroded	0.0210
	Hydrotest, New, Field	0.0260

Vortex Shedding Calculations
Table Lookup Values

2.4.1 Basic Load Combinations for Allowable Stress Design	
Load combinations considered in accordance with ASCE section 2.4.1:	
5.	$D + P + P_s + 0.6W$
7.	$0.6D + P + P_s + 0.6W$
Parameter Description	
D	= Dead load
P	= Internal or external pressure load
P_s	= Static head load
W	= Wind load

Wind Deflection Reports:

Operating, Corroded
Empty, Corroded
Hydrotest, New, field
Operating, Corroded,Vortex Shedding
Empty, Corroded, Vortex Shedding
Wind Pressure Calculations
Wind Pressures at Critical Speed: Operating, Corroded
Wind Pressures at Critical Speed: Empty, Corroded

Wind Deflection Report: Operating, Corroded								
Component	**Elevation of Bottom above Base (in)**	**Effective OD (ft)**	**Elastic Modulus E (10^6 psi)**	**Inertia I (ft^4)**	**Platform Wind Shear at Bottom (lb_f)**	**Total Wind Shear at Bottom (lb_f)**	**Bending Moment at Bottom (lb_f-ft)**	**Deflection at Top (in)**
TOP HEAD	1,367.9955	7.69	27.5	*	0	218	146	10.8991
SHELL RG 11	1,247.9955	7.69	27.5	2.638	0	1,922	14,906	10.7035
SHELL RG 10	1,127.9955	7.69	27.5	2.638	0	3,592	44,704	9.3707
SHELL RG 9	1,034.9955	7.69	27.5	2.638	0	4,853	78,800	8.0397
CONE RG 8	998.9955	6.96	27.5	*	0	5,288	97,447	7.0116
SHELL RG 7	911.9955	6.17	27.5	0.727	0	6,212	139,809	6.615
SHELL RG 6	791.9955	6.17	27.5	0.727	0	7,455	208,932	5.6706
SHELL RG 5	671.9955	6.08	27.5	0.727	0	8,647	292,360	4.4207
SHELL RG 4	551.9955	6.00	27.5	0.727	0	9,782	383,025	3.2584
SHELL RG 3	431.9955	6.00	27.5	0.727	0	10,872	485,026	2.2175
SHELL RG 2	311.9955	5.83	27.5	0.727	0	11,879	600,108	1.3363
SHELL RG 1	191.9955	5.83	27.5	0.727	0	12,801	723,738	0.6578
BOTTOM HEAD (top)	186.81	5.83	27.5	*	0	12,839	729,278	0.2298
Support Skirt #1	120	5.58	27.5	1.404	0	13,285	802,000	0.2178
Support Skirt #2	0	5.58	28.8	1.404	0	14,085	938,849	0.092
*Moment of Inertia I varies over the length of the component								

Wind Deflection Report: Empty, Corroded								
Component	Elevation of Bottom above Base (in)	Effective OD (ft)	Elastic Modulus E (10^6 psi)	Inertia I (ft^4)	Platform Wind Shear at Bottom (lb_f)	Total Wind Shear at Bottom (lb_f)	Bending Moment at Bottom (lb_f-ft)	Deflection at Top (in)
TOP HEAD	1,367.9955	7.69	28.3	*	0	226	151	10.9887
SHELL RG 11	1,247.9955	7.69	28.3	2.638	0	1,993	15,308	10.7917
SHELL RG 10	1,127.9955	7.69	28.3	2.638	0	3,725	46,129	9.4486
SHELL RG 9	1,034.9955	7.69	28.3	2.638	0	5,033	81,439	8.1074
CONE RG 8	998.9955	6.96	28.3	*	0	5,484	100,650	7.0714
SHELL RG 7	911.9955	6.17	28.3	0.727	0	6,442	144,557	6.6718
SHELL RG 6	791.9955	6.17	28.3	0.727	0	7,731	216,212	5.72
SHELL RG 5	671.9955	6.08	28.3	0.727	0	8,967	302,623	4.4603
SHELL RG 4	551.9955	6.00	28.3	0.727	0	10,144	396,701	3.2886
SHELL RG 3	431.9955	6.00	28.3	0.727	0	11,275	502,529	2.2391
SHELL RG 2	311.9955	5.83	28.3	0.727	0	12,319	621,826	1.3502
SHELL RG 1	191.9955	5.83	28.3	0.727	0	13,275	750,029	0.6655
BOTTOM HEAD (top)	186.81	5.83	28.3	*	0	13,315	755,774	0.2331
Support Skirt #1	120	5.58	28.3	1.404	0	13,777	831,190	0.2209
Support Skirt #2	0	5.58	29.4	1.404	0	14,607	973,107	0.0934
*Moment of Inertia I varies over the length of the component								

Wind Deflection Report: Field Hydrotest, New								
Component	Elevation of Bottom above Base (in)	Effective OD (ft)	Elastic Modulus E (10^6 psi)	Inertia I (ft^4)	Platform Wind Shear at Bottom (lb_f)	Total Wind Shear at Bottom (lb_f)	Bending Moment at Bottom (lb_f-ft)	Deflection at Top (in)
TOP HEAD	1,367.9955	7.69	28.3	*	0	95	63	5.0303
SHELL RG 11	1,247.9955	7.69	28.3	2.638	0	833	8,758	4.9402
SHELL RG 10	1,127.9955	7.69	28.3	2.638	0	1,571	22,288	4.3263
SHELL RG 9	1,034.9955	7.69	28.3	2.638	0	2,142	38,144	3.7133
CONE RG 8	998.9955	6.96	28.3	*	0	2,343	45,731	3.2399
SHELL RG 7	911.9955	6.17	28.3	0.727	0	2,772	65,269	3.0573
SHELL RG 6	791.9955	6.17	28.3	0.727	0	3,364	98,406	2.6224
SHELL RG 5	671.9955	6.08	28.3	0.727	0	3,948	135,880	2.0462
SHELL RG 4	551.9955	6.00	28.3	0.727	0	4,524	181,170	1.5098
SHELL RG 3	431.9955	6.00	28.3	0.727	0	5,100	230,132	1.0287
SHELL RG 2	311.9955	5.83	28.3	0.727	0	5,660	284,638	0.6209
SHELL RG 1	191.9955	5.83	28.3	0.727	0	6,220	344,175	0.3065
BOTTOM HEAD (top)	186.81	5.83	28.3	*	0	6,244	346,868	0.1076
Support Skirt #1	120	5.58	28.3	1.404	0	6,543	382,464	0.102
Support Skirt #2	0	5.58	29.4	1.404	0	7,079	450,570	0.0431
*Moment of Inertia I varies over the length of the component								

Wind Deflection Report: Operating, Corroded, Vortex Shedding								
Component	Elevation of Bottom above Base (in)	Effective OD (ft)	Elastic Modulus E (10^6 psi)	Inertia I (ft^4)	Platform Wind Shear at Bottom (lb_f)	Total Wind Shear at Bottom (lb_f)	Bending Moment at Bottom (lb_f-ft)	Deflection at Top (in)
TOP HEAD	1,367.9955	7.69	27.5	*	0	95	64	5.1546
SHELL RG 11	1,247.9955	7.69	27.5	2.638	0	836	8,780	5.062
SHELL RG 10	1,127.9955	7.69	27.5	2.638	0	1,577	22,995	4.4306
SHELL RG 9	1,034.9955	7.69	27.5	2.638	0	2,152	38,792	3.8004
CONE RG 8	998.9955	6.96	27.5	*	0	2,353	48,972	3.3137
SHELL RG 7	911.9955	6.17	27.5	0.727	0	2,785	68,255	3.126
SHELL RG 6	791.9955	6.17	27.5	0.727	0	3,377	99,816	2.6793
SHELL RG 5	671.9955	6.08	27.5	0.727	0	3,961	139,383	2.0889
SHELL RG 4	551.9955	6.00	27.5	0.727	0	4,537	180,347	1.5404
SHELL RG 3	431.9955	6.00	27.5	0.727	0	5,113	227,273	1.0493
SHELL RG 2	311.9955	5.83	27.5	0.727	0	5,673	282,467	0.6333
SHELL RG 1	191.9955	5.83	27.5	0.727	0	6,233	342,155	0.3123
BOTTOM HEAD (top)	186.81	5.83	27.5	*	0	6,257	344,854	0.1094
Support Skirt #1	120	5.58	27.5	1.404	0	6,555	380,521	0.1037
Support Skirt #2	0	5.58	28.8	1.404	0	7,091	448,756	0.0439
*Moment of Inertia I varies over the length of the component								

Wind Deflection Report: Empty, Corroded, Vortex Shedding								
Component	Elevation of Bottom above Base (in)	Effective OD (ft)	Elastic Modulus E (10^6 psi)	Inertia I (ft^4)	Platform Wind Shear at Bottom (lb_f)	Total Wind Shear at Bottom (lb_f)	Bending Moment at Bottom (lb_f-ft)	Deflection at Top (in)
TOP HEAD	1,367.9955	7.69	28.3	*	0	95	64	5.0215
SHELL RG 11	1,247.9955	7.69	28.3	2.638	0	837	8,787	4.9313
SHELL RG 10	1,127.9955	7.69	28.3	2.638	0	1,580	23,019	4.3165
SHELL RG 9	1,034.9955	7.69	28.3	2.638	0	2,155	38,837	3.7027
CONE RG 8	998.9955	6.96	28.3	*	0	2,357	49,026	3.2288
SHELL RG 7	911.9955	6.17	28.3	0.727	0	2,789	68,337	3.046
SHELL RG 6	791.9955	6.17	28.3	0.727	0	3,381	99,940	2.611
SHELL RG 5	671.9955	6.08	28.3	0.727	0	3,965	139,548	2.036
SHELL RG 4	551.9955	6.00	28.3	0.727	0	4,541	180,554	1.5018
SHELL RG 3	431.9955	6.00	28.3	0.727	0	5,117	227,522	1.0234
SHELL RG 2	311.9955	5.83	28.3	0.727	0	5,677	282,757	0.618
SHELL RG 1	191.9955	5.83	28.3	0.727	0	6,237	342,488	0.3052
BOTTOM HEAD (top)	186.81	5.83	28.3	*	0	6,261	345,188	0.1072
Support Skirt #1	120	5.58	28.3	1.404	0	6,560	380,878	0.1016
Support Skirt #2	0	5.58	29.4	1.404	0	7,096	449,155	0.043
*Moment of Inertia I varies over the length of the component								

Wind Pressure (WP) Calculations

Gust Factor (G^-) Calculations

$Kz = 2.01 * (Z/\underline{Zg})^{2/\underline{\alpha}}$

$= 2.01 * (Z/900.00)^{0.2105}$

$qz = 0.00256 * Kz * Kzt * Kd * \underline{V}^2$

$= 0.00256 * Kz * 1.0000 * 0.9500 * 120.0000^2$

$= 35.0208 * Kz$

$WP = 0.6 * qz * \underline{G} * \underline{Cf}$ (Minimum 16 lb/ft^2)

$= 0.6 * qz * \underline{G} * 0.7000$ (Minimum 16 lb/ft^2)

Design Wind Pressures							
Height Z (')	Kz	qz (psf)	WP (psf)				
			Operating	Empty	Hydrotest New	Hydrotest Corroded	Vacuum
15.0	0.8489	29.73	14.30	14.83	9.60	N.A.	N.A.
20.0	0.9019	31.58	15.20	15.76	9.60	N.A.	N.A.
25.0	0.9453	33.10	15.93	16.52	9.60	N.A.	N.A.
30.0	0.9823	34.40	16.55	17.16	9.60	N.A.	N.A.
40.0	1.0436	36.55	17.59	18.24	9.60	N.A.	N.A.
50.0	1.0938	38.30	18.43	19.11	9.60	N.A.	N.A.
60.0	1.1366	39.80	19.15	19.86	9.60	N.A.	N.A.
70.0	1.1741	41.12	19.78	20.52	9.60	N.A.	N.A.
80.0	1.2075	42.29	20.35	21.10	9.60	N.A.	N.A.
90.0	1.2379	43.35	20.86	21.63	9.60	N.A.	N.A.
100.0	1.2656	44.32	21.33	22.12	9.60	N.A.	N.A.
120.0	1.3151	46.06	22.16	22.98	9.60	N.A.	N.A.
Design Wind Force determined from: F = Pressure * Af , where Af is the projected area.							

Vortex Shedding Calculations			
Calculations based on NBC 1995 building code, Structural Commentaries (Part 4).			
Average diameter of vessel, upper third, D	4.6591 ft		
Aspect ratio, Ar	24.7832		
	Operating, Corroded	Empty, Corroded	Vacuum, Corroded
Vortex shedding factor, C_1	6.0000	6.0000	N.A.
Vortex shedding factor, C_2	1.2000	1.2000	N.A.
Weight per foot of vessel, upper third, M	757.1557 lb/ft	757.1557 lb/ft	N.A.
Strouhal number, S	0.2000	0.2000	N.A.

Critical wind speed at top of vessel, V_h = (n*D/S)*(3600/5280) mph

Operating, Corroded: V_h = (0.5358*4.6591/0.2000)*(3600/5280) = 8.5104 mph (13.6961 km/h)
Empty, Corroded: V_h = (0.5430*4.6591/0.2000)*(3600/5280) = 8.6245 mph (13.8798 km/h)

Reference wind speed corresponding to critical wind speed, V_{Ref}

Operating, Corroded: V_{Ref} = 7.4592 mph (12.0044 km/h)
Empty, Corroded: V_{Ref} = 7.5592 mph (12.1654 km/h)

Corresponding reference wind speed, V_{Ref}

Operating, Corroded: V_{Ref} = 120.0000 mph (193.1213 km/h)
Empty, Corroded: V_{Ref} = 120.0000 mph (193.1213 km/h)

Corresponding pressure at top of vessel, $q_h = 0.00256 * V_h^2$

Operating, Corroded: $q_h = 0.00256 * (8.5104)^2 = 0.1854$ psf

Empty, Corroded: $q_h = 0.00256 * (8.6245)^2 = 0.1904$ psf

Equivalent static loading, $FL = q_h * C_1 * D / (SQR(Ar) * SQR(\beta - (C_2 * R0 * D^2/M)))$

Operating, Corroded:
FL = 0.1854*6.0000*4.6591 / (SQR(24.7832)*SQR(0.0257 - (1.2000*0.0765*(4.6591)^2/757.1557)))
= 6.8523 lb/ft

Empty, Corroded:
FL = 0.1904*6.0000*4.6591 / (SQR(24.7832)*SQR(0.0210 - (1.2000*0.0765*(4.6591)^2/757.1557)))
= 7.8895 lb/ft

Static loading FL is applied throughout the top third of the vessel

Wind Pressures at Critical Wind Speed: Operating, Corroded (V_h = 8.5104 mph)

$Kz = 2.01 * (Z/\underline{Zg})^{2/\underline{\alpha}}$
$= 2.01 * (Z/900.00)^{0.2105}$
$qz = 0.00256 * Kz * Kd * Kzt * \underline{Vh^2} * \underline{I}$
$= 0.00256 * Kz * 0.9500 * 1.0000 * (8.5104)^2 * 1.0000$
$= 0.1761 * Kz$
$WP = qz * \underline{G^-} * \underline{Cf}$
$= qz * 0.8809 * 0.7000$

Height Z(')	Kz	qz(psf)	WP(psf)
15.0	0.8489	0.1495	0.0553
20.0	0.9019	0.1589	0.0588
25.0	0.9453	0.1665	0.0616
30.0	0.9823	0.1730	0.0640
40.0	1.0436	0.1838	0.0680
50.0	1.0938	0.1927	0.0713
60.0	1.1366	0.2002	0.0741
70.0	1.1741	0.2068	0.0765
80.0	1.2075	0.2127	0.0787
90.0	1.2379	0.2180	0.0807
100.0	1.2656	0.2229	0.0825
120.0	1.3151	0.2317	0.0857

Wind Pressures at Critical Wind Speed: Empty, Corroded (V_h = 8.6245 mph)

$Kz = 2.01 * (Z/\underline{Zg})^{2/\underline{\alpha}}$
$= 2.01 * (Z/900.00)^{0.2105}$
$qz = 0.00256 * Kz * Kd * Kzt * \underline{Vh^2} * \underline{I}$
$= 0.00256 * Kz * 0.9500 * 1.0000 * (8.6245)^2 * 1.0000$
$= 0.1809 * Kz$
$WP = qz * \underline{G^-} * \underline{Cf}$

= qz * 0.8814 * 0.7000

Height Z(')	Kz	qz(psf)	WP(psf)
15.0	0.8489	0.1536	0.0568
20.0	0.9019	0.1631	0.0604
25.0	0.9453	0.1710	0.0633
30.0	0.9823	0.1777	0.0658
40.0	1.0436	0.1888	0.0699
50.0	1.0938	0.1979	0.0732
60.0	1.1366	0.2056	0.0761
70.0	1.1741	0.2124	0.0786
80.0	1.2075	0.2184	0.0809
90.0	1.2379	0.2239	0.0829
100.0	1.2656	0.2289	0.0848
120.0	1.3151	0.2379	0.0881

Gust Factor Calculations

Operating, Corroded
Empty, Corroded
Hydrotest, New, field
Operating, Corroded, Vortex Shedding
Empty, Corroded, Vortex Shedding

Gust Factor Calculations: Operating, Corroded

Vessel is considered a flexible structure as n_1 = 0.5358 Hz < 1 Hz.

z^- = max (0.60 * h, z_{min})
= max (0.60 * 115.4665 , 15.0000)
= 69.2799

I_{z^-} = c * $(33 / z^-)^{1/6}$
= 0.2000 * $(33 / 69.2799)^{1/6}$
= 0.1767

L_{z^-} = l * $(z^- / 33)^{ep}$
= 500.0000 * $(69.2799 / 33)^{0.2000}$
= 579.9474

Q^2 = 1 / (1 + 0.63 * ((b + h) / L_{z^-})$^{0.63}$)
= 1 / (1 + 0.63 * ((3.8333 + 115.4665) / 579.9474)$^{0.63}$)
= 0.8113

V_{z^-} = b^- * $(z^- / 33)^{a^-}$ * Vref * (88/60)
= 0.6500 * $(69.2799 / 33)^{0.1538}$ * 120.00 * (88/60)
= 128.2268

N_1 = n_1 * L_{z^-} / V_{z^-}
= 0.5358 * 579.9474 / 128.2268

$= 2.4234$

$R_n = 7.465 * N_1 / (1 + 10.302 * N_1)^{5/3}$

$= 7.465 * 2.4234 / (1 + 10.302 * 2.4234)^{5/3}$

$= 0.0795$

$n_h = 4.60 * n_1 * \underline{h} / Vz^-$

$= 4.60 * 0.5358 * 115.4665 / 128.2268$

$= 2.2195$

$R_h = 1 / n_h - (1 - e^{-2*nh}) / (2*n_h^2)$

$= 1 / 2.2195 - (1 - e^{-2*2.2195}) / (2*2.2195^2)$

$= 0.3503$

$n_b = 4.60 * n_1 * \underline{b} / Vz^-$

$= 4.60 * 0.5358 * 3.8333 / 128.2268$

$= 0.0737$

$R_b = 1 / n_b - (1 - e^{-2*nb}) / (2*n_b^2)$

$= 1 / 0.0737 - (1 - e^{-2*0.0737}) / (2*0.0737^2)$

$= 0.9526$

$n_d = 15.40 * n_1 * \underline{b} / Vz^-$

$= 15.40 * 0.5358 * 3.8333 / 128.2268$

$= 0.2467$

$R_d = 1 / n_d - (1 - e^{-2*nd}) / (2*n_d^2)$

$= 1 / 0.2467 - (1 - e^{-2*0.2467}) / (2*0.2467^2)$

$= 0.8540$

$R^2 = (1 / \underline{\beta}) * R_n * R_h * R_b * (0.53 + 0.47 * R_L)$

$= (1 / 0.0257) * 0.0795 * 0.3503 * 0.9526 * (0.53 + 0.47 * 0.8540)$

$= 0.9611$

$g_R = Sqr(2 * ln(3600 * \underline{n_t})) + 0.577 / Sqr(2 * ln(3600 * \underline{n_t}))$

$= Sqr(2 * ln(3600 * 0.5358)) + 0.577 / Sqr(2 * ln(3600 * 0.5358))$

$= 4.0380$

$G = 0.925 * (1 + 1.7 * I_{z^-} * Sqr(\underline{g_Q}^2 * Q^2 + g_R^2 * R^2) / (1 + 1.7 * \underline{g_v} * I_{z^-})$

$= 0.925 * (1 + 1.7 * 0.1767 * Sqr(3.40^2 * 0.8113 + 4.0380^2 * 0.9611)) / (1 + 1.7 * 3.40 * 0.1767)$

$= 1.1456$

Gust Factor Calculations: Empty, Corroded

Vessel is considered a flexible structure as $n_1 = 0.5430$ Hz < 1 Hz.

$z^- = max (0.60 * \underline{h}, \underline{z_{min}})$

$= max (0.60 * 115.4665 , 15.0000)$

$= 69.2799$

$I_{z^-} = \underline{c} * (33 / z^-)^{1/6}$

$= 0.2000 * (33 / 69.2799)^{1/6}$

$= 0.1767$

$L_{z^-} = \underline{l} * (z^- / 33)^{\underline{ep}}$

$= 500.0000 * (69.2799 / 33)^{0.2000}$

$= 579.9474$

$Q^2 = 1 / (1 + 0.63 * ((\underline{b} + \underline{h}) / L_{z^-})^{0.63})$

$= 1 / (1 + 0.63 * ((3.8333 + 115.4665) / 579.9474)^{0.63})$

$= 0.8113$

$V_{z^-} = \underline{b^-} * (z^- / 33)^{\underline{a^-}} * \underline{Vref} * (88/60)$
$= 0.6500 * (69.2799 / 33)^{0.1538} * 120.00 * (88/60)$
$= 128.2268$

$N_1 = \underline{n_1} * L_{z^-} / V_{z^-}$
$= 0.5430 * 579.9474 / 128.2268$
$= 2.4559$

$R_n = 7.465 * N_1 / (1 + 10.302 * N_1)^{5/3}$
$= 7.465 * 2.4559 / (1 + 10.302 * 2.4559)^{5/3}$
$= 0.0789$

$n_h = 4.60 * n_1 * \underline{h} / Vz^-$
$= 4.60 * 0.5430 * 115.4665 / 128.2268$
$= 2.2492$

$R_h = 1 / n_h - (1 - e^{-2*nh}) / (2*n_h^2)$
$= 1 / 2.2492 - (1 - e^{-2*2.2492}) / (2*2.2492^2)$
$= 0.3469$

$n_b = 4.60 * n_1 * \underline{b} / Vz^-$
$= 4.60 * 0.5430 * 3.8333 / 128.2268$
$= 0.0747$

$R_b = 1 / n_b - (1 - e^{-2*nb}) / (2*n_b^2)$
$= 1 / 0.0747 - (1 - e^{-2*0.0747}) / (2*0.0747^2)$
$= 0.9520$

$n_d = 15.40 * n_1 * \underline{b} / Vz^-$
$= 15.40 * 0.5430 * 3.8333 / 128.2268$
$= 0.2500$

$R_d = 1 / n_d - (1 - e^{-2*nd}) / (2*n_d^2)$
$= 1 / 0.2500 - (1 - (e^{-2*0.2500})) / (2*0.2500^2)$
$= 0.8523$

$R^2 = (1 / \underline{\beta}) * R_n * R_h * R_b * (0.53 + 0.47 * R_L)$
$= (1 / 0.0210) * 0.0789 * 0.3469 * 0.9520 * (0.53 + 0.47 * 0.8523)$
$= 1.1545$

$g_R = Sqr(2 * ln(3600 * \underline{n_1})) + 0.577 / Sqr(2 * ln(3600 * \underline{n_1}))$
$= Sqr(2 * ln(3600 * 0.5430)) + 0.577 / Sqr(2 * ln(3600 * 0.5430))$
$= 4.0413$

$G = 0.925 * (1 + 1.7 * I_{z^-} * Sqr(\underline{g_Q^2} * Q^2 + g_R^2 * R^2) / (1 + 1.7 * \underline{g_v} * I_{z^-})$
$= 0.925 * (1 + 1.7 * 0.1767 * Sqr(3.40^2 * 0.8113 + 4.0413^2 * 1.1545)) / (1 + 1.7 * 3.40 * 0.1767)$
$= 1.1881$

Gust Factor Calculations: Hydrotest, New, field

Vessel is considered a flexible structure as $n_1 = 0.3555$ Hz < 1 Hz.

$z^- = max (0.60 * \underline{h}, \underline{z_{min}})$
$= max (0.60 * 115.4665 , 15.0000)$
$= 69.2799$

$I_{z^-} = \underline{c} * (33 / z^-)^{1/6}$
$= 0.2000 * (33 / 69.2799)^{1/6}$

$= 0.1767$

$L_{z^-} = \underline{l} * (z^- / 33)^{\underline{ep}}$

$= 500.0000 * (69.2799 / 33)^{0.2000}$

$= 579.9474$

$Q^2 = 1 / (1 + 0.63 * ((\underline{b} + \underline{h}) / L_{z^-})^{0.63})$

$= 1 / (1 + 0.63 * ((3.8333 + 115.4665) / 579.9474)^{0.63})$

$= 0.8113$

$V_{z^-} = \underline{b^-} * (z^- / 33)^{\underline{a^-}} * \underline{Vref} * (88/60)$

$= 0.6500 * (69.2799 / 33)^{0.1538} * 120.00 * (88/60)$

$= 128.2268$

$N_1 = \underline{n_1} * L_{z^-} / V_{z^-}$

$= 0.3555 * 579.9474 / 128.2268$

$= 1.6078$

$R_n = 7.465 * N_1 / (1 + 10.302 * N_1)^{5/3}$

$= 7.465 * 1.6078 / (1 + 10.302 * 1.6078)^{5/3}$

$= 0.1012$

$n_h = 4.60 * n_1 * \underline{h} / Vz^-$

$= 4.60 * 0.3555 * 115.4665 / 128.2268$

$= 1.4725$

$R_h = 1 / n_h - (1 - e^{-2*nh}) / 2*n_h^2$

$= 1 / 1.4725 - (1 - e^{-2*1.4725}) / 2*1.4725^2$

$= 0.4606$

$n_b = 4.60 * n_1 * \underline{b} / Vz^-$

$= 4.60 * 0.3555 * 3.8333 / 128.2268$

$= 0.0489$

$R_b = 1 / n_b - (1 - e^{-2*nb}) / 2*n_b^2$

$= 1 / 0.0489 - (1 - e^{-2*0.0489}) / 2*0.0489^2$

$= 0.9682$

$n_d = 15.40 * n_1 * \underline{b} / Vz^-$

$= 15.40 * 0.3555 * 3.8333 / 128.2268$

$= 0.1637$

$R_d = 1 / n_d - (1 - e^{-2*nd}) / 2*n_d^2$

$= 1 / 0.1637 - (1 - e^{-2*0.1637}) / 2*0.1637^2$

$= 0.8993$

$R^2 = (1 / \underline{\beta}) * R_n * R_h * R_b * (0.53 + 0.47 * R_L)$

$= (1 / 0.0260) * 0.1012 * 0.4606 * 0.9682 * (0.53 + 0.47 * 0.8993)$

$= 1.6543$

$g_R = Sqr(2 * ln(3600 * \underline{n_1})) + 0.577 / Sqr(2 * ln(3600 * \underline{n_1}))$

$= Sqr(2 * ln(3600 * 0.3555)) + 0.577 / Sqr(2 * ln(3600 * 0.3555))$

$= 3.9352$

$G = 0.925 * (1 + 1.7 * I_{z^-} * Sqr(\underline{g_Q}^2 * Q^2 + g_R^2 * R^2) / (1 + 1.7 * \underline{g_v} * I_{z^-})$

$= 0.925 * (1 + 1.7 * 0.1767 * Sqr(3.40^2 * 0.8113 + 3.9352^2 * 1.6543)) / (1 + 1.7 * 3.40 * 0.1767)$

$= 1.2709$

Gust Factor Calculations: Operating, Corroded, Vortex Shedding

Vessel is considered a flexible structure as $n_1 = 0.5358$ Hz < 1 Hz.

$z^- = \max (0.60 * \underline{h}, \underline{z_{min}})$
$= \max (0.60 * 115.4665 , 15.0000)$
$= 69.2799$

$I_{z^-} = \underline{c} * (33 / z^-)^{1/6}$
$= 0.2000 * (33 / 69.2799)^{1/6}$
$= 0.1767$

$L_{z^-} = \underline{l} * (z^- / 33)^{\underline{ep}}$
$= 500.0000 * (69.2799 / 33)^{0.2000}$
$= 579.9474$

$Q^2 = 1 / (1 + 0.63 * ((\underline{b} + \underline{h}) / L_{z^-})^{0.63})$
$= 1 / (1 + 0.63 * ((3.8333 + 115.4665) / 579.9474)^{0.63})$
$= 0.8113$

$V_{z^-} = \underline{b^-} * (z^- / 33)^{\underline{a^-}} * \underline{Vh} * (88/60)$
$= 0.6500 * (69.2799 / 33)^{0.1538} * 8.5104 * (88/60)$
$= 9.0938$

$N_1 = \underline{n_+} * L_{z^-} / V_{z^-}$
$= 0.5358 * 579.9474 / 9.0938$
$= 34.1707$

$R_n = 7.465 * N_1 / (1 + 10.302 * N_1)^{5/3}$
$= 7.465 * 34.1707 / (1 + 10.302 * 34.1707)^{5/3}$
$= 0.0145$

$n_h = 4.60 * n_1 * \underline{h} / Vz^-$
$= 4.60 * 0.5358 * 115.4665 / 9.0938$
$= 31.2953$

$R_h = 1 / n_h - (1 - e^{-2*nh}) / 2*n_h^2$
$= 1 / 31.2953 - (1 - e^{-2*31.2953}) / 2*31.2953^2$
$= 0.0314$

$n_b = 4.60 * n_1 * \underline{b} / Vz^-$
$= 4.60 * 0.5358 * 3.8333 / 9.0938$
$= 1.0390$

$R_b = 1 / n_b - (1 - e^{-2*nb}) / 2*n_b^2$
$= 1 / 1.0390 - (1 - e^{-2*1.0390}) / 2*1.0390^2$
$= 0.5573$

$n_d = 15.40 * n_1 * \underline{b} / Vz^-$
$= 15.40 * 0.5358 * 3.8333 / 9.0938$
$= 3.4783$

$R_d = 1 / n_d - (1 - e^{-2*nd}) / 2*n_d^2$
$= 1 / 3.4783 - (1 - e^{-2*3.4783}) / 2*3.4783^2$
$= 0.2462$

$R^2 = (1 / \underline{\beta}) * R_n * R_h * R_b * (0.53 + 0.47 * R_L)$
$= (1 / 0.0257) * 0.0145 * 0.0314 * 0.5573 * (0.53 + 0.47 * 0.2462)$
$= 0.0064$

$g_R = Sqr(2 * ln(3600 * \underline{n_+})) + 0.577 / Sqr(2 * ln(3600 * \underline{n_+}))$
$= Sqr(2 * ln(3600 * 0.5358)) + 0.577 / Sqr(2 * ln(3600 * 0.5358))$
$= 4.0380$

$G = 0.925 * (1 + 1.7 * I_{z^-} * Sqr(\underline{g_Q}^2 * Q^2 + g_R^2 * R^2) / (1 + 1.7 * \underline{g_v} * I_{z^-})$
$= 0.925 * (1 + 1.7 * 0.1767 * Sqr(3.40^2 * 0.8113 + 4.0380^2 * 0.0064)) / (1 + 1.7 * 3.40 * 0.1767)$

= 0.8809

Gust Factor Calculations: Empty, Corroded, Vortex Shedding

Vessel is considered a flexible structure as n_1 = 0.5430 Hz < 1 Hz.

z^- = max (0.60 * $\underline{h}$, $\underline{z_{min}}$)
= max (0.60 * 115.4665 , 15.0000)
= 69.2799

I_{z^-} = $\underline{c}$ * (33 / z^-)$^{1/6}$
= 0.2000 * (33 / 69.2799)$^{1/6}$
= 0.1767

L_{z^-} = $\underline{l}$ * (z^- / 33)$^{\underline{ep}}$
= 500.0000 * (69.2799 / 33)$^{0.2000}$
= 579.9474

Q^2 = 1 / (1 + 0.63 * (($\underline{b}$ + $\underline{h}$) / L_{z^-})$^{0.63}$)
= 1 / (1 + 0.63 * ((3.8333 + 115.4665) / 579.9474)$^{0.63}$)
= 0.8113

V_{z^-} = $\underline{b^-}$ * (z^- / 33)$^{\underline{a^-}}$ * $\underline{Vh}$ * (88/60)
= 0.6500 * (69.2799 / 33)$^{0.1538}$ * 8.6245 * (88/60)
= 9.2158

N_1 = $\underline{n_1}$ * L_{z^-} / V_{z^-}
= 0.5430 * 579.9474 / 9.2158
= 34.1707

R_n = 7.465 * N_1 / (1 + 10.302 * N_1)$^{5/3}$
= 7.465 * 34.1707 / (1 + 10.302 * 34.1707)$^{5/3}$
= 0.0145

n_h = 4.60 * n_1 * $\underline{h}$ / Vz^-
= 4.60 * 0.5430 * 115.4665 / 9.2158
= 31.2953

R_h = 1 / n_h - (1 - e^{-2*nh}) / 2*n_h^2
= 1 / 31.2953 - (1 - $e^{-2*31.2953}$) / 2*31.2953^2
= 0.0314

n_b = 4.60 * n_1 * $\underline{b}$ / Vz^-
= 4.60 * 0.5430 * 3.8333 / 9.2158
= 1.0390

R_b = 1 / n_b - (1 - e^{-2*nb}) / 2*n_b^2
= 1 / 1.0390 - (1 - $e^{-2*1.0390}$) / 2*1.0390^2
= 0.5573

n_d = 15.40 * n_1 * $\underline{b}$ / Vz^-
= 15.40 * 0.5430 * 3.8333 / 9.2158
= 3.4783

R_d = 1 / n_d - (1 - e^{-2*nd}) / 2*n_d^2
= 1 / 3.4783 - (1 - $e^{-2*3.4783}$) / 2*3.4783^2
= 0.2462

R^2 = (1 / $\underline{\beta}$) * R_n * R_h * R_b * (0.53 + 0.47 * R_L)
= (1 / 0.0210) * 0.0145 * 0.0314 * 0.5573 * (0.53 + 0.47 * 0.2462)

$= 0.0078$

$g_R = \text{Sqr}(2 * \ln(3600 * \underline{n_+})) + 0.577 / \text{Sqr}(2 * \ln(3600 * \underline{n_+}))$

$= \text{Sqr}(2 * \ln(3600 * 0.5430)) + 0.577 / \text{Sqr}(2 * \ln(3600 * 0.5430))$

$= 4.0413$

$G = 0.925 * (1 + 1.7 * I_{z^-} * \text{Sqr}(\underline{g_Q^2} * Q^2 + g_R^2 * R^2) / (1 + 1.7 * \underline{g_v} * I_{z^-})$

$= 0.925 * (1 + 1.7 * 0.1767 * \text{Sqr}(3.40^2 * 0.8113 + 4.0413^2 * 0.0078)) / (1 + 1.7 * 3.40 * 0.1767)$

$= 0.8814$

Table Lookup Values	
$\alpha = 9.5000$, $z_g = 900.00$ ft	[Table 26.9-1, page 256]
c = 0.2000, l = 500.0000, ep = 0.2000	[Table 26.9-1, page 256]
$a^- = 0.1538$, $b^- = 0.6500$	[Table 26.9-1, page 256]
$z_{min} = 15.0000$ ft	[Table 26.9-1, page 256]
$g_Q = 3.40$	[26.9.5 page 255]
$g_v = 3.40$	[26.9.5 page 255]

Building Code: ASCE 7-10 ground supported		
Site Class		D
Importance Factor, I_e		1.2500
Spectral Response Acceleration at short period (% g), S_s		100.00%
Spectral Response Acceleration at period of 1 sec (% g), S_1		40.00%
Response Modification Coeficient from Table 15.4-2, R		3.0000
Acceleration-based Site Coefficient, F_a		1.1000
Velocity-based Site Coefficient, F_v		1.6000
Long-period Transition Period, T_L		12.0000
Redundancy factor, ρ		1.0000
Risk Category (Table 1.5-1)		II
User Defined Vertical Accelerations Considered		No
Vessel Characteristics		
Height		115.4665 ft
Weight	Operating, Corroded	78,561 lb
	Empty, Corroded	70,616 lb
Period of Vibration Calculation		
Fundamental Period, T	Operating, Corroded	1.866 sec (f = 0.5 Hz)
	Empty, Corroded	1.842 sec (f = 0.5 Hz)

The fundamental period of vibration T (above) is calculated using the Rayleigh method of approximation

$T = 2 * PI * Sqr(\{Sum(W_i * y_i^2)\} / \{g * Sum(W_i * y_i)\})$, where

W_i is the weight of the i^{th} lumped mass, and
y_i is its deflection when the system is treated as a cantilever beam.

12.4.2.3 Basic Load Combinations for Allowable Stress Design			
Load combinations considered in accordance with ASCE section 2.4.1:			
5.	$D + P + P_s + 0.7E$	$= (1.0 + 0.14S_{DS})D + P + P_s + 0.7\rho Q_E$	
8.	$0.6D + P + P_s + 0.7E$	$= (0.6 - 0.14S_{DS})D + P + P_s + 0.7\rho Q_E$	
Parameter description			
D	= Dead load		
P	= Internal or external pressure load		
P_s	= Static head load		
E	= Seismic load	$= E_h +/- E_v$	$= \rho Q_E +/- 0.2S_{DS}D$

Seismic Shear Reports:

Operating, Corroded
Empty, Corroded
Base Shear Calculations

Seismic Shear Report: Operating, Corroded					
Component	**Elevation of Bottom above Base (in)**	**Elastic Modulus E (10^6 psi)**	**Inertia I (ft^4)**	**Seismic Shear at Bottom (lb_f)**	**Bending Moment at Bottom (lb_f-ft)**
TOP HEAD	1,367.9955	27.5	*	277	235
SHELL RG 11	1,247.9955	27.5	2.6376	1,318	12,191
SHELL RG 10	1,127.9955	27.5	2.6376	2,347	32,646
SHELL RG 9	1,034.9955	27.5	2.6376	3,063	55,010
CONE RG 8	998.9955	27.5	*	3,388	68,103
SHELL RG 7	911.9955	27.5	0.7270	3,730	94,449
SHELL RG 6	791.9955	27.5	0.7270	4,224	134,762
SHELL RG 5	671.9955	27.5	0.7270	4,534	181,405
SHELL RG 4	551.9955	27.5	0.7270	4,813	226,553
SHELL RG 3	431.9955	27.5	0.7270	5,008	274,356
SHELL RG 2	311.9955	27.5	0.7270	5,129	326,381
SHELL RG 1	191.9955	27.5	0.7270	5,202	378,196
BOTTOM HEAD (top)	186.81	27.5	*	5,204	380,444
Support Skirt #1	120	27.5	1.404	5,238	409,601
Support Skirt #2	0	28.8	1.404	5,239	461,988
*Moment of Inertia I varies over the length of the component					

Seismic Shear Report: Empty, Corroded					
Component	Elevation of Bottom above Base (in)	Elastic Modulus E (10^6 psi)	Inertia I (ft^4)	Seismic Shear at Bottom (lb_f)	Bending Moment at Bottom (lb_f-ft)
TOP HEAD	1,367.9955	28.3	*	266	226
SHELL RG 11	1,247.9955	28.3	2.6376	1,270	11,892
SHELL RG 10	1,127.9955	28.3	2.6376	2,262	31,681
SHELL RG 9	1,034.9955	28.3	2.6376	2,953	53,291
CONE RG 8	998.9955	28.3	*	3,268	66,040
SHELL RG 7	911.9955	28.3	0.7270	3,599	91,478
SHELL RG 6	791.9955	28.3	0.7270	4,078	130,407
SHELL RG 5	671.9955	28.3	0.7270	4,378	175,536
SHELL RG 4	551.9955	28.3	0.7270	4,649	219,088
SHELL RG 3	431.9955	28.3	0.7270	4,840	265,229
SHELL RG 2	311.9955	28.3	0.7270	4,958	315,555
SHELL RG 1	191.9955	28.3	0.7270	5,000	365,558
BOTTOM HEAD (top)	186.81	28.3	*	5,002	367,719
Support Skirt #1	120	28.3	1.404	5,033	395,737
Support Skirt #2	0	29.4	1.404	5,035	446,076
*Moment of Inertia I varies over the length of the component					

11.4.3: Maximum considered earthquake spectral response acceleration

The maximum considered earthquake spectral response acceleration at short period, S_{MS}
$S_{MS} = \underline{F_a} * \underline{S_s} = 1.1000 * 100.00 / 100 = 1.1000$
The maximum considered earthquake spectral response acceleration at 1 s period, S_{M1}
$S_{M1} = \underline{F_v} * \underline{S_1} = 1.6000 * 40.00 / 100 = 0.6400$

11.4.4: Design spectral response acceleration parameters

Design earthquake spectral response acceleration at short period, S_{DS}
$S_{DS} = 2 / 3 * S_{MS} = 2 / 3 * 1.1000 = 0.7333$
Design earthquake spectral response acceleration at 1 s period, S_{D1}
$S_{D1} = 2 / 3 * S_{M1} = 2 / 3 * 0.6400 = 0.4267$

11.6 Seismic Design Category

The Risk Category is II.
From Table 11.6-1, the Seismic Design Category based on $\underline{S_{Ds}} = 0.7333$ is D.
From Table 11.6-2, the Seismic Design Category based on $\underline{S_{D1}} = 0.4267$ is D.
This vessel is assigned to Seismic Design Category D.

12.4.2.3: Seismic Load Combinations: Vertical Term

Factor is applied to dead load.

Compressive Side: $= 1.0 + 0.14 * S_{DS}$
$= 1.0 + 0.14 * 0.7333$

= 1.1027

Tensile Side: = 0.6 - 0.14 * S_{DS}
= 0.6 - 0.14 * 0.7333
= 0.4973

Base Shear Calculations

Operating, Corroded
Empty, Corroded

Base Shear Calculations: Operating, Corroded

Paragraph 15.4.4: Period Determination

Fundamental Period is taken from the Rayleigh method listed previously in this report.

T = 1.8663 sec.

12.8.1: Calculation of Seismic Response Coefficient

C_s is the value computed below, bounded by C_sMin and C_sMax:
C_sMin is calculated with equation 15.4-1 and shall not be less than 0.03; in addition, if S_1 >= 0.6g, C_sMin shall not be less than eqn 15.4-2.
C_sMax calculated with 12.8-3 because (T = 1.8663) <= (T_L = 12.0000)

$C_s = \underline{S_{DS}} / (\underline{R} / \underline{I_e})$ = 0.7333 / (3.0000 / 1.2500) = 0.3056
C_sMin = max (0.044 * $\underline{S_{DS}}$ * $\underline{I_e}$, 0.03) = max (0.044 * 0.7333 * 1.2500 , 0.03) = 0.0403
C_sMax = $\underline{S_{D1}}$ / (T * ($\underline{R}$ / $\underline{I_e}$)) = 0.4267 / (1.8663 * (3.0000 / 1.2500)) = 0.0953
C_s = 0.0953

12.8.1: Calculation of Base Shear

V = C_s * $\underline{W}$
= 0.0953 * 78,560.7891
= 7,483.34 lb

12.4.2.1 Seismic Load Combinations: Horizontal Seismic Load Effect, E_h
Q_E = V
E_h = 0.7 * ρ * Q_E (Only 70% of seismic load considered as per Section 2.4.1)
= 0.70 * 1.0000 * 7,483.34
= 5,238.34 lb

Base Shear Calculations: Empty, Corroded

Paragraph 15.4.4: Period Determination

Fundamental Period is taken from the Rayleigh method listed previously in this report.

T = 1.8416 sec.

12.8.1: Calculation of Seismic Response Coefficient

C_s is the value computed below, bounded by C_sMin and C_sMax:
C_sMin is calculated with equation 15.4-1 and shall not be less than 0.03; in addition, if S_1 >= 0.6g, C_sMin shall not be less than eqn 15.4-2.
C_sMax calculated with 12.8-3 because (T = 1.8416) <= (T_L = 12.0000)

$C_s = \underline{S_{DS}} / (\underline{R} / \underline{I_e})$ = 0.7333 / (3.0000 / 1.2500) = 0.3056
C_sMin = max (0.044 * $\underline{S_{DS}}$ * $\underline{I_e}$, 0.03) = max (0.044 * 0.7333 * 1.2500 , 0.03) = 0.0403
C_sMax = $\underline{S_{D1}}$ / (T * ($\underline{R}$ / $\underline{I_e}$)) = 0.4267 / (1.8416 * (3.0000 / 1.2500)) = 0.0965
C_s = 0.0965

12.8.1: Calculation of Base Shear

V = C_s * $\underline{W}$
= 0.0965 * 70,616.2578
= 6,816.81 lb

12.4.2.1 Seismic Load Combinations: Horizontal Seismic Load Effect, E_h
Q_E = V
E_h = 0.7 * ρ * Q_E (Only 70% of seismic load considered as per Section 2.4.1)
= 0.70 * 1.0000 * 6,816.81
= 4,771.77 lb

TOP HEAD

ASME Section VIII Division 1, 2015 Edition				
Component		Ellipsoidal Head		
Material		SA-240 304 (II-D p. 86, ln. 44)		
Attached To		SHELL RG 11		
Impact Tested	**Normalized**	**Fine Grain Practice**	**PWHT**	**Optimize MDMT/ Find MAWP**
No	No	No	No	No
		Design Pressure (psi)	**Design Temperature (°F)**	**Design MDMT (°F)**
Internal		400	200	-200
Static Liquid Head				
Condition		**P_s (psi)**	**H_s (in)**	**SG**
Test horizontal		2.48	68.625	1
Test vertical		0.87	24	1
Dimensions				
Inner Diameter		60"		
Head Ratio		2		
Minimum Thickness		0.602"		
Corrosion	**Inner**	0"		
	Outer	0"		
Length L_{sf}		2"		
Nominal Thickness t_{sf}		0.625"		
Weight and Capacity				
		Weight (lb)[1]		**Capacity (US gal)[1]**
New		795.47		146.88
Corroded		795.47		146.88
Insulation				
		Thickness (in)	**Density (lb/ft^3)**	**Weight (lb)**
Insulation		3.5	15	150.59
		Spacing(in)	**Individual Weight (lb)**	**Total Weight (lb)**
Insulation Supports		145	150	150
Radiography				
Category A joints		Seamless No RT		
Head to shell seam		Full UW-11(a) Type 1		

[1] includes straight flange

Results Summary	
Governing condition	internal pressure
Minimum thickness per UG-16	0.0625" + 0" = 0.0625"
Design thickness due to internal pressure (t)	0.6013"
Maximum allowable working pressure (MAWP)	400.53 psi
Maximum allowable pressure (MAP)	400.53 psi
Straight Flange governs MDMT	-320°F

Design thickness for internal pressure, (Corroded at 200 °F) UG-32(c)(1)

t = P*D / (2*S*E - 0.2*P) + Corrosion
= 400*60 / (2*20,000*1 - 0.2*400) + 0
= 0.6012"

Maximum allowable working pressure, (Corroded at 200 °F) UG-32(c)(1)

P = 2*S*E*t / (D + 0.2*t) - P_s
= 2*20,000*1*0.602 / (60 +0.2*0.602) - 0
= 400.53 psi

Maximum allowable pressure, (New at 70 °F) UG-32(c)(1)

P = 2*S*E*t / (D + 0.2*t) - P_s
= 2*20,000*1*0.602 / (60 +0.2*0.602) - 0
= 400.53 psi

% Forming strain - UHA-44(a)(2)

EFE = $(75*t / R_f)*(1 - R_f / R_o)$
= $(75*0.625 / 10.5125)*(1 - 10.5125 / \infty)$
= 4.459%

Straight Flange on TOP HEAD

ASME Section VIII Division 1, 2015 Edition				
Component		Cylinder		
Material		SA-240 304 (II-D p. 86, ln. 44)		
Impact Tested	**Normalized**	**Fine Grain Practice**	**PWHT**	**Optimize MDMT/ Find MAWP**
No	No	No	No	No
		Design Pressure (psi)	**Design Temperature (°F)**	**Design MDMT (°F)**
Internal		400	200	-200
Static Liquid Head				
Condition		**P_s (psi)**	**H_s (in)**	**SG**
Test horizontal		2.48	68.625	1
Test vertical		0.94	26	1
Dimensions				
Inner Diameter		60"		
Length		2"		
Nominal Thickness		0.625"		
Corrosion	**Inner**	0"		
	Outer	0"		
Weight and Capacity				
		Weight (lb)		**Capacity (US gal)**
New		69.04		24.48
Corroded		69.04		24.48
Insulation				
		Thickness (in)	**Density (lb/ft^3)**	**Weight (lb)**
Insulation		3.5	15	0
		Spacing(in)	**Individual Weight (lb)**	**Total Weight (lb)**
Insulation Supports		0	0	0
Radiography				
Longitudinal seam		Seamless No RT		
Bottom Circumferential seam		Full UW-11(a) Type 1		

Results Summary	
Governing condition	Internal pressure
Minimum thickness per UG-16	0.0625" + 0" = 0.0625"
Design thickness due to internal pressure (t)	0.6073"
Design thickness due to combined loadings + corrosion	0.2491"
Maximum allowable working pressure (MAWP)	411.52 psi
Maximum allowable pressure (MAP)	411.52 psi
Rated MDMT	-320 °F

UHA-51 Material Toughness Requirements
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

Design thickness, (at 200 °F) UG-27(c)(1)

t = P*R / (S*E - 0.60*P) + Corrosion
= 400*30 / (20,000*1.00 - 0.60*400) + 0
= 0.6073"

Maximum allowable working pressure, (at 200 °F) UG-27(c)(1)

P = S*E*t / (R + 0.60*t) - P_s
= 20,000*1.00*0.625 / (30 + 0.60*0.625) - 0
= 411.52 psi

Maximum allowable pressure, (at 70 °F) UG-27(c)(1)

P = S*E*t / (R + 0.60*t)
= 20,000*1.00*0.625 / (30 + 0.60*0.625)
= 411.52 psi

% Forming strain - UHA-44(a)(2)

EFE = (50*t / R_f)*(1 - R_f / R_o)
= (50*0.625 / 30.3125)*(1 - 30.3125 / ∞)
= 1.0309%

Thickness Required Due to Pressure + External Loads								
Condition	Pressure P (psi)	Allowable Stress Before UG-23 Stress Increase (psi)		Temperature (°F)	Corrosion C (in)	Load	Req'd Thk Due to Tension (in)	Req'd Thk Due to Compression (in)
		S_t	S_c					
Operating, Hot & Corroded	400	20,000	10,846	200	0	Wind	0.2491	0.2489
						Seismic	0.2491	0.2489
Operating, Hot & New	400	20,000	10,846	200	0	Wind	0.2491	0.2489
						Seismic	0.2491	0.2489
Hot Shut Down, Corroded	0	20,000	10,846	200	0	Wind	0.0002	0.0005
						Seismic	0.0001	0.0006
Hot Shut Down, New	0	20,000	10,846	200	0	Wind	0.0002	0.0005
						Seismic	0.0001	0.0006
Empty, Corroded	0	20,000	12,090	70	0	Wind	0.0002	0.0004
						Seismic	0.0001	0.0005
Empty, New	0	20,000	12,090	70	0	Wind	0.0002	0.0004
						Seismic	0.0001	0.0005
Hot Shut Down, Corroded, Weight & Eccentric Moments Only	0	20,000	10,846	200	0	Weight	0.0005	0.0005
Operating, Hot & Corroded, Vortex Shedding	400	20,000	10,846	200	0	Wind	0.249	0.2489
Empty, Cold & Corroded, Vortex Shedding	0	20,000	12,090	70	0	Wind	0.0002	0.0004

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ASME Section VIII Division 1, 2015 Edition				
Component		Cylinder		
Material		SA-240 304 (II-D p. 86, ln. 44)		
Impact Tested	**Normalized**	**Fine Grain Practice**	**PWHT**	**Optimize MDMT/ Find MAWP**
No	No	No	No	No
		Design Pressure (psi)	**Design Temperature (°F)**	**Design MDMT (°F)**
Internal		400	200	-200
Static Liquid Head				
Condition		**P_s (psi)**	**H_s (in)**	**SG**
Test horizontal		2.48	68.625	1
Test vertical		5.27	146	1
Dimensions				
Inner Diameter		60"		
Length		120"		
Nominal Thickness		0.625"		
Corrosion	**Inner**	0"		
	Outer	0"		
Weight and Capacity				
		Weight (lb)		**Capacity (US gal)**
New		4,082.66		1,468.8
Corroded		4,082.66		1,468.8
Insulation				
		Thickness (in)	**Density (lb/ft^3)**	**Weight (lb)**
Insulation		3.5	15	741.63
		Spacing(in)	**Individual Weight (lb)**	**Total Weight (lb)**
Insulation Supports		145	150	150
Radiography				
Longitudinal seam		Full UW-11(a) Type 1		
Top Circumferential seam		Full UW-11(a) Type 1		
Bottom Circumferential seam		Full UW-11(a) Type 1		

Results Summary	
Governing condition	Internal pressure
Minimum thickness per UG-16	0.0625" + 0" = 0.0625"
Design thickness due to internal pressure (t)	0.6073"
Design thickness due to combined loadings + corrosion	0.2508"
Maximum allowable working pressure (MAWP)	411.52 psi
Maximum allowable pressure (MAP)	411.52 psi
Rated MDMT	-320 °F

UHA-51 Material Toughness Requirements
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

Design thickness, (at 200 °F) UG-27(c)(1)

t = P*R / (S*E - 0.60*P) + Corrosion
= 400*30 / (20,000*1.00 - 0.60*400) + 0
= 0.6073"

Maximum allowable working pressure, (at 200 °F) UG-27(c)(1)

P = S*E*t / (R + 0.60*t) - P_s
= 20,000*1.00*0.625 / (30 + 0.60*0.625) - 0
= 411.52 psi

Maximum allowable pressure, (at 70 °F) UG-27(c)(1)

P = S*E*t / (R + 0.60*t)
= 20,000*1.00*0.625 / (30 + 0.60*0.625)
= 411.52 psi

% Forming strain - UHA-44(a)(2)

EFE = $(50*t / R_f)*(1 - R_f / R_o)$
= $(50*0.625 / 30.3125)*(1 - 30.3125 / \infty)$
= 1.0309%

Thickness Required Due to Pressure + External Loads								
Condition	Pressure P (psi)	Allowable Stress Before UG-23 Stress Increase (psi)		Temperature (°F)	Corrosion C (in)	Load	Req'd Thk Due to Tension (in)	Req'd Thk Due to Compression (in)
		S_t	S_c					
Operating, Hot & Corroded	400	20,000	10,846	200	0	Wind	0.2508	0.2449
						Seismic	0.2505	0.2452
Operating, Hot & New	400	20,000	10,846	200	0	Wind	0.2508	0.2449
						Seismic	0.2505	0.2452
Hot Shut Down, Corroded	0	20,000	10,846	200	0	Wind	0.0016	0.0078
						Seismic	0.0013	0.0072
Hot Shut Down, New	0	20,000	10,846	200	0	Wind	0.0016	0.0078
						Seismic	0.0013	0.0072
Empty, Corroded	0	20,000	12,090	70	0	Wind	0.0017	0.0071
						Seismic	0.0012	0.0064
Empty, New	0	20,000	12,090	70	0	Wind	0.0017	0.0071
						Seismic	0.0012	0.0064
Hot Shut Down, Corroded, Weight & Eccentric Moments Only	0	20,000	10,846	200	0	Weight	0.0021	0.0052
Operating, Hot & Corroded, Vortex Shedding	400	20,000	10,846	200	0	Wind	0.2497	0.246
Empty, Cold & Corroded, Vortex Shedding	0	20,000	12,090	70	0	Wind	0.0005	0.0052

ASME Section VIII Division 1, 2015 Edition				
Component		Cylinder		
Material		SA-240 304 (II-D p. 86, ln. 44)		
Impact Tested	**Normalized**	**Fine Grain Practice**	**PWHT**	**Optimize MDMT/ Find MAWP**
No	No	No	No	No
		Design Pressure (psi)	**Design Temperature (°F)**	**Design MDMT (°F)**
Internal		400	200	-200
Static Liquid Head				
Condition		**P_s (psi)**	**H_s (in)**	**SG**
Test horizontal		2.48	68.625	1
Test vertical		9.6	266	1
Dimensions				
Inner Diameter		60"		
Length		120"		
Nominal Thickness		0.625"		
Corrosion	**Inner**	0"		
	Outer	0"		
Weight and Capacity				
		Weight (lb)		**Capacity (US gal)**
New		4,118.7		1,468.8
Corroded		4,118.7		1,468.8
Insulation				
		Thickness (in)	**Density (lb/ft^3)**	**Weight (lb)**
Insulation		3.5	15	741.63
		Spacing(in)	**Individual Weight (lb)**	**Total Weight (lb)**
Insulation Supports		145	150	150
Radiography				
Longitudinal seam		Full UW-11(a) Type 1		
Top Circumferential seam		Full UW-11(a) Type 1		
Bottom Circumferential seam		Full UW-11(a) Type 1		

Results Summary	
Governing condition	Internal pressure
Minimum thickness per UG-16	0.0625" + 0" = 0.0625"
Design thickness due to internal pressure (t)	0.6073"
Design thickness due to combined loadings + corrosion	0.2551"
Maximum allowable working pressure (MAWP)	411.52 psi
Maximum allowable pressure (MAP)	411.52 psi
Rated MDMT	-320 °F

UHA-51 Material Toughness Requirements
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

Design thickness, (at 200 °F) UG-27(c)(1)

t = P*R / (S*E - 0.60*P) + Corrosion
= 400*30 / (20,000*1.00 - 0.60*400) + 0
= 0.6073"

Maximum allowable working pressure, (at 200 °F) UG-27(c)(1)

P = S*E*t / (R + 0.60*t) - P_s
= 20,000*1.00*0.625 / (30 + 0.60*0.625) - 0
= 411.52 psi

Maximum allowable pressure, (at 70 °F) UG-27(c)(1)

P = S*E*t / (R + 0.60*t)
= 20,000*1.00*0.625 / (30 + 0.60*0.625)
= 411.52 psi

% Forming strain - UHA-44(a)(2)

EFE = (50*t / R_f)*(1 - R_f / R_o)
= (50*0.625 / 30.3125)*(1 - 30.3125 / ∞)
= 1.0309%

Thickness Required Due to Pressure + External Loads								
Condition	Pressure P (psi)	Allowable Stress Before UG-23 Stress Increase (psi)		Temperature (°F)	Corrosion C (in)	Load	Req'd Thk Due to Tension (in)	Req'd Thk Due to Compression (in)
		S_t	S_c					
Operating, Hot & Corroded	400	20,000	10,846	200	0	Wind	0.2551	0.2385
						Seismic	0.2534	0.2403
Operating, Hot & New	400	20,000	10,846	200	0	Wind	0.2551	0.2385
						Seismic	0.2534	0.2403
Hot Shut Down, Corroded	0	20,000	10,846	200	0	Wind	0.006	0.0197
						Seismic	0.0042	0.0164
Hot Shut Down, New	0	20,000	10,846	200	0	Wind	0.006	0.0197
						Seismic	0.0042	0.0164
Empty, Corroded	0	20,000	12,090	70	0	Wind	0.0062	0.0181
						Seismic	0.004	0.0145
Empty, New	0	20,000	12,090	70	0	Wind	0.0062	0.0181
						Seismic	0.004	0.0145
Hot Shut Down, Corroded, Weight & Eccentric Moments Only	0	20,000	10,846	200	0	Weight	0.0041	0.0089
Operating, Hot & Corroded, Vortex Shedding	400	20,000	10,846	200	0	Wind	0.2514	0.2422
Empty, Cold & Corroded, Vortex Shedding	0	20,000	12,090	70	0	Wind	0.0022	0.0115

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ASME Section VIII Division 1, 2015 Edition				
Component		Cylinder		
Material		SA-240 304 (II-D p. 86, ln. 44)		
Impact Tested	**Normalized**	**Fine Grain Practice**	**PWHT**	**Optimize MDMT/ Find MAWP**
No	No	No	No	No
		Design Pressure (psi)	**Design Temperature (°F)**	**Design MDMT (°F)**
Internal		400	200	-200
Static Liquid Head				
Condition		**P_s (psi)**	**H_s (in)**	**SG**
Test horizontal		2.48	68.625	1
Test vertical		12.96	359	1
Dimensions				
Inner Diameter		60"		
Length		93"		
Nominal Thickness		0.625"		
Corrosion	**Inner**	0"		
	Outer	0"		
Weight and Capacity				
		Weight (lb)		**Capacity (US gal)**
New		3,187.28		1,138.32
Corroded		3,187.28		1,138.32
Insulation				
		Thickness (in)	**Density (lb/ft^3)**	**Weight (lb)**
Insulation		3.5	15	574.76
		Spacing(in)	**Individual Weight (lb)**	**Total Weight (lb)**
Insulation Supports		145	150	150
Radiography				
Longitudinal seam		Full UW-11(a) Type 1		
Top Circumferential seam		Full UW-11(a) Type 1		
Bottom Circumferential seam		Full UW-11(a) Type 1		

Results Summary	
Governing condition	Internal pressure
Minimum thickness per UG-16	0.0625" + 0" = 0.0625"
Design thickness due to internal pressure (t)	0.6073"
Design thickness due to combined loadings + corrosion	0.2599"
Maximum allowable working pressure (MAWP)	411.52 psi
Maximum allowable pressure (MAP)	411.52 psi
Rated MDMT	-320 °F

UHA-51 Material Toughness Requirements
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

Design thickness, (at 200 °F) UG-27(c)(1)

t = P*R / (S*E - 0.60*P) + Corrosion
= 400*30 / (20,000*1.00 - 0.60*400) + 0
= 0.6073"

Maximum allowable working pressure, (at 200 °F) UG-27(c)(1)

P = S*E*t / (R + 0.60*t) - P_s
= 20,000*1.00*0.625 / (30 + 0.60*0.625) - 0
= 411.52 psi

Maximum allowable pressure, (at 70 °F) UG-27(c)(1)

P = S*E*t / (R + 0.60*t)
= 20,000*1.00*0.625 / (30 + 0.60*0.625)
= 411.52 psi

% Forming strain - UHA-44(a)(2)

EFE = (50*t / R_f)*(1 - R_f / R_o)
= (50*0.625 / 30.3125)*(1 - 30.3125 / ∞)
= 1.0309%

Thickness Required Due to Pressure + External Loads								
Condition	Pressure P (psi)	Allowable Stress Before UG-23 Stress Increase (psi)		Temperature (°F)	Corrosion C (in)	Load	Req'd Thk Due to Tension (in)	Req'd Thk Due to Compression (in)
		S_t	S_c					
Operating, Hot & Corroded	400	20,000	10,846	200	0	Wind	0.2599	0.2307
						Seismic	0.2563	0.2343
Operating, Hot & New	400	20,000	10,846	200	0	Wind	0.2599	0.2307
						Seismic	0.2563	0.2343
Hot Shut Down, Corroded	0	20,000	10,846	200	0	Wind	0.0107	0.0341
						Seismic	0.0071	0.0274
Hot Shut Down, New	0	20,000	10,846	200	0	Wind	0.0107	0.0341
						Seismic	0.0071	0.0274
Empty, Corroded	0	20,000	12,090	70	0	Wind	0.0112	0.0313
						Seismic	0.0068	0.0241
Empty, New	0	20,000	12,090	70	0	Wind	0.0112	0.0313
						Seismic	0.0068	0.0241
Hot Shut Down, Corroded, Weight & Eccentric Moments Only	0	20,000	10,846	200	0	Weight	0.0078	0.0136
Operating, Hot & Corroded, Vortex Shedding	400	20,000	10,846	200	0	Wind	0.253	0.2376
Empty, Cold & Corroded, Vortex Shedding	0	20,000	12,090	70	0	Wind	0.0038	0.0191

ASME Section VIII Division 1, 2015 Edition				
Component		Cone		
Material		SA-240 304 (II-D p. 86, ln. 44)		
Impact Tested	**Normalized**	**Fine Grain Practice**	**PWHT**	**Optimize MDMT/ Find MAWP**
No	No	No	No	No
		Design Pressure (psi)	**Design Temperature (°F)**	**Design MDMT (°F)**
Internal		400	200	-200
Static Liquid Head				
Condition		**P_s (psi)**	**H_s (in)**	**SG**
Test horizontal	**Large**	2.48	68.625	1
	Small	2.15	59.625	
Test vertical	**Large**	12.96	359	1
	Small	14.26	395	
Dimensions				
Inner Diameter	**Large**	60"		
	Small	42"		
Length		36"		
Nominal Thickness		0.75"		
Corrosion	**Inner**	0"		
	Outer	0"		
Weight and Capacity				
		Weight (lb)		**Capacity (US gal)**
New		1,216.65		321.67
Corroded		1,216.65		321.67
Insulation				
		Thickness (in)	**Density (lb/ft^3)**	**Weight (lb)**
Insulation		3.5	15	198.89
		Spacing(in)	**Individual Weight (lb)**	**Total Weight (lb)**
Insulation Supports		145	150	150
Radiography				
Longitudinal seam		Full UW-11(a) Type 1		
Top Circumferential seam		Full UW-11(a) Type 1		

Bottom Circumferential seam	Full UW-11(a) Type 1

Results Summary	
Governing condition	Internal pressure
Minimum thickness per UG-16	0.0625" + 0" = 0.0625"
Design thickness due to internal pressure (t)	0.626"
Design thickness due to combined loadings + corrosion	0.3127"
Maximum allowable working pressure (MAWP)	411.52 psi
Maximum allowable pressure (MAP)	411.52 psi
Rated MDMT	-320 °F

UHA-51 Material Toughness Requirements
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

Design thickness, (at 200 °F) UG-32(f) (Large End)

t = P*D / (2*cos(α)*(S*E - 0.60*P)) + Corrosion
= 400*60 / (2*cos(14.0362)*(20,000*1.00 - 0.60*400)) + 0
= 0.626"

Small End design thickness (t = 0.4382") does not govern.

Maximum allowable working pressure, (Corroded at 200 °F) UG-32(f) (Large End)

P = 2*S*E*t*cos(α) / (D + 1.20*t*cos(α)) - P_s
= 2*20,000*1.00*0.75*cos(14.0362) / (60 + 1.20*0.75*cos(14.0362)) - 0
= 478.11 psi

Small End MAWP (678.85 psi) does not govern.

Maximum allowable pressure, (New at 70 °F) UG-32(f) (Large End)

P = 2*S*E*t*cos(α) / (D + 1.20*t*cos(α))
= 2*20,000*1.00*0.75*cos(14.0362) / (60 + 1.20*0.75*cos(14.0362))
= 478.11 psi

Small End MAP (678.85 psi) does not govern.

% Forming strain - UHA-44(a)(2)

EFE = (50*t / R_f)*(1 - R_f / R_o)
= (50*0.7731 / 21.3865)*(1 - 21.3865 / ∞)
= 1.8074%

Thickness Required Due to Pressure + External Loads									
Condition	Pressure P (psi)	Allowable Stress Before UG-23 Stress Increase (psi)		Temperature (°F)	Corrosion C (in)	Location	Load	Req'd Thk Due to Tension (in)	Req'd Thk Due to Compression (in)
		S_t	S_c						
Operating, Hot & Corroded	400	20,000	11,208	200	0	Top	Wind	0.2679	0.2379
							Seismic	0.2641	0.2416
						Bottom	Wind	0.21	0.1369
							Seismic	0.2003	0.1466
Operating, Hot & New	400	20,000	11,208	200	0	Top	Wind	0.2679	0.2379
							Seismic	0.2641	0.2416
						Bottom	Wind	0.21	0.1369
							Seismic	0.2003	0.1466
Hot Shut Down, Corroded	0	20,000	11,208	200	0	Top	Wind	0.011	0.0339
							Seismic	0.0073	0.0272
						Bottom	Wind	0.0302	0.0766
							Seismic	0.0205	0.0593
Hot Shut Down, New	0	20,000	11,208	200	0	Top	Wind	0.011	0.0339
							Seismic	0.0073	0.0272
						Bottom	Wind	0.0302	0.0766
							Seismic	0.0205	0.0593
Empty, Corroded	0	20,000	12,462	70	0	Top	Wind	0.0115	0.0312
							Seismic	0.007	0.024
						Bottom	Wind	0.0313	0.0707
							Seismic	0.0197	0.0521
Empty, New	0	20,000	12,462	70	0	Top	Wind	0.0115	0.0312
							Seismic	0.007	0.024
						Bottom	Wind	0.0313	0.0707
							Seismic	0.0197	0.0521
Hot Shut Down, Corroded, Weight & Eccentric Moments Only	0	20,000	11,208	200	0	Top	Weight	0.0078	0.0135
						Bottom	Weight	0.0086	0.0255
Operating, Hot & Corroded, Vortex Shedding	400	20,000	11,208	200	0	Top	Wind	0.3127	0.2938
						Bottom	Wind	0.2309	0.185
Empty, Cold & Corroded, Vortex Shedding	0	20,000	12,462	70	0	Top	Wind	0.0047	0.0229
						Bottom	Wind	0.0154	0.0492

Cone juncture large end calculations, P =411.523 psi Appendix 1-5(d)								
Loading	**Area check required ($\Delta < \alpha$)**	**U-2(g) analysis required**	**f_1 (lbf/in)**	**Q_L (lbf/in)**	**A_{rL} (in2)**	**A_{eL} (in2)**	**Ring area (in²)**	**Status**
Wind Corroded	No	No	257.97	6,430.81	0	0.51	none	OK
Seismic Corroded	No	No	170.98	6,343.83	0	0.51	none	OK
Vortex Shedding	No	No	91.65	6,264.5	0	0.51	none	OK

Cone large end calculations per Appendix 1-5(d)(1), wind + pressure, corroded

$L_{min} = 2*(R_L*t_s)^{0.5}$
$= 2*(30*0.625)^{0.5}$
$= 8.6603$ in

The length of the attached cylinder (93 in) ≥ L_{min}.

$f_1 = -0.6*W_l / (\pi*2*R_m) + 12*M_l / (\pi*R_m^2)$
$= -0.6*22{,}096.16 / (\pi*2*30.3125) + 12*78{,}800.1 / (\pi*30.3125^2)$
$= 257.97$ lb$_f$/in

$P*R_L / 2 = 6{,}172.84$ lb$_f$/in

f_1 is in tension so a U-2(g) analysis is not required.

$P / (S_s*E_1) = 411.52 / (20{,}000*1) = 0.020576$

From table 1-5.1 $\Delta = 30°$

As $\Delta >= \alpha$ no additional reinforcement is required.

Cone juncture small end calculations, P =411.523 psi Appendix 1-5(e)								
Loading	Area check required ($\Delta < \alpha$)	U-2(g) analysis required	f_2 (lbf/in)	Q_s (lbf/in)	A_{rs} (in2)	A_{es} (in2)	Ring area (in²)	Status
Wind Corroded	Yes	No	712.39	5,033.38	0.13	0.94	none	OK
Seismic Corroded	Yes	No	483.32	4,804.31	0.13	0.94	none	OK
Vortex Shedding	Yes	No	302.34	4,623.33	0.12	0.94	none	OK

Cone small end calculations per Appendix 1-5(e)(1), wind + pressure, corroded

$L_{min} = 1.4*(R_S*t_s)^{0.5}$
$= 1.4*(21*0.5)^{0.5}$
$= 4.5365$ in

The length of the attached cylinder (87 in) ≥ L_{min}.

$f_2 = -0.6*W_s / (\pi*2*R_m) + 12*M_s / (\pi*R_m^2)$
$= -0.6*24{,}902.44 / (\pi*2*21.25) + 12*97{,}447 / (\pi*21.25^2)$
$= 712.39$ lb_f/in

$P*R_s / 2 = 4{,}320.9914$ lb_f/in

f_2 is in tension so a U-2(g) analysis is not required.

$P / (S_s*E_1) = 411.52 / (20{,}000*1) = 0.020576$

From table 1-5.2 $\Delta = 12.64°$

As $\Delta < \alpha$ reinforcement is required.

$Q_s = P*R_s / 2 + f_2$
$= 4{,}320.99 + 712.39$
$= 5{,}033.38$ lb_f/in

$A_{rs} = (k*Q_s*R_s / (S_s*E_1))*(1 - \Delta / \alpha)*\tan(\alpha)$
$= (1*5{,}033.38*21 / (20{,}000*1))*(1 - 12.64 / 14.0362)*\tan(14.0362)$
$= 0.1314$ in²

$A_{es} = 0.78*(R_s*t_s)^{0.5}*[(t_s - t) + (t_c - t_r) / \cos(\alpha)]$
$= 0.78*(21*0.5)^{0.5}*[(0.5 - 0.4375) + (0.75 - 0.451) / \cos(14.0362)]$
$= 0.937$ in²

$A_{es} >= A_{rs}$ therefore the small end juncture is adequately reinforced.

MAP Cone juncture large end calculations, P =411.523 psi Appendix 1-5(d)								
Loading	Area check required ($\Delta < \alpha$)	U-2(g) analysis required	f_1 (lbf/in)	Q_L (lbf/in)	A_{rL} (in2)	A_{eL} (in2)	Ring area (in^2)	Status
Wind New	No	No	268.94	6,441.78	0	0.51	none	OK

Cone large end calculations per Appendix 1-5(d)(1), wind + pressure, new

$L_{min} = 2*(R_L*t_s)^{0.5}$
$= 2*(30*0.625)^{0.5}$
$= 8.6603$ in

The length of the attached cylinder (93 in) ≥ L_{min}.

$f_1 = -0.6*W_l / (\pi*2*R_m) + 12*M_l / (\pi*R_m^2)$
$= -0.6*22{,}096.16 / (\pi*2*30.3125) + 12*81{,}438.7 / (\pi*30.3125^2)$
$= 268.94$ lb$_f$/in

$P*R_L / 2 = 6{,}172.84$ lb$_f$/in

f_1 is in tension so a U-2(g) analysis is not required.

$P / (S_s*E_1) = 411.52 / (20{,}000*1) = 0.020576$

From table 1-5.1 $\Delta = 30°$

As $\Delta >= \alpha$ no additional reinforcement is required.

MAP Cone juncture small end calculations, P =411.523 psi Appendix 1-5(e)								
Loading	Area check required ($\Delta < \alpha$)	U-2(g) analysis required	f_2 (lbf/in)	Q_s (lbf/in)	A_{rs} (in2)	A_{es} (in2)	Ring area (in^2)	Status
Wind New	Yes	No	739.48	5,060.47	0.13	0.94	none	OK

Cone small end calculations per Appendix 1-5(e)(1), wind + pressure, new

$L_{min} = 1.4*(R_S*t_s)^{0.5}$
$= 1.4*(21*0.5)^{0.5}$
$= 4.5365$ in

The length of the attached cylinder (87 in) ≥ L_{min}.

$f_2 = -0.6*W_s / (\pi*2*R_m) + 12*M_s / (\pi*R_m^2)$
$= -0.6*24{,}902.44 / (\pi*2*21.25) + 12*100{,}649.8 / (\pi*21.25^2)$
$= 739.48$ lb_f/in

$P*R_s / 2 = 4{,}320.9914$ lb_f/in

f_2 is in tension so a U-2(g) analysis is not required.

$P / (S_s*E_1) = 411.52 / (20{,}000*1) = 0.020576$

From table 1-5.2 $\Delta = 12.64°$

As $\Delta < \alpha$ reinforcement is required.

$Q_s = P*R_s / 2 + f_2$
$= 4{,}320.99 + 739.48$
$= 5{,}060.47$ lb_f/in

$A_{rs} = (k*Q_s*R_s / (S_s*E_1))*(1 - \Delta / \alpha)*\tan(\alpha)$
$= (1*5{,}060.47*21 / (20{,}000*1))*(1 - 12.64 / 14.0362)*\tan(14.0362)$
$= 0.1321$ in^2

$A_{es} = 0.78*(R_s*t_s)^{0.5}*[(t_s - t) + (t_c - t_r) / \cos(\alpha)]$
$= 0.78*(21*0.5)^{0.5}*[(0.5 - 0.4375) + (0.75 - 0.451) / \cos(14.0362)]$
$= 0.937$ in^2

$A_{es} >= A_{rs}$ therefore the small end juncture is adequately reinforced.

SHELL RG 7

ASME Section VIII Division 1, 2015 Edition				
Component		Cylinder		
Material		SA-240 304 (II-D p. 86, ln. 44)		
Impact Tested	**Normalized**	**Fine Grain Practice**	**PWHT**	**Optimize MDMT/ Find MAWP**
No	No	No	No	No
		Design Pressure (psi)	**Design Temperature (°F)**	**Design MDMT (°F)**
Internal		400	200	-200
Static Liquid Head				
Condition		**P_s (psi)**	**H_s (in)**	**SG**
Test horizontal		2.15	59.625	1
Test vertical		17.4	482	1
Dimensions				
Inner Diameter		42"		
Length		87"		
Nominal Thickness		0.5"		
Corrosion	**Inner**	0"		
	Outer	0"		
Weight and Capacity				
		Weight (lb)		**Capacity (US gal)**
New		1,665.81		521.79
Corroded		1,665.81		521.79
Insulation				
		Thickness (in)	**Density (lb/ft^3)**	**Weight (lb)**
Insulation		3.5	15	386.13
		Spacing(in)	**Individual Weight (lb)**	**Total Weight (lb)**
Insulation Supports		145	150	150
Radiography				
Longitudinal seam		Full UW-11(a) Type 1		
Top Circumferential seam		Full UW-11(a) Type 1		
Bottom Circumferential seam		Full UW-11(a) Type 1		

Results Summary	
Governing condition	Internal pressure
Minimum thickness per UG-16	0.0625" + 0" = 0.0625"
Design thickness due to internal pressure (t)	0.4252"
Design thickness due to combined loadings + corrosion	0.2186"
Maximum allowable working pressure (MAWP)	469.48 psi
Maximum allowable pressure (MAP)	469.48 psi
Rated MDMT	-320 °F

UHA-51 Material Toughness Requirements
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

Design thickness, (at 200 °F) UG-27(c)(1)

t = P*R / (S*E - 0.60*P) + Corrosion
= 400*21 / (20,000*1.00 - 0.60*400) + 0
= 0.4252"

Maximum allowable working pressure, (at 200 °F) UG-27(c)(1)

P = S*E*t / (R + 0.60*t) - P_s
= 20,000*1.00*0.5 / (21 + 0.60*0.5) - 0
= 469.48 psi

Maximum allowable pressure, (at 70 °F) UG-27(c)(1)

P = S*E*t / (R + 0.60*t)
= 20,000*1.00*0.5 / (21 + 0.60*0.5)
= 469.48 psi

% Forming strain - UHA-44(a)(2)

EFE = (50*t / R_f)*(1 - R_f / R_o)
= (50*0.5 / 21.25)*(1 - 21.25 / ∞)
= 1.1765%

Thickness Required Due to Pressure + External Loads								
Condition	Pressure P (psi)	Allowable Stress Before UG-23 Stress Increase (psi)		Temperature (°F)	Corrosion C (in)	Load	Req'd Thk Due to Tension (in)	Req'd Thk Due to Compression (in)
		S_t	S_c					
Operating, Hot & Corroded	400	20,000	11,166	200	0	Wind	0.2186	0.1166
						Seismic	0.2035	0.1317
Operating, Hot & New	400	20,000	11,166	200	0	Wind	0.2186	0.1166
						Seismic	0.2035	0.1317
Hot Shut Down, Corroded	0	20,000	11,166	200	0	Wind	0.0442	0.1036
						Seismic	0.029	0.0765
Hot Shut Down, New	0	20,000	11,166	200	0	Wind	0.0442	0.1036
						Seismic	0.029	0.0765
Empty, Corroded	0	20,000	12,419	70	0	Wind	0.0458	0.0958
						Seismic	0.028	0.0671
Empty, New	0	20,000	12,419	70	0	Wind	0.0458	0.0958
						Seismic	0.028	0.0671
Hot Shut Down, Corroded, Weight & Eccentric Moments Only	0	20,000	11,166	200	0	Weight	0.0096	0.0272
Operating, Hot & Corroded, Vortex Shedding	400	20,000	11,166	200	0	Wind	0.1933	0.1418
Empty, Cold & Corroded, Vortex Shedding	0	20,000	12,419	70	0	Wind	0.019	0.0525

SHELL RG 6

ASME Section VIII Division 1, 2015 Edition				
Component		Cylinder		
Material		SA-240 304 (II-D p. 86, ln. 44)		
Impact Tested	**Normalized**	**Fine Grain Practice**	**PWHT**	**Optimize MDMT/ Find MAWP**
No	No	No	No	No
		Design Pressure (psi)	**Design Temperature (°F)**	**Design MDMT (°F)**
Internal		400	200	-200
Static Liquid Head				
Condition		**P_s (psi)**	**H_s (in)**	**SG**
Test horizontal		2.15	59.625	1
Test vertical		21.73	602	1
Dimensions				
Inner Diameter		42"		
Length		120"		
Nominal Thickness		0.5"		
Corrosion	**Inner**	0"		
	Outer	0"		
Weight and Capacity				
		Weight (lb)		**Capacity (US gal)**
New		2,256.32		719.71
Corroded		2,256.32		719.71
Insulation				
		Thickness (in)	**Density (lb/ft^3)**	**Weight (lb)**
Insulation		3.5	15	532.6
		Spacing(in)	**Individual Weight (lb)**	**Total Weight (lb)**
Insulation Supports		145	150	150
Radiography				
Longitudinal seam		Full UW-11(a) Type 1		
Top Circumferential seam		Full UW-11(a) Type 1		
Bottom Circumferential seam		Full UW-11(a) Type 1		

Results Summary	
Governing condition	Internal pressure
Minimum thickness per UG-16	0.0625" + 0" = 0.0625"
Design thickness due to internal pressure (t)	0.4252"
Design thickness due to combined loadings + corrosion	0.2415"
Maximum allowable working pressure (MAWP)	469.48 psi
Maximum allowable pressure (MAP)	469.48 psi
Rated MDMT	-320 °F

UHA-51 Material Toughness Requirements
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

Design thickness, (at 200 °F) UG-27(c)(1)

t = P*R / (S*E - 0.60*P) + Corrosion
= 400*21 / (20,000*1.00 - 0.60*400) + 0
= 0.4252"

Maximum allowable working pressure, (at 200 °F) UG-27(c)(1)

P = S*E*t / (R + 0.60*t) - P_s
= 20,000*1.00*0.5 / (21 + 0.60*0.5) - 0
= 469.48 psi

Maximum allowable pressure, (at 70 °F) UG-27(c)(1)

P = S*E*t / (R + 0.60*t)
= 20,000*1.00*0.5 / (21 + 0.60*0.5)
= 469.48 psi

% Forming strain - UHA-44(a)(2)

EFE = $(50*t / R_f)*(1 - R_f / R_o)$
= $(50*0.5 / 21.25)*(1 - 21.25 / \infty)$
= 1.1765%

Thickness Required Due to Pressure + External Loads								
Condition	Pressure P (psi)	Allowable Stress Before UG-23 Stress Increase (psi)		Temperature (°F)	Corrosion C (in)	Load	Req'd Thk Due to Tension (in)	Req'd Thk Due to Compression (in)
		S_t	S_c					
Operating, Hot & Corroded	400	20,000	11,166	200	0	Wind	0.2415	0.0899
						Seismic	0.2165	0.1149
Operating, Hot & New	400	20,000	11,166	200	0	Wind	0.2415	0.0899
						Seismic	0.2165	0.1149
Hot Shut Down, Corroded	0	20,000	11,166	200	0	Wind	0.0671	0.1515
						Seismic	0.0421	0.1066
Hot Shut Down, New	0	20,000	11,166	200	0	Wind	0.0671	0.1515
						Seismic	0.0421	0.1066
Empty, Corroded	0	20,000	12,419	70	0	Wind	0.0697	0.1403
						Seismic	0.0405	0.0934
Empty, New	0	20,000	12,419	70	0	Wind	0.0697	0.1403
						Seismic	0.0405	0.0934
Hot Shut Down, Corroded, Weight & Eccentric Moments Only	0	20,000	11,166	200	0	Weight	0.0141	0.0328
Operating, Hot & Corroded, Vortex Shedding	400	20,000	11,166	200	0	Wind	0.203	0.1283
Empty, Cold & Corroded, Vortex Shedding	0	20,000	12,419	70	0	Wind	0.0287	0.0743

SHELL RG 5

ASME Section VIII Division 1, 2015 Edition				
Component		Cylinder		
Material		SA-240 304 (II-D p. 86, ln. 44)		
Impact Tested	**Normalized**	**Fine Grain Practice**	**PWHT**	**Optimize MDMT/ Find MAWP**
No	No	No	No	No
		Design Pressure (psi)	**Design Temperature (°F)**	**Design MDMT (°F)**
Internal		400	200	-200
Static Liquid Head				
Condition		**P_s (psi)**	**H_s (in)**	**SG**
Test horizontal		2.15	59.625	1
Test vertical		26.06	722	1
Dimensions				
Inner Diameter		42"		
Length		120"		
Nominal Thickness		0.5"		
Corrosion	**Inner**	0"		
	Outer	0"		
Weight and Capacity				
		Weight (lb)		**Capacity (US gal)**
New		2,304.18		719.71
Corroded		2,304.18		719.71
Insulation				
		Thickness (in)	**Density (lb/ft^3)**	**Weight (lb)**
Insulation		3	15	451.6
		Spacing(in)	**Individual Weight (lb)**	**Total Weight (lb)**
Insulation Supports		145	150	150
Radiography				
Longitudinal seam		Full UW-11(a) Type 1		
Top Circumferential seam		Full UW-11(a) Type 1		
Bottom Circumferential seam		Full UW-11(a) Type 1		

Results Summary	
Governing condition	Internal pressure
Minimum thickness per UG-16	0.0625" + 0" = 0.0625"
Design thickness due to internal pressure (t)	0.4252"
Design thickness due to combined loadings + corrosion	0.27"
Maximum allowable working pressure (MAWP)	469.48 psi
Maximum allowable pressure (MAP)	469.48 psi
Rated MDMT	-320 °F

UHA-51 Material Toughness Requirements
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

Design thickness, (at 200 °F) UG-27(c)(1)

t = P*R / (S*E - 0.60*P) + Corrosion
= 400*21 / (20,000*1.00 - 0.60*400) + 0
= 0.4252"

Maximum allowable working pressure, (at 200 °F) UG-27(c)(1)

P = S*E*t / (R + 0.60*t) - P_s
= 20,000*1.00*0.5 / (21 + 0.60*0.5) - 0
= 469.48 psi

Maximum allowable pressure, (at 70 °F) UG-27(c)(1)

P = S*E*t / (R + 0.60*t)
= 20,000*1.00*0.5 / (21 + 0.60*0.5)
= 469.48 psi

% Forming strain - UHA-44(a)(2)

EFE = $(50*t / R_f)*(1 - R_f / R_o)$
= $(50*0.5 / 21.25)*(1 - 21.25 / \infty)$
= 1.1765%

Thickness Required Due to Pressure + External Loads								
Condition	Pressure P (psi)	Allowable Stress Before UG-23 Stress Increase (psi)		Temperature (°F)	Corrosion C (in)	Load	Req'd Thk Due to Tension (in)	Req'd Thk Due to Compression (in)
		S_t	S_c					
Operating, Hot & Corroded	400	20,000	11,166	200	0	Wind	0.27	0.0589
						Seismic	0.2321	0.0967
Operating, Hot & New	400	20,000	11,166	200	0	Wind	0.27	0.0589
						Seismic	0.2321	0.0967
Hot Shut Down, Corroded	0	20,000	11,166	200	0	Wind	0.0955	0.207
						Seismic	0.0577	0.1392
Hot Shut Down, New	0	20,000	11,166	200	0	Wind	0.0955	0.207
						Seismic	0.0577	0.1392
Empty, Corroded	0	20,000	12,419	70	0	Wind	0.0992	0.1919
						Seismic	0.0557	0.1218
Empty, New	0	20,000	12,419	70	0	Wind	0.0992	0.1919
						Seismic	0.0557	0.1218
Hot Shut Down, Corroded, Weight & Eccentric Moments Only	0	20,000	11,166	200	0	Weight	0.0153	0.0384
Operating, Hot & Corroded, Vortex Shedding	400	20,000	11,166	200	0	Wind	0.216	0.1128
Empty, Cold & Corroded, Vortex Shedding	0	20,000	12,419	70	0	Wind	0.0417	0.0993

SHELL RG 4

ASME Section VIII Division 1, 2015 Edition				
Component		Cylinder		
Material		SA-240 304 (II-D p. 86, ln. 44)		
Impact Tested	**Normalized**	**Fine Grain Practice**	**PWHT**	**Optimize MDMT/ Find MAWP**
No	No	No	No	No
		Design Pressure (psi)	**Design Temperature (°F)**	**Design MDMT (°F)**
Internal		400	200	-200
Static Liquid Head				
Condition		**P_s (psi)**	**H_s (in)**	**SG**
Test horizontal		2.15	59.625	1
Test vertical		30.39	842	1
Dimensions				
Inner Diameter		42"		
Length		120"		
Nominal Thickness		0.5"		
Corrosion	**Inner**	0"		
	Outer	0"		
Weight and Capacity				
		Weight (lb)		**Capacity (US gal)**
New		2,242.2		719.71
Corroded		2,242.2		719.71
Insulation				
		Thickness (in)	**Density (lb/ft^3)**	**Weight (lb)**
Insulation		2.5	15	372.25
		Spacing(in)	**Individual Weight (lb)**	**Total Weight (lb)**
Insulation Supports		145	150	150
Radiography				
Longitudinal seam		Full UW-11(a) Type 1		
Top Circumferential seam		Full UW-11(a) Type 1		
Bottom Circumferential seam		Full UW-11(a) Type 1		

Results Summary	
Governing condition	Internal pressure
Minimum thickness per UG-16	0.0625" + 0" = 0.0625"
Design thickness due to internal pressure (t)	0.4252"
Design thickness due to combined loadings + corrosion	0.3007"
Maximum allowable working pressure (MAWP)	469.48 psi
Maximum allowable pressure (MAP)	469.48 psi
Rated MDMT	-320 °F

UHA-51 Material Toughness Requirements
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

Design thickness, (at 200 °F) UG-27(c)(1)

t = P*R / (S*E - 0.60*P) + Corrosion
= 400*21 / (20,000*1.00 - 0.60*400) + 0
= 0.4252"

Maximum allowable working pressure, (at 200 °F) UG-27(c)(1)

P = S*E*t / (R + 0.60*t) - P_s
= 20,000*1.00*0.5 / (21 + 0.60*0.5) - 0
= 469.48 psi

Maximum allowable pressure, (at 70 °F) UG-27(c)(1)

P = S*E*t / (R + 0.60*t)
= 20,000*1.00*0.5 / (21 + 0.60*0.5)
= 469.48 psi

% Forming strain - UHA-44(a)(2)

EFE = (50*t / R_f)*(1 - R_f / R_o)
= (50*0.5 / 21.25)*(1 - 21.25 / ∞)
= 1.1765%

Thickness Required Due to Pressure + External Loads								
Condition	Pressure P (psi)	Allowable Stress Before UG-23 Stress Increase (psi)		Temperature (°F)	Corrosion C (in)	Load	Req'd Thk Due to Tension (in)	Req'd Thk Due to Compression (in)
		S_t	S_c					
Operating, Hot & Corroded	400	20,000	11,166	200	0	Wind	0.3007	0.0249
						Seismic	0.247	0.0785
Operating, Hot & New	400	20,000	11,166	200	0	Wind	0.3007	0.0249
						Seismic	0.247	0.0785
Hot Shut Down, Corroded	0	20,000	11,166	200	0	Wind	0.1263	0.2679
						Seismic	0.0726	0.1718
Hot Shut Down, New	0	20,000	11,166	200	0	Wind	0.1263	0.2679
						Seismic	0.0726	0.1718
Empty, Corroded	0	20,000	12,419	70	0	Wind	0.1311	0.2486
						Seismic	0.07	0.1502
Empty, New	0	20,000	12,419	70	0	Wind	0.1311	0.2486
						Seismic	0.07	0.1502
Hot Shut Down, Corroded, Weight & Eccentric Moments Only	0	20,000	11,166	200	0	Weight	0.0209	0.0417
Operating, Hot & Corroded, Vortex Shedding	400	20,000	11,166	200	0	Wind	0.2293	0.0963
Empty, Cold & Corroded, Vortex Shedding	0	20,000	12,419	70	0	Wind	0.0549	0.1259

SHELL RG 3

ASME Section VIII Division 1, 2015 Edition				
Component		Cylinder		
Material		SA-240 304 (II-D p. 86, ln. 44)		
Impact Tested	**Normalized**	**Fine Grain Practice**	**PWHT**	**Optimize MDMT/ Find MAWP**
No	No	No	No	No
		Design Pressure (psi)	**Design Temperature (°F)**	**Design MDMT (°F)**
Internal		400	200	-200
Static Liquid Head				
Condition		**P_s (psi)**	**H_s (in)**	**SG**
Test horizontal		2.15	59.625	1
Test vertical		34.73	962	1
Dimensions				
Inner Diameter		42"		
Length		120"		
Nominal Thickness		0.5"		
Corrosion	**Inner**	0"		
	Outer	0"		
Weight and Capacity				
		Weight (lb)		**Capacity (US gal)**
New		2,304.18		719.71
Corroded		2,304.18		719.71
Insulation				
		Thickness (in)	**Density (lb/ft^3)**	**Weight (lb)**
Insulation		2.5	15	372.25
		Spacing(in)	**Individual Weight (lb)**	**Total Weight (lb)**
Insulation Supports		145	150	150
Radiography				
Longitudinal seam		Full UW-11(a) Type 1		
Top Circumferential seam		Full UW-11(a) Type 1		
Bottom Circumferential seam		Full UW-11(a) Type 1		

Results Summary	
Governing condition	Internal pressure
Minimum thickness per UG-16	0.0625" + 0" = 0.0625"
Design thickness due to internal pressure (t)	0.4252"
Design thickness due to combined loadings + corrosion	0.3358"
Maximum allowable working pressure (MAWP)	469.48 psi
Maximum allowable pressure (MAP)	469.48 psi
Rated MDMT	-320 °F

UHA-51 Material Toughness Requirements
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

Design thickness, (at 200 °F) UG-27(c)(1)

t = P*R / (S*E - 0.60*P) + Corrosion
= 400*21 / (20,000*1.00 - 0.60*400) + 0
= 0.4252"

Maximum allowable working pressure, (at 200 °F) UG-27(c)(1)

P = S*E*t / (R + 0.60*t) - P_s
= 20,000*1.00*0.5 / (21 + 0.60*0.5) - 0
= 469.48 psi

Maximum allowable pressure, (at 70 °F) UG-27(c)(1)

P = S*E*t / (R + 0.60*t)
= 20,000*1.00*0.5 / (21 + 0.60*0.5)
= 469.48 psi

% Forming strain - UHA-44(a)(2)

EFE = (50*t / R_f)*(1 - R_f / R_o)
= (50*0.5 / 21.25)*(1 - 21.25 / ∞)
= 1.1765%

Thickness Required Due to Pressure + External Loads								
Condition	Pressure P (psi)	Allowable Stress Before UG-23 Stress Increase (psi)		Temperature (°F)	Corrosion C (in)	Load	Req'd Thk Due to Tension (in)	Req'd Thk Due to Compression (in)
		S_t	S_c					
Operating, Hot & Corroded	400	20,000	11,166	200	0	Wind	0.3358	0.0233
						Seismic	0.2631	0.0601
Operating, Hot & New	400	20,000	11,166	200	0	Wind	0.3358	0.0233
						Seismic	0.2631	0.0601
Hot Shut Down, Corroded	0	20,000	11,166	200	0	Wind	0.1613	0.3349
						Seismic	0.0887	0.2048
Hot Shut Down, New	0	20,000	11,166	200	0	Wind	0.1613	0.3349
						Seismic	0.0887	0.2048
Empty, Corroded	0	20,000	12,419	70	0	Wind	0.1675	0.311
						Seismic	0.0855	0.179
Empty, New	0	20,000	12,419	70	0	Wind	0.1675	0.311
						Seismic	0.0855	0.179
Hot Shut Down, Corroded, Weight & Eccentric Moments Only	0	20,000	11,166	200	0	Weight	0.025	0.0438
Operating, Hot & Corroded, Vortex Shedding	400	20,000	11,166	200	0	Wind	0.2449	0.0783
Empty, Cold & Corroded, Vortex Shedding	0	20,000	12,419	70	0	Wind	0.0706	0.1549

SHELL RG 2

ASME Section VIII Division 1, 2015 Edition				
Component		Cylinder		
Material		SA-240 304 (II-D p. 86, ln. 44)		
Impact Tested	**Normalized**	**Fine Grain Practice**	**PWHT**	**Optimize MDMT/ Find MAWP**
No	No	No	No	No
		Design Pressure (psi)	**Design Temperature (°F)**	**Design MDMT (°F)**
Internal		400	200	-200
Static Liquid Head				
Condition		**P_s (psi)**	**H_s (in)**	**SG**
Test horizontal		2.15	59.625	1
Test vertical		39.06	1,082	1
Dimensions				
Inner Diameter		42"		
Length		120"		
Nominal Thickness		0.5"		
Corrosion	**Inner**	0"		
	Outer	0"		
Weight and Capacity				
		Weight (lb)		**Capacity (US gal)**
New		2,286.23		719.71
Corroded		2,286.23		719.71
Insulation				
		Thickness (in)	**Density (lb/ft^3)**	**Weight (lb)**
Insulation		1.5	15	218.44
		Spacing(in)	**Individual Weight (lb)**	**Total Weight (lb)**
Insulation Supports		145	150	150
Radiography				
Longitudinal seam		Full UW-11(a) Type 1		
Top Circumferential seam		Full UW-11(a) Type 1		
Bottom Circumferential seam		Full UW-11(a) Type 1		

Results Summary	
Governing condition	Internal pressure
Minimum thickness per UG-16	0.0625" + 0" = 0.0625"
Design thickness due to internal pressure (t)	0.4252"
Design thickness due to combined loadings + corrosion	0.413"
Maximum allowable working pressure (MAWP)	469.48 psi
Maximum allowable pressure (MAP)	469.48 psi
Rated MDMT	-320 °F

UHA-51 Material Toughness Requirements
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

Design thickness, (at 200 °F) UG-27(c)(1)

t = P*R / (S*E - 0.60*P) + Corrosion
= 400*21 / (20,000*1.00 - 0.60*400) + 0
= 0.4252"

Maximum allowable working pressure, (at 200 °F) UG-27(c)(1)

P = S*E*t / (R + 0.60*t) - P_s
= 20,000*1.00*0.5 / (21 + 0.60*0.5) - 0
= 469.48 psi

Maximum allowable pressure, (at 70 °F) UG-27(c)(1)

P = S*E*t / (R + 0.60*t)
= 20,000*1.00*0.5 / (21 + 0.60*0.5)
= 469.48 psi

% Forming strain - UHA-44(a)(2)

EFE = (50*t / R_f)*(1 - R_f / R_o)
= (50*0.5 / 21.25)*(1 - 21.25 / ∞)
= 1.1765%

Thickness Required Due to Pressure + External Loads								
Condition	Pressure P (psi)	Allowable Stress Before UG-23 Stress Increase (psi)		Temperature (°F)	Corrosion C (in)	Load	Req'd Thk Due to Tension (in)	Req'd Thk Due to Compression (in)
		S_t	S_c					
Operating, Hot & Corroded	400	20,000	11,166	200	0	Wind	0.3745	0.1014
						Seismic	0.28	0.0384
Operating, Hot & New	400	20,000	11,166	200	0	Wind	0.3745	0.1014
						Seismic	0.28	0.0384
Hot Shut Down, Corroded	0	20,000	11,166	200	0	Wind	0.2001	0.413
						Seismic	0.1056	0.2437
Hot Shut Down, New	0	20,000	11,166	200	0	Wind	0.2001	0.413
						Seismic	0.1056	0.2437
Empty, Corroded	0	20,000	12,419	70	0	Wind	0.2077	0.3836
						Seismic	0.1017	0.213
Empty, New	0	20,000	12,419	70	0	Wind	0.2077	0.3836
						Seismic	0.1017	0.213
Hot Shut Down, Corroded, Weight & Eccentric Moments Only	0	20,000	11,166	200	0	Weight	0.0306	0.0513
Operating, Hot & Corroded, Vortex Shedding	400	20,000	11,166	200	0	Wind	0.2625	0.0558
Empty, Cold & Corroded, Vortex Shedding	0	20,000	12,419	70	0	Wind	0.0882	0.1912

ASME Section VIII Division 1, 2015 Edition				
Component		Cylinder		
Material		SA-240 304 (II-D p. 86, ln. 44)		
Impact Tested	**Normalized**	**Fine Grain Practice**	**PWHT**	**Optimize MDMT/ Find MAWP**
No	No	No	No	No
		Design Pressure (psi)	**Design Temperature (°F)**	**Design MDMT (°F)**
Internal		400	200	-200

Static Liquid Head			
Condition	**P_s (psi)**	**H_s (in)**	**SG**
Operating	2.6	72	1
Test horizontal	2.15	59.625	1
Test vertical	43.39	1,202	1

Dimensions		
Inner Diameter		42"
Length		120"
Nominal Thickness		0.5"
Corrosion	**Inner**	0"
	Outer	0"

Weight and Capacity		
	Weight (lb)	**Capacity (US gal)**
New	2,314.22	719.71
Corroded	2,314.22	719.71

Insulation			
	Thickness (in)	**Density (lb/ft^3)**	**Weight (lb)**
Insulation	1.5	15	218.44
	Spacing(in)	**Individual Weight (lb)**	**Total Weight (lb)**
Insulation Supports	145	150	150

Radiography	
Longitudinal seam	Full UW-11(a) Type 1
Top Circumferential seam	Full UW-11(a) Type 1
	Full UW-11(a) Type 1

Bottom Circumferential seam	

Results Summary	
Governing condition	Hot Shut Down, Corroded
Minimum thickness per UG-16	0.0625" + 0" = 0.0625"
Design thickness due to internal pressure (t)	0.4279"
Design thickness due to combined loadings + corrosion	0.4925"
Maximum allowable working pressure (MAWP)	466.88 psi
Maximum allowable pressure (MAP)	469.48 psi
Rated MDMT	-320 °F

UHA-51 Material Toughness Requirements
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

Design thickness, (at 200 °F) UG-27(c)(1)

t = P*R / (S*E - 0.60*P) + Corrosion
= 402.6*21 / (20,000*1.00 - 0.60*402.6) + 0
= 0.4279"

Maximum allowable working pressure, (at 200 °F) UG-27(c)(1)

P = S*E*t / (R + 0.60*t) - P_s
= 20,000*1.00*0.5 / (21 + 0.60*0.5) - 2.6
= 466.88 psi

Maximum allowable pressure, (at 70 °F) UG-27(c)(1)

P = S*E*t / (R + 0.60*t)
= 20,000*1.00*0.5 / (21 + 0.60*0.5)
= 469.48 psi

% Forming strain - UHA-44(a)(2)

EFE = $(50*t / R_f)*(1 - R_f / R_o)$
= $(50*0.5 / 21.25)*(1 - 21.25 / \infty)$
= 1.1765%

Thickness Required Due to Pressure + External Loads								
Condition	Pressure P (psi)	Allowable Stress Before UG-23 Stress Increase (psi)		Temperature (°F)	Corrosion C (in)	Load	Req'd Thk Due to Tension (in)	Req'd Thk Due to Compression (in)
		S_t	S_c					
Operating, Hot & Corroded	400	20,000	11,166	200	0	Wind	0.4176	0.1809
						Seismic	0.2978	0.0192
Operating, Hot & New	400	20,000	11,166	200	0	Wind	0.4176	0.1809
						Seismic	0.2978	0.0192
Hot Shut Down, Corroded	0	20,000	11,166	200	0	Wind	0.2432	0.4925
						Seismic	0.1234	0.278
Hot Shut Down, New	0	20,000	11,166	200	0	Wind	0.2432	0.4925
						Seismic	0.1234	0.278
Empty, Corroded	0	20,000	12,419	70	0	Wind	0.2524	0.4577
						Seismic	0.119	0.2428
Empty, New	0	20,000	12,419	70	0	Wind	0.2524	0.4577
						Seismic	0.119	0.2428
Hot Shut Down, Corroded, Weight & Eccentric Moments Only	0	20,000	11,166	200	0	Weight	0.0323	0.0532
Operating, Hot & Corroded, Vortex Shedding	400	20,000	11,166	200	0	Wind	0.2831	0.0339
Empty, Cold & Corroded, Vortex Shedding	0	20,000	12,419	70	0	Wind	0.1088	0.2264

Straight Flange on BOTTOM HEAD

ASME Section VIII Division 1, 2015 Edition				
Component		Cylinder		
Material		SA-240 304 (II-D p. 86, ln. 44)		
Impact Tested	**Normalized**	**Fine Grain Practice**	**PWHT**	**Optimize MDMT/ Find MAWP**
No	No	No	No	No
		Design Pressure (psi)	**Design Temperature (°F)**	**Design MDMT (°F)**
Internal		400	200	-200
Static Liquid Head				
Condition		**P_s (psi)**	**H_s (in)**	**SG**
Operating		2.67	74	1
Test horizontal		2.15	59.625	1
Test vertical		43.46	1,204	1
Dimensions				
Inner Diameter		42"		
Length		2"		
Nominal Thickness		0.5"		
Corrosion	**Inner**	0"		
	Outer	0"		
Weight and Capacity				
		Weight (lb)		**Capacity (US gal)**
New		38.72		12
Corroded		38.72		12
Insulation				
		Thickness (in)	**Density (lb/ft^3)**	**Weight (lb)**
Insulation		1.5	15	0
		Spacing(in)	**Individual Weight (lb)**	**Total Weight (lb)**
Insulation Supports		0	0	0
Radiography				
Longitudinal seam		Seamless No RT		
Top Circumferential seam		Full UW-11(a) Type 1		

Results Summary	
Governing condition	Hot Shut Down, Corroded
Minimum thickness per UG-16	0.0625" + 0" = 0.0625"
Design thickness due to internal pressure (t)	0.428"
Design thickness due to combined loadings + corrosion	0.4939"
Maximum allowable working pressure (MAWP)	466.81 psi
Maximum allowable pressure (MAP)	469.48 psi
Rated MDMT	-320 °F

UHA-51 Material Toughness Requirements
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

Design thickness, (at 200 °F) UG-27(c)(1)

t = P*R / (S*E - 0.60*P) + Corrosion
= 402.67*21 / (20,000*1.00 - 0.60*402.67) + 0
= 0.428"

Maximum allowable working pressure, (at 200 °F) UG-27(c)(1)

P = S*E*t / (R + 0.60*t) - P_s
= 20,000*1.00*0.5 / (21 + 0.60*0.5) - 2.67
= 466.81 psi

Maximum allowable pressure, (at 70 °F) UG-27(c)(1)

P = S*E*t / (R + 0.60*t)
= 20,000*1.00*0.5 / (21 + 0.60*0.5)
= 469.48 psi

% Forming strain - UHA-44(a)(2)

EFE = (50*t / R_f)*(1 - R_f / R_o)
= (50*0.5 / 21.25)*(1 - 21.25 / ∞)
= 1.1765%

Thickness Required Due to Pressure + External Loads								
Condition	Pressure P (psi)	Allowable Stress Before UG-23 Stress Increase (psi)		Temperature (°F)	Corrosion C (in)	Load	Req'd Thk Due to Tension (in)	Req'd Thk Due to Compression (in)
		S_t	S_c					
Operating, Hot & Corroded	400	20,000	11,166	200	0	Wind	0.4183	0.1823
						Seismic	0.2981	0.0189
Operating, Hot & New	400	20,000	11,166	200	0	Wind	0.4183	0.1823
						Seismic	0.2981	0.0189
Hot Shut Down, Corroded	0	20,000	11,166	200	0	Wind	0.2439	0.4939
						Seismic	0.1237	0.2786
Hot Shut Down, New	0	20,000	11,166	200	0	Wind	0.2439	0.4939
						Seismic	0.1237	0.2786
Empty, Corroded	0	20,000	12,419	70	0	Wind	0.2532	0.459
						Seismic	0.1192	0.2433
Empty, New	0	20,000	12,419	70	0	Wind	0.2532	0.459
						Seismic	0.1192	0.2433
Hot Shut Down, Corroded, Weight & Eccentric Moments Only	0	20,000	11,166	200	0	Weight	0.0323	0.0532
Operating, Hot & Corroded, Vortex Shedding	400	20,000	11,166	200	0	Wind	0.2835	0.0336
Empty, Cold & Corroded, Vortex Shedding	0	20,000	12,419	70	0	Wind	0.1091	0.227

BOTTOM HEAD

ASME Section VIII Division 1, 2015 Edition				
Component		Ellipsoidal Head		
Material		SA-240 304 (II-D p. 86, ln. 44)		
Attached To		SHELL RG 1		
Impact Tested	**Normalized**	**Fine Grain Practice**	**PWHT**	**Optimize MDMT/ Find MAWP**
No	No	No	No	No
		Design Pressure (psi)	**Design Temperature (°F)**	**Design MDMT (°F)**
Internal		400	200	-200
Static Liquid Head				
Condition		**P_s (psi)**	**H_s (in)**	**SG**
Operating		3.05	84.5	1
Test horizontal		2.15	59.625	1
Test vertical		43.84	1,214.5	1
Dimensions				
Inner Diameter		42"		
Head Ratio		2		
Minimum Thickness		0.425"		
Corrosion	**Inner**	0"		
	Outer	0"		
Length L_{sf}		2"		
Nominal Thickness t_{sf}		0.5"		
Weight and Capacity				
		Weight (lb)[1]		**Capacity (US gal)[1]**
New		291.3		53.98
Corroded		291.3		53.98
Insulation				
		Thickness (in)	**Density (lb/ft^3)**	**Weight (lb)**
Insulation		1.5	15	31.17
		Spacing(in)	**Individual Weight (lb)**	**Total Weight (lb)**
Insulation Supports		145	150	150
Radiography				
Category A joints		Seamless No RT		

Head to shell seam	Full UW-11(a) Type 1

[1] includes straight flange

Results Summary	
Governing condition	internal pressure
Minimum thickness per UG-16	0.0625" + 0" = 0.0625"
Design thickness due to internal pressure (t)	0.4241"
Maximum allowable working pressure (MAWP)	400.89 psi
Maximum allowable pressure (MAP)	403.94 psi
Straight Flange governs MDMT	-320°F

Design thickness for internal pressure, (Corroded at 200 °F) UG-32(c)(1)

t = P*D / (2*S*E - 0.2*P) + Corrosion
= 403.05*42 / (2*20,000*1 - 0.2*403.05) + 0
= 0.4241"

Maximum allowable working pressure, (Corroded at 200 °F) UG-32(c)(1)

P = 2*S*E*t / (D + 0.2*t) - P_s
= 2*20,000*1*0.425 / (42 +0.2*0.425) - 3.05
= 400.89 psi

Maximum allowable pressure, (New at 70 °F) UG-32(c)(1)

P = 2*S*E*t / (D + 0.2*t) - P_s
= 2*20,000*1*0.425 / (42 +0.2*0.425) - 0
= 403.94 psi

% Forming strain - UHA-44(a)(2)

EFE = $(75*t / R_f)*(1 - R_f / R_o)$
= $(75*0.5 / 7.39)*(1 - 7.39 / \infty)$
= 5.0744%

Support Skirt #1

ASME Section VIII Division 1, 2015 Edition		
Component		Support Skirt
Material		SA-240 304 (II-D p. 86, ln. 44)
Skirt is Attached To		BOTTOM HEAD
Skirt Attachment Offset		5.1855" down from the top seam
Design Temperature		
Internal		200 °F
Dimensions		
Inner Diameter	**Top**	41"
	Botttom	41"
Length (includes base ring thickness)		66.81"
Nominal Thickness		1"
Corrosion	**Inner**	0"
	Outer	0"
Weight		
New		2,556.46 lb
Corroded		2,556.46 lb
Joint Efficiency		
Top		0.55
Bottom		0.8

Skirt design thickness, largest of the following + corrosion = 0.6173 in

The governing condition is due to wind, compressive stress at the base, operating & corroded.

The skirt thickness of 1 in is adequate.

Results Summary							
Loading	Condition	Tensile or Compressive Side	Governing Skirt Location	Temperature (°F)	Allowable Stress (psi)	Calculated Stress/E (psi)	Required thickness (in)
Wind	operating, corroded	Tensile	top	200	20,000	10,904.74	0.5452
		Compressive	bottom		12,147.14	7,497.86	0.6173
	empty, corroded	Tensile	top	70	20,000	11,355.67	0.5678
		Compressive	bottom		13,303.26	7,719.83	0.5803
	test, new	Tensile	top	70	20,000	4,368.95	0.2184
		Compressive	bottom		13,303.26	4,334.8	0.3258
Seismic	operating, corroded	Tensile	top	200	20,000	5,510.48	0.2755
		Compressive	bottom		12,147.14	4,155.7	0.3421
	empty, corroded	Tensile	top	70	20,000	5,338	0.2669
		Compressive	bottom		13,303.26	4,001.59	0.3008
Vortex shedding	operating, corroded	Tensile	top	200	20,000	4,850.77	0.2425
		Compressive	bottom		12,147.14	3,847.22	0.3167
	empty, corroded	Tensile	top	70	20,000	4,889.69	0.2445
		Compressive	bottom		13,303.26	3,819.46	0.2871

Loading due to wind, operating & corroded

Windward side (tensile)

Required thickness, tensile stress at base:

$t = -0.6*W / (\pi*D*S_t*E) + 48*M / (\pi*D^2*S_t*E)$
$= -0.6*72{,}747.7 / (\pi*42*20{,}000*0.8) + 48*802{,}000.1 / (\pi*42^2*20{,}000*0.8)$
$= 0.4135$ in

Required thickness, tensile stress at the top:

$t = -0.6*W_t / (\pi*D_t*S_t*E) + 48*M_t / (\pi*D_t^2*S_t*E)$
$= -0.6*70{,}157.67 / (\pi*42*20{,}000*0.55) + 48*729{,}277.8 / (\pi*42^2*20{,}000*0.55)$
$= 0.5452$ in

Leeward side (compressive)

Required thickness, compressive stress at base:

$t = W / (\pi*D*S_c*E_c) + 48*M / (\pi*D^2*S_c*E_c)$
$= 72{,}747.7 / (\pi*42*12{,}147*1) + 48*802{,}000.1 / (\pi*42^2*12{,}147*1)$
$= 0.6173$ in

Required thickness, compressive stress at the top:

$t = W_t / (\pi*D_t*S_c*E_c) + 48*M_t / (\pi*D_t^2*S_c*E_c)$
$= 70{,}157.67 / (\pi*42*12{,}147*1) + 48*729{,}277.8 / (\pi*42^2*12{,}147*1)$
$= 0.5638$ in

Support Skirt #2

ASME Section VIII Division 1, 2015 Edition		
Component		Support Skirt
Material		SA-516 70 (II-D p. 18, ln. 37)
Skirt is Attached To		Support Skirt #1
Skirt Attachment Offset		0" up from the bottom seam
Design Temperature		
Internal		200°F
Dimensions		
Inner Diameter	**Top**	41"
	Botttom	41"
Length (includes base ring thickness)		120"
Nominal Thickness		1"
Corrosion	**Inner**	0"
	Outer	0"
Weight		
New		4,424.9 lb
Corroded		4,424.9 lb
Joint Efficiency		
Top		0.55
Bottom		0.8

Skirt design thickness, largest of the following + corrosion = 0.6261 in

The governing condition is due to wind, tensile stress at the top, empty & corroded.

The skirt thickness of 1 in is adequate.

Results Summary							
Loading	Condition	Tensile or Compressive Side	Governing Skirt Location	Temperature (°F)	Allowable Stress (psi)	Calculated Stress/E (psi)	Required thickness (in)
Wind	operating, corroded	Tensile	top	200	20,000	12,028.57	0.6014
		Compressive	bottom		17,237.1	8,716.9	0.5057
	empty, corroded	Tensile	top	70	20,000	12,521.91	0.6261
		Compressive	bottom		17,237.1	8,982.77	0.5211
	test, new	Tensile	top	70	20,000	4,908.1	0.2454
		Compressive	bottom		17,237.1	4,958.43	0.2877
Seismic	operating, corroded	Tensile	top	200	20,000	5,951.91	0.2976
		Compressive	bottom		17,237.1	4,646.64	0.2696
	empty, corroded	Tensile	top	70	20,000	5,761.48	0.2881
		Compressive	bottom		17,237.1	4,474.79	0.2596
Vortex shedding	operating, corroded	Tensile	top	200	20,000	5,391.04	0.2696
		Compressive	bottom		17,237.1	4,471.96	0.2594
	empty, corroded	Tensile	top	70	20,000	5,430.33	0.2715
		Compressive	bottom		17,237.1	4,444.56	0.2578

Loading due to wind, empty & corroded

Windward side (tensile)

Required thickness, tensile stress at base:

$t = -0.6*W / (\pi*D*S_t*E) + 48*M / (\pi*D^2*S_t*E)$
$= -0.6*73,126.35 / (\pi*42*20,000*0.8) + 48*973,107.2 / (\pi*42^2*20,000*0.8)$
$= 0.506$ in

Required thickness, tensile stress at the top:

$t = -0.6*W_t / (\pi*D_t*S_t*E) + 48*M_t / (\pi*D_t^2*S_t*E)$
$= -0.6*68,676.62 / (\pi*42*20,000*0.55) + 48*831,189.8 / (\pi*42^2*20,000*0.55)$
$= 0.6261$ in

Leeward side (compressive)

Required thickness, compressive stress at base:

$t = W / (\pi*D*S_c*E_c) + 48*M / (\pi*D^2*S_c*E_c)$
$= 73,126.35 / (\pi*42*17,237*1) + 48*973,107.2 / (\pi*42^2*17,237*1)$
$= 0.5211$ in

Required thickness, compressive stress at the top:

$t = W_t / (\pi*D_t*S_c*E_c) + 48*M_t / (\pi*D_t^2*S_c*E_c)$
$= 68,676.62 / (\pi*42*17,237*1) + 48*831,189.8 / (\pi*42^2*17,237*1)$
$= 0.4479$ in

Skirt Base Ring #1

Inputs	
Base configuration	double base plate
Base plate material	SA-516-70
Base plate allowable stress, S_p	20,000 psi
Foundation compressive strength	1,350 psi
Concrete ultimate 28-day strength	3,000 psi
Bolt circle, BC	50"
Base plate inner diameter, D_i	39"
Base plate outer diameter, D_o	56"
Base plate thickness, t_b	1.5"
Gusset separation, w	6"
Gusset height, h	10"
Gusset thickness, t_g	0.625"
Compression ring width	6.25"
Compression ring thickness, t_c	2.25"
Anchor Bolts	
Material	
Allowable stress, S_b	20,000 psi
Bolt size and type	2.5" series 8 threaded
Number of bolts, N	12
Corrosion allowance (applied to root radius)	0"
Anchor bolt clearance	0.375"
Bolt root area (corroded), A_b	4.29 in^2
Diameter of anchor bolt holes, d_b	2.875"
Initial bolt preload	0% (0 psi)
Bolt at 0°	No

Results Summary									
Load	Vessel condition	Base V (lb_f)	Base M (lb_f-ft)	W (lb)	Required bolt area (in^2)	t_r Base (in)	Foundation bearing stress (psi)	t_r comp ring (in)	t_r gusset (in)
Wind	operating, corroded	14,085.1	938,849.4	78,576.6	3.559	1.1119	811.97	2.0122	0.3807
Wind	operating, new	14,085.1	938,849.4	78,576.6	3.559	1.1119	811.97	2.0122	0.3807
Wind	empty, corroded	14,606.7	973,107.2	74,505.6	3.7062	1.1275	834.87	2.0538	0.3906
Wind	empty, new	14,606.7	973,107.2	74,505.6	3.7062	1.1275	834.87	2.0538	0.3906
Wind	test, new	7,078.6	450,570.2	140,690.9	1.4506	0.8579	483.33	1.2733	0.252
Seismic	operating, corroded	5,239.4	461,988.2	78,576.6	1.6851	0.8383	461.58	1.393	0.2673
Seismic	operating, new	5,239.4	461,988.2	78,576.6	1.6851	0.8383	461.58	1.393	0.2673
Seismic	empty, corroded	5,034.6	446,075.9	74,505.6	1.6299	0.8222	444.02	1.3699	0.2642
Seismic	empty, new	5,034.6	446,075.9	74,505.6	1.6299	0.8222	444.02	1.3699	0.2642
Vortex shedding	operating, corroded	7,091.5	448,755.6	78,576.6	1.5986	0.8061	426.78	1.3443	0.2608
Vortex shedding	empty, corroded	7,095.7	449,154.9	74,505.6	1.6104	0.8029	423.34	1.3497	0.2615

Anchor bolt load (governing)

P = -0.6*W / N + 48 * M / (N*BC)
= -0.6*74,505.56 / 12 + 48 * 973,107.2 / (12*50)
= 74,123.3 lb_f

Required area per bolt = P / S_b = 3.7062 in^2

The area provided (4.292 in^2) by the specified anchor bolt is adequate.

Support calculations (Jawad & Farr chapter 12, governing)

Base plate width, t_c: 8.5 in
Average base plate diameter, d: 47.5 in
Base plate elastic modulus, E_s: 29.0E+06 psi
Base plate yield stress, S_y: 38,000 psi

E_c = 57,000*Sqr(3,000) = 3,122,019 psi

n = E_s/E_c = 29.0E+06 / 3,122,019 = 9.2889

$t_s = (N*A_b) / (\pi*d)$
= (12*4.292) / (π*47.5)
= 0.3451 in

From table 12.4 for k = 0.340661:

K_1 = 2.3537, K_2 = 1.6163
L_1 = 7.5708, L_2 = 24.384, L_3 = 12.7963

Total tensile force on bolting

$T = (12*M - 0.6*W*(L_1 + L_3)) / (L_2 + L_3)$
$= (12*973{,}107.2 - 0.6*74{,}505.56*(7.5708 + 12.7963)) / (24.384 + 12.7963)$
$= 289{,}583.22\ lb_f$

Tensile stress in bolts use the larger of f_s or bolt preload = 0 psi

$f_s = T / (t_s * (d / 2) * K_1)$
$= 289{,}583.22 / (0.3451 * (47.5 / 2) * 2.3537)$
$= 15{,}010$ psi

Total compressive load on foundation

$C_c = T + W + \text{Bolt Preload}$
$= 289{,}583.22 + 74{,}505.56 + 0$
$= 364{,}088.78\ lb_f$

Foundation bearing stress

$f_c = C_c / (((t_c - t_s) + n*t_s)*(d / 2)*K_2)$
$= 364{,}088.78 / (((8.5 - 0.3451) + 9.2889*0.3451)*(47.5 / 2)*1.6163)$
$= \underline{835}$ psi

As $f_c <= 1{,}350$ psi the base plate width is satisfactory.

$k = 1 / (1 + f_s / (n*f_c))$
$= 1 / (1 + 15{,}010 / (9.2889*835))$
$= 0.340661$

Base plate required thickness (governing)

From Brownell & Young, Table 10.3:, l / b = 1.113

$M_x = 0.103*835*5.84^2 = 2{,}933.6\ lb_f$

$M_y = -0.1201*835*6.5^2 = -4{,}237.4\ lb_f$

$t_r = (6*M_{max} / S_p)^{0.5}$
$= (6*4{,}237.36 / 20{,}000)^{0.5}$
$= \underline{1.1275}$ in

The base plate thickness is satisfactory.

Check the compression ring for bolt load (Jawad & Farr equation 12.13)

$t_{cr} = (3.91*F / (S_y*(2*b / w+w / (2*l)-d_b*(2 / w+1 / (2*l)))))^{0.5}$
$= (3.91*64{,}420.89 / (38{,}000*(2*6.25 / 6+6 / (2*3.5)-2.875*(2 / 6+1 / (2*3.5)))))^{0.5}$
$= \underline{2.0538}$ in

The compression ring thickness is satisfactory.

Check gusset plate thickness (Bednar chapter 4.3)

Radius of gyration of gusset

$r = 0.289*t_g$
$= 0.289*0.625$
$= 0.1806$ in

Cross sectional area of one gusset

$A_g = t_g*(b - 0.25)$
$= 0.625*(6.5 - 0.25)$
$= 3.9063 \text{ in}^2$

Gusset allowable stress

$S_a = 17000 - 0.485*(h / r)^2$
$= 17000 - 0.485*(10 / 0.1806)^2$
$= 15{,}513 \text{ psi}$

Gusset axial stress due to bolt load

$S_g = F / (2 * A_g)$
$= 64{,}420.89 / (2 * 3.9063)$
$= 8{,}246 \text{ psi}$

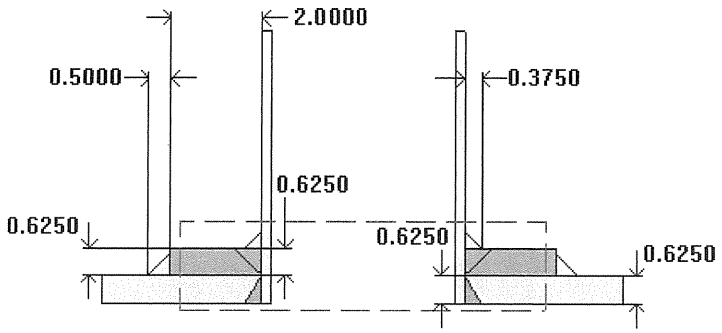
The gusset plate thickness is satisfactory.

Check skirt thickness for bolt load reaction (Brownell & Young eq. 10.59)

$t = 1.76*(F*l / (M_b*h_c*S_s))^{2/3}*(OD_s / 2)^{1/3}$
$= 1.76*(64{,}420.89*3.5 / (11.2574*13.75*30{,}000))^{2/3}*(43 / 2)^{1/3}$
$= 0.6514 \text{ in}$

The skirt thickness is satisfactory.

REFLUX INLET (A)

ASME Section VIII Division 1, 2015 Edition	
	
Note: round inside edges per UG-76(c)	
Location and Orientation	
Located on	SHELL RG 11
Orientation	0°
Nozzle center line offset to datum line	1,075"
End of nozzle to shell center	38.625"
Passes through a Category A joint	No
Nozzle	
Description	NPS 4 Sch 40S (Std)
Access opening	No
Material specification	SA-312 TP304 Wld pipe (II-D p. 90, ln. 11)
Inside diameter, new	4.026"
Pipe nominal wall thickness	0.237"
Pipe minimum wall thickness[1]	0.2074"
Corrosion allowance	0"
Projection available outside vessel, Lpr	4.62"
Projection available outside vessel to flange face, Lf	8"
Local vessel minimum thickness	0.625"
Liquid static head included	0 psi
Longitudinal joint efficiency	1
Reinforcing Pad	
Material specification	SA-240 304 (II-D p. 86, ln. 44)
Diameter, D_p	8.5"

Thickness, t_e	0.625"
Is split	Yes
Butt welds tested to confirm full penetration	No
Butt welds located at least 45° from long seam	Yes
Joint efficiency	1
Welds	
Inner fillet, Leg_{41}	0.375"
Outer fillet, Leg_{42}	0.5"
Nozzle to vessel groove weld	0.625"
Pad groove weld	0.625"

[1]Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0.875.

ASME B16.5-2013 Flange	
Description	NPS 4 Class 300 WN A182 F304
Bolt Material	SA-193 B8 1 Bolt (II-D p. 352, ln. 20)
Blind included	No
Rated MDMT	-320°F
Liquid static head	0 psi
MAWP rating	600 psi @ 200°F
MAP rating	720 psi @ 70°F
Hydrotest rating	1,100 psi @ 70°F
PWHT performed	No
Impact Tested	No
Circumferential joint radiography	Spot UW-11(b) Type 1
Notes	
Flange rated MDMT per UHA-51(d)(1)(a) = -320°F Bolts rated MDMT = -320°F	

UHA-51 Material Toughness Requirements Nozzle	
t_r = 400.53*2.013 / (17,000*1 - 0.6*400.53) =	0.0481"
Stress ratio = t_r*E* / (t_n - c) = 0.0481*1 / (0.2074 - 0) =	0.232
Impact test exempt per UHA-51(g) (coincident ratio = 0.232)	
Rated MDMT =	-320°F
Material is exempt from impact testing at the Design MDMT of -200°F.	

UHA-51 Material Toughness Requirements Pad
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

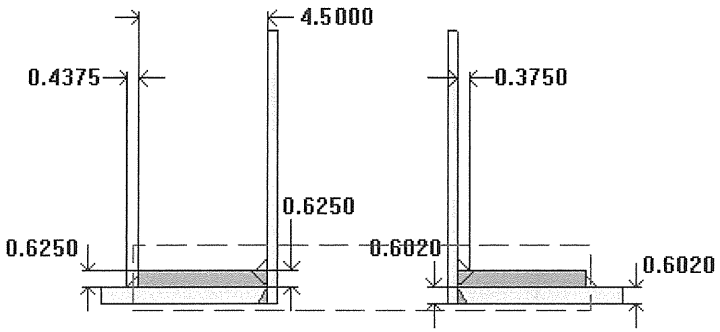
Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in^2)							UG-45 Summary (in)	
For P = 400 psi @ 200 °F The opening is adequately reinforced							The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
2.445	2.9099	0.0713	0.478	--	2.22	0.1406	0.2074	0.2074

UG-41 Weld Failure Path Analysis Summary (lb_f)						
All failure paths are stronger than the applicable weld loads						
Weld load W	Weld load W_{1-1}	Path 1-1 strength	Weld load W_{2-2}	Path 2-2 strength	Weld load W_{3-3}	Path 3-3 strength
47,640.88	56,772	84,309.26	18,297	152,849.28	62,697	130,808.06

UW-16 Weld Sizing Summary			
Weld description	Required weld size (in)	Actual weld size (in)	Status
Nozzle to pad fillet (Leg_{41})	0.1659	0.2625	weld size is adequate
Pad to shell fillet (Leg_{42})	0.3125	0.35	weld size is adequate

VAPOR OUTLET (B)

ASME Section VIII Division 1, 2015 Edition	
	
Note: round inside edges per UG-76(c)	
Location and Orientation	
Located on	TOP HEAD
Orientation	0°
End of nozzle to datum line	1,190"
Calculated as hillside	No
Distance to head center, R	0"
Passes through a Category A joint	No
Nozzle	
Description	NPS 10 Sch 40S (Std)
Access opening	No
Material specification	SA-312 TP304 Wld pipe (II-D p. 90, ln. 11)
Inside diameter, new	10.02"
Pipe nominal wall thickness	0.365"
Pipe minimum wall thickness[1]	0.3194"
Corrosion allowance	0"
Projection available outside vessel, Lpr	4.0205"
Projection available outside vessel to flange face, Lf	8.6405"
Local vessel minimum thickness	0.602"
Liquid static head included	0 psi
Longitudinal joint efficiency	1
Reinforcing Pad	
Material specification	SA-240 304 (II-D p. 86, ln. 44)

Diameter, D_p	19.75"
Thickness, t_e	0.625"
Is split	Yes
Butt welds tested to confirm full penetration	No
Joint efficiency	0.75
Welds	
Inner fillet, Leg_{41}	0.375"
Outer fillet, Leg_{42}	0.4375"
Nozzle to vessel groove weld	0.602"
Pad groove weld	0.625"

[1] Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0.875.

ASME B16.5-2013 Flange	
Description	NPS 10 Class 300 WN A182 F304
Bolt Material	SA-193 B8 1 Bolt (II-D p. 352, ln. 20)
Blind included	No
Rated MDMT	-320°F
Liquid static head	0 psi
MAWP rating	600 psi @ 200°F
MAP rating	720 psi @ 70°F
Hydrotest rating	1,100 psi @ 70°F
PWHT performed	No
Impact Tested	No
Circumferential joint radiography	Full UW-11(a) Type 1
Notes	
Flange rated MDMT per UHA-51(d)(1)(a) = -320°F Bolts rated MDMT = -320°F	

UHA-51 Material Toughness Requirements Nozzle
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

UHA-51 Material Toughness Requirements Pad
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

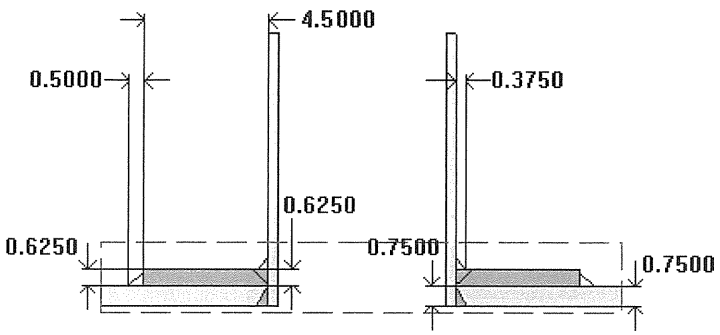
Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in^2)							UG-45 Summary (in)	
For P = 400 psi @ 200 °F The opening is adequately reinforced							The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
5.4216	5.8691	0.6104	0.7934	--	4.2188	0.2465	0.3194	0.3194

UG-41 Weld Failure Path Analysis Summary (lb_f)						
All failure paths are stronger than the applicable weld loads						
Weld load W	Weld load W_{1-1}	Path 1-1 strength	Weld load W_{2-2}	Path 2-2 strength	Weld load W_{3-3}	Path 3-3 strength
97,113.87	105,173	203,866.39	27,469.2	359,391.95	113,962.2	283,460.14

UW-16 Weld Sizing Summary			
Weld description	Required weld size (in)	Actual weld size (in)	Status
Nozzle to pad fillet (Leg_{41})	0.25	0.2625	weld size is adequate
Pad to shell fillet (Leg_{42})	0.301	0.3062	weld size is adequate

TOP FEED (C)

ASME Section VIII Division 1, 2015 Edition	
	
Note: round inside edges per UG-76(c)	
Location and Orientation	
Located on	CONE RG 8
Orientation	270°
Nozzle center line offset to datum line	813"
End of nozzle to shell center	38"
Longitudinal axis is	perpendicular to the vessel longitudinal axis
Passes through a Category A joint	No
Nozzle	
Description	NPS 12 Sch 40S (Std)
Access opening	No
Material specification	SA-312 TP304 Wld pipe (II-D p. 90, ln. 11)
Inside diameter, new	12"
Pipe nominal wall thickness	0.375"
Pipe minimum wall thickness[1]	0.3281"
Corrosion allowance	0"
Opening chord length	12.3693"
Projection available outside vessel, Lpr	5.0132"
Projection available outside vessel to flange face, Lf	10.1332"
Local vessel minimum thickness	0.75"
Liquid static head included	0 psi
Longitudinal joint efficiency	1
Reinforcing Pad	

Material specification	SA-240 304 (II-D p. 86, ln. 44)
Diameter, D_p	22.1424"
Thickness, t_e	0.625"
Is split	Yes
Butt welds tested to confirm full penetration	No
Joint efficiency	0.75
Welds	
Inner fillet, Leg_{41}	0.375"
Outer fillet, Leg_{42}	0.5"
Nozzle to vessel groove weld	0.75"
Pad groove weld	0.625"

[1]Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0.875.

ASME B16.5-2013 Flange	
Description	NPS 12 Class 300 WN A182 F304
Bolt Material	SA-193 B8 1 Bolt (II-D p. 352, ln. 20)
Blind included	No
Rated MDMT	-320°F
Liquid static head	0 psi
MAWP rating	600 psi @ 200°F
MAP rating	720 psi @ 70°F
Hydrotest rating	1,100 psi @ 70°F
PWHT performed	No
Impact Tested	No
Circumferential joint radiography	Full UW-11(a) Type 1
Notes	
Flange rated MDMT per UHA-51(d)(1)(a) = -320°F Bolts rated MDMT = -320°F	

UHA-51 Material Toughness Requirements Nozzle
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

UHA-51 Material Toughness Requirements Pad
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

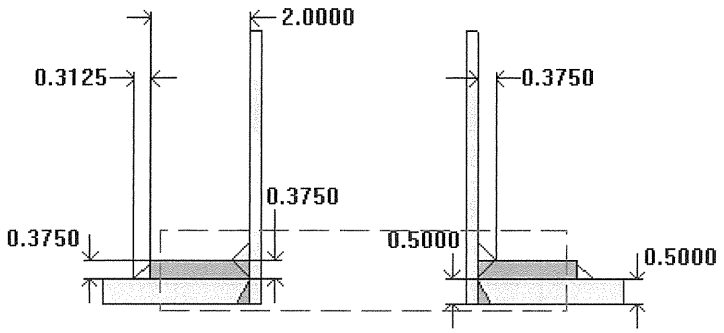
Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in^2)							UG-45 Summary (in)	
For P = 400 psi @ 200 °F The opening is adequately reinforced							The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
6.5815	8.0971	2.6955	0.7922	--	4.2188	0.3906	0.3281	0.3281

UG-41 Weld Failure Path Analysis Summary (lb_f)						
All failure paths are stronger than the applicable weld loads						
Weld load W	Weld load W_{1-1}	Path 1-1 strength	Weld load W_{2-2}	Path 2-2 strength	Weld load W_{3-3}	Path 3-3 strength
80,988.12	108,031	257,172.65	29,906	470,124.12	119,281	392,734.83

UW-16 Weld Sizing Summary			
Weld description	Required weld size (in)	Actual weld size (in)	Status
Nozzle to pad fillet (Leg_{41})	0.25	0.2625	weld size is adequate
Pad to shell fillet (Leg_{42})	0.3125	0.35	weld size is adequate

BOTTOM FEED (D)

ASME Section VIII Division 1, 2015 Edition	
	
Note: round inside edges per UG-76(c)	
Location and Orientation	
Located on	SHELL RG 6
Orientation	0°
Nozzle center line offset to datum line	607"
End of nozzle to shell center	29.5"
Passes through a Category A joint	No
Nozzle	
Description	NPS 4 Sch 40S (Std)
Access opening	No
Material specification	SA-312 TP304 Wld pipe (II-D p. 90, ln. 11)
Inside diameter, new	4.026"
Pipe nominal wall thickness	0.237"
Pipe minimum wall thickness[1]	0.2074"
Corrosion allowance	0"
Projection available outside vessel, Lpr	4.62"
Projection available outside vessel to flange face, Lf	8"
Local vessel minimum thickness	0.5"
Liquid static head included	0 psi
Longitudinal joint efficiency	1
Reinforcing Pad	
Material specification	SA-240 304 (II-D p. 86, ln. 44)
Diameter, D_p	8.5"

Thickness, t_e	0.375"
Is split	Yes
Butt welds tested to confirm full penetration	No
Butt welds located at least 45° from long seam	Yes
Joint efficiency	1
Welds	
Inner fillet, Leg_{41}	0.375"
Outer fillet, Leg_{42}	0.3125"
Nozzle to vessel groove weld	0.5"
Pad groove weld	0.375"

[1]Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0.875.

ASME B16.5-2013 Flange	
Description	NPS 4 Class 300 WN A182 F304
Bolt Material	SA-193 B8 1 Bolt (II-D p. 352, ln. 20)
Blind included	No
Rated MDMT	-320°F
Liquid static head	0 psi
MAWP rating	600 psi @ 200°F
MAP rating	720 psi @ 70°F
Hydrotest rating	1,100 psi @ 70°F
PWHT performed	No
Impact Tested	No
Circumferential joint radiography	Spot UW-11(b) Type 1
Notes	
Flange rated MDMT per UHA-51(d)(1)(a) = -320°F Bolts rated MDMT = -320°F	

UHA-51 Material Toughness Requirements Nozzle	
t_r = 400.53*2.013 / (17,000*1 - 0.6*400.53) =	0.0481"
Stress ratio = t_r*E* / (t_n - c) = 0.0481*1 / (0.2074 - 0) =	0.232
Impact test exempt per UHA-51(g) (coincident ratio = 0.232)	
Rated MDMT =	-320°F
Material is exempt from impact testing at the Design MDMT of -200°F.	

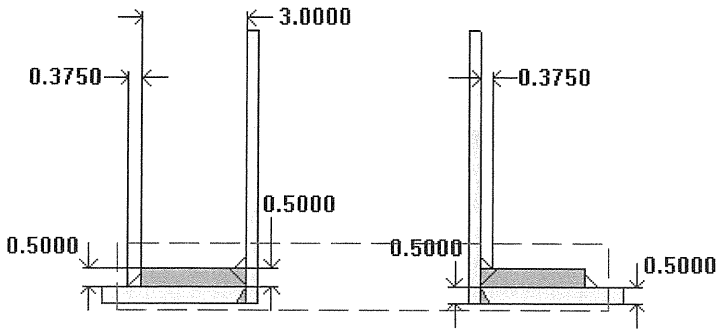
UHA-51 Material Toughness Requirements Pad
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in^2)							UG-45 Summary (in)	
For P = 400 psi @ 200 °F The opening is adequately reinforced							The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
1.7115	2.1539	0.3015	0.3798	--	1.332	0.1406	0.2074	0.2074

UG-41 Weld Failure Path Analysis Summary (lb_f)						
All failure paths are stronger than the applicable weld loads						
Weld load W	Weld load W_{1-1}	Path 1-1 strength	Weld load W_{2-2}	Path 2-2 strength	Weld load W_{3-3}	Path 3-3 strength
28,909.1	37,048	59,775.38	15,148	113,618.64	41,788	93,197.31

UW-16 Weld Sizing Summary			
Weld description	Required weld size (in)	Actual weld size (in)	Status
Nozzle to pad fillet (Leg_{41})	0.1659	0.2625	weld size is adequate
Pad to shell fillet (Leg_{42})	0.1875	0.2188	weld size is adequate

ASME Section VIII Division 1, 2015 Edition	
	
Note: round inside edges per UG-76(c)	
Location and Orientation	
Located on	SHELL RG 4
Orientation	45°
Nozzle center line offset to datum line	389"
End of nozzle to shell center	29.5"
Passes through a Category A joint	No
Nozzle	
Description	NPS 8 Sch 40S (Std)
Access opening	No
Material specification	SA-312 TP304 Wld pipe (II-D p. 90, ln. 11)
Inside diameter, new	7.981"
Pipe nominal wall thickness	0.322"
Pipe minimum wall thickness[1]	0.2818"
Corrosion allowance	0"
Projection available outside vessel, Lpr	3.62"
Projection available outside vessel to flange face, Lf	8"
Local vessel minimum thickness	0.5"
Liquid static head included	0 psi
Longitudinal joint efficiency	1
Reinforcing Pad	
Material specification	SA-240 304 (II-D p. 86, ln. 44)
Diameter, D_p	14.625"

Thickness, t_e	0.5"
Is split	Yes
Butt welds tested to confirm full penetration	No
Butt welds located at least 45° from long seam	Yes
Joint efficiency	1
Welds	
Inner fillet, Leg_{41}	0.375"
Outer fillet, Leg_{42}	0.375"
Nozzle to vessel groove weld	0.5"
Pad groove weld	0.5"

[1]Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0.875.

ASME B16.5-2013 Flange	
Description	NPS 8 Class 300 WN A182 F304
Bolt Material	SA-193 B8 1 Bolt (II-D p. 352, ln. 20)
Blind included	No
Rated MDMT	-320°F
Liquid static head	0 psi
MAWP rating	600 psi @ 200°F
MAP rating	720 psi @ 70°F
Hydrotest rating	1,100 psi @ 70°F
PWHT performed	No
Impact Tested	No
Circumferential joint radiography	Spot UW-11(b) Type 1
Notes	
Flange rated MDMT per UHA-51(d)(1)(a) = -320°F Bolts rated MDMT = -320°F	

UHA-51 Material Toughness Requirements Nozzle	
t_r = 400.53*3.9905 / (17,000*1 - 0.6*400.53) =	0.0954"
Stress ratio = t_r*E^* / (t_n - c) = 0.0954*1 / (0.2818 - 0) =	0.3385
Impact test exempt per UHA-51(g) (coincident ratio = 0.3385)	
Rated MDMT =	-320°F
Material is exempt from impact testing at the Design MDMT of -200°F.	

UHA-51 Material Toughness Requirements Pad
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

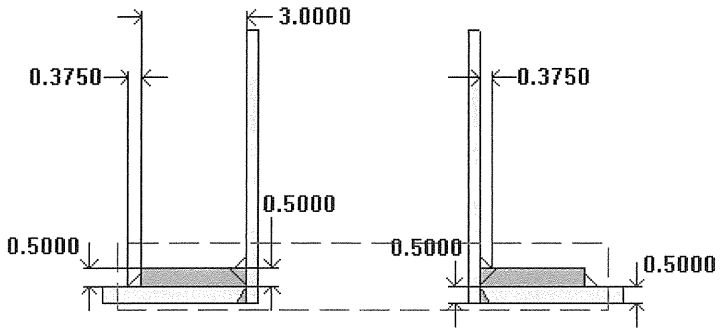
Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in^2)							UG-45 Summary (in)	
For P = 400 psi @ 200 °F The opening is adequately reinforced							The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
3.3927	4.482	0.5978	0.603	--	3	0.2812	0.2818	0.2818

UG-41 Weld Failure Path Analysis Summary (lb_f)						
All failure paths are stronger than the applicable weld loads						
Weld load W	Weld load W_{1-1}	Path 1-1 strength	Weld load W_{2-2}	Path 2-2 strength	Weld load W_{3-3}	Path 3-3 strength
56,863.17	77,684	134,400.96	21,312	242,833.08	84,124	184,681.47

UW-16 Weld Sizing Summary			
Weld description	Required weld size (in)	Actual weld size (in)	Status
Nozzle to pad fillet (Leg_{41})	0.2254	0.2625	weld size is adequate
Pad to shell fillet (Leg_{42})	0.25	0.2625	weld size is adequate

FROM E-205 (F)

ASME Section VIII Division 1, 2015 Edition	
	
Note: round inside edges per UG-76(c)	
Location and Orientation	
Located on	SHELL RG 4
Orientation	180°
Nozzle center line offset to datum line	365"
End of nozzle to shell center	29.5"
Passes through a Category A joint	No
Nozzle	
Description	NPS 8 Sch 40S (Std)
Access opening	No
Material specification	SA-312 TP304 Wld pipe (II-D p. 90, ln. 11)
Inside diameter, new	7.981"
Pipe nominal wall thickness	0.322"
Pipe minimum wall thickness[1]	0.2818"
Corrosion allowance	0"
Projection available outside vessel, Lpr	3.62"
Projection available outside vessel to flange face, Lf	8"
Local vessel minimum thickness	0.5"
Liquid static head included	0 psi
Longitudinal joint efficiency	1
Reinforcing Pad	
Material specification	SA-240 304 (II-D p. 86, ln. 44)
Diameter, D_p	14.625"

Thickness, t_e	0.5"
Is split	Yes
Butt welds tested to confirm full penetration	No
Butt welds located at least 45° from long seam	Yes
Joint efficiency	1
Welds	
Inner fillet, Leg_{41}	0.375"
Outer fillet, Leg_{42}	0.375"
Nozzle to vessel groove weld	0.5"
Pad groove weld	0.5"

[1]Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0.875.

ASME B16.5-2013 Flange	
Description	NPS 8 Class 300 WN A182 F304
Bolt Material	SA-193 B8 1 Bolt (II-D p. 352, ln. 20)
Blind included	No
Rated MDMT	-320°F
Liquid static head	0 psi
MAWP rating	600 psi @ 200°F
MAP rating	720 psi @ 70°F
Hydrotest rating	1,100 psi @ 70°F
PWHT performed	No
Impact Tested	No
Circumferential joint radiography	Spot UW-11(b) Type 1
Notes	
Flange rated MDMT per UHA-51(d)(1)(a) = -320°F Bolts rated MDMT = -320°F	

UHA-51 Material Toughness Requirements Nozzle	
t_r = 400.53*3.9905 / (17,000*1 - 0.6*400.53) =	0.0954"
Stress ratio = t_r*E^* / (t_n - c) = 0.0954*1 / (0.2818 - 0) =	0.3385
Impact test exempt per UHA-51(g) (coincident ratio = 0.3385)	
Rated MDMT =	-320°F
Material is exempt from impact testing at the Design MDMT of -200°F.	

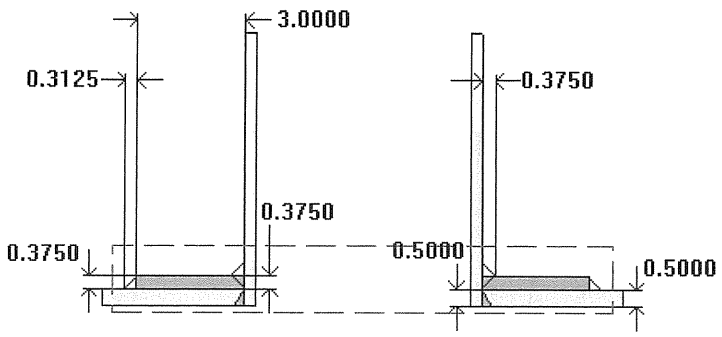
UHA-51 Material Toughness Requirements Pad
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in^2)							UG-45 Summary (in)	
For P = 400 psi @ 200 °F The opening is adequately reinforced							The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
3.3927	4.482	0.5978	0.603	--	3	0.2812	0.2818	0.2818

UG-41 Weld Failure Path Analysis Summary (lb_f)						
All failure paths are stronger than the applicable weld loads						
Weld load W	Weld load W_{1-1}	Path 1-1 strength	Weld load W_{2-2}	Path 2-2 strength	Weld load W_{3-3}	Path 3-3 strength
56,863.17	77,684	134,400.96	21,312	242,833.08	84,124	184,681.47

UW-16 Weld Sizing Summary			
Weld description	Required weld size (in)	Actual weld size (in)	Status
Nozzle to pad fillet (Leg_{41})	0.2254	0.2625	weld size is adequate
Pad to shell fillet (Leg_{42})	0.25	0.2625	weld size is adequate

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Note: round inside edges per UG-76(c)	
Location and Orientation	
Located on	SHELL RG 2
Orientation	270°
Nozzle center line offset to datum line	130"
End of nozzle to shell center	29.5"
Passes through a Category A joint	No
Nozzle	
Description	NPS 8 Sch 40S (Std)
Access opening	No
Material specification	SA-312 TP304 Wld pipe (II-D p. 90, ln. 11)
Inside diameter, new	7.981"
Pipe nominal wall thickness	0.322"
Pipe minimum wall thickness[1]	0.2818"
Corrosion allowance	0"
Projection available outside vessel, Lpr	3.62"
Projection available outside vessel to flange face, Lf	8"
Local vessel minimum thickness	0.5"
Liquid static head included	0 psi
Longitudinal joint efficiency	1
Reinforcing Pad	
Material specification	SA-240 304 (II-D p. 86, ln. 44)
Diameter, D_p	14.625"

Thickness, t_e	0.375"
Is split	Yes
Butt welds tested to confirm full penetration	No
Butt welds located at least 45° from long seam	Yes
Joint efficiency	1
Welds	
Inner fillet, Leg_{41}	0.375"
Outer fillet, Leg_{42}	0.3125"
Nozzle to vessel groove weld	0.5"
Pad groove weld	0.375"

[1]Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0.875.

ASME B16.5-2013 Flange	
Description	NPS 8 Class 300 WN A182 F304
Bolt Material	SA-193 B8 1 Bolt (II-D p. 352, ln. 20)
Blind included	No
Rated MDMT	-320°F
Liquid static head	0 psi
MAWP rating	600 psi @ 200°F
MAP rating	720 psi @ 70°F
Hydrotest rating	1,100 psi @ 70°F
PWHT performed	No
Impact Tested	No
Circumferential joint radiography	Spot UW-11(b) Type 1
Notes	
Flange rated MDMT per UHA-51(d)(1)(a) = -320°F Bolts rated MDMT = -320°F	

UHA-51 Material Toughness Requirements Nozzle	
t_r = 400.53*3.9905 / (17,000*1 - 0.6*400.53) =	0.0954"
Stress ratio = t_r*E^* / (t_n - c) = 0.0954*1 / (0.2818 - 0) =	0.3385
Impact test exempt per UHA-51(g) (coincident ratio = 0.3385)	
Rated MDMT =	-320°F
Material is exempt from impact testing at the Design MDMT of -200°F.	

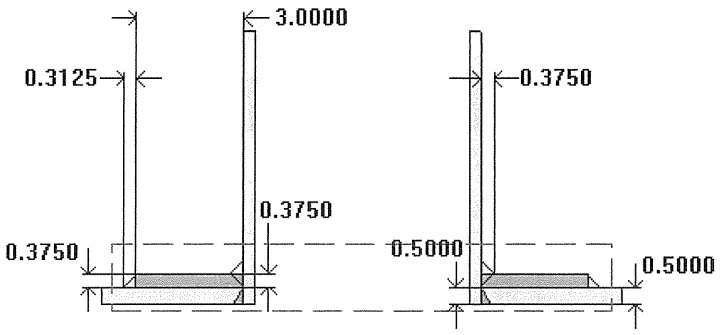
UHA-51 Material Toughness Requirements Pad
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in^2)							UG-45 Summary (in)	
For P = 400 psi @ 200 °F The opening is adequately reinforced							The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
3.3927	3.6553	0.5978	0.5692	--	2.25	0.2383	0.2818	0.2818

UG-41 Weld Failure Path Analysis Summary (lb_f)						
All failure paths are stronger than the applicable weld loads						
Weld load W	Weld load W_{1-1}	Path 1-1 strength	Weld load W_{2-2}	Path 2-2 strength	Weld load W_{3-3}	Path 3-3 strength
56,863.17	61,150	120,330.06	20,636	217,769.06	67,590	170,610.57

UW-16 Weld Sizing Summary			
Weld description	Required weld size (in)	Actual weld size (in)	Status
Nozzle to pad fillet (Leg_{41})	0.2254	0.2625	weld size is adequate
Pad to shell fillet (Leg_{42})	0.1875	0.2188	weld size is adequate

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Note: round inside edges per UG-76(c)	
Location and Orientation	
Located on	SHELL RG 1
Orientation	90°
Nozzle center line offset to datum line	75"
End of nozzle to shell center	29.5"
Passes through a Category A joint	No
Nozzle	
Description	NPS 8 Sch 40S (Std)
Access opening	No
Material specification	SA-312 TP304 Wld pipe (II-D p. 90, ln. 11)
Inside diameter, new	7.981"
Pipe nominal wall thickness	0.322"
Pipe minimum wall thickness[1]	0.2818"
Corrosion allowance	0"
Projection available outside vessel, Lpr	3.62"
Projection available outside vessel to flange face, Lf	8"
Local vessel minimum thickness	0.5"
Liquid static head included	0 psi
Longitudinal joint efficiency	1
Reinforcing Pad	
Material specification	SA-240 304 (II-D p. 86, ln. 44)
Diameter, D_p	14.625"

Thickness, t_e	0.375"
Is split	Yes
Butt welds tested to confirm full penetration	No
Butt welds located at least 45° from long seam	Yes
Joint efficiency	1
Welds	
Inner fillet, Leg_{41}	0.375"
Outer fillet, Leg_{42}	0.3125"
Nozzle to vessel groove weld	0.5"
Pad groove weld	0.375"

[1]Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0.875.

ASME B16.5-2013 Flange	
Description	NPS 8 Class 300 WN A182 F304
Bolt Material	SA-193 B8 1 Bolt (II-D p. 352, ln. 20)
Blind included	No
Rated MDMT	-320°F
Liquid static head	0 psi
MAWP rating	600 psi @ 200°F
MAP rating	720 psi @ 70°F
Hydrotest rating	1,100 psi @ 70°F
PWHT performed	No
Impact Tested	No
Circumferential joint radiography	Spot UW-11(b) Type 1
Notes	
Flange rated MDMT per UHA-51(d)(1)(a) = -320°F Bolts rated MDMT = -320°F	

UHA-51 Material Toughness Requirements Nozzle	
t_r = 400.53*3.9905 / (17,000*1 - 0.6*400.53) =	0.0954"
Stress ratio = t_r*E* / (t_n - c) = 0.0954*1 / (0.2818 - 0) =	0.3385
Impact test exempt per UHA-51(g) (coincident ratio = 0.3385)	
Rated MDMT =	-320°F
Material is exempt from impact testing at the Design MDMT of -200°F.	

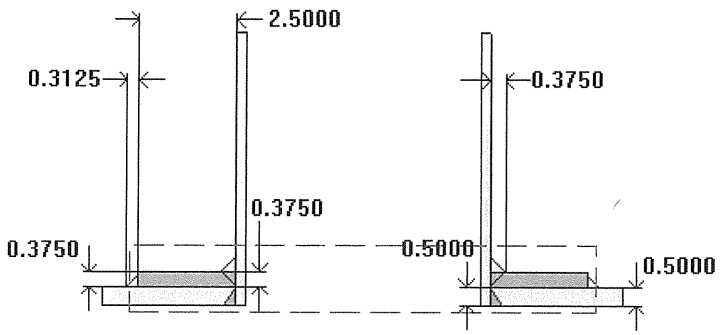
UHA-51 Material Toughness Requirements Pad
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in^2)							UG-45 Summary (in)	
For P = 400 psi @ 200 °F The opening is adequately reinforced							The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
3.3927	3.6553	0.5978	0.5692	--	2.25	0.2383	0.2818	0.2818

UG-41 Weld Failure Path Analysis Summary (lb_f)						
All failure paths are stronger than the applicable weld loads						
Weld load W	Weld load W_{1-1}	Path 1-1 strength	Weld load W_{2-2}	Path 2-2 strength	Weld load W_{3-3}	Path 3-3 strength
56,863.17	61,150	120,330.06	20,636	217,769.06	67,590	170,610.57

UW-16 Weld Sizing Summary			
Weld description	Required weld size (in)	Actual weld size (in)	Status
Nozzle to pad fillet (Leg_{41})	0.2254	0.2625	weld size is adequate
Pad to shell fillet (Leg_{42})	0.1875	0.2188	weld size is adequate

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Note: round inside edges per UG-76(c)

Location and Orientation	
Located on	SHELL RG 2
Orientation	0°
Nozzle center line offset to datum line	114"
End of nozzle to shell center	29.5"
Passes through a Category A joint	No
Nozzle	
Description	NPS 6 Sch 40S (Std)
Access opening	No
Material specification	SA-312 TP304 Wld pipe (II-D p. 90, ln. 11)
Inside diameter, new	6.065"
Pipe nominal wall thickness	0.28"
Pipe minimum wall thickness[1]	0.245"
Corrosion allowance	0"
Projection available outside vessel, Lpr	4.12"
Projection available outside vessel to flange face, Lf	8"
Local vessel minimum thickness	0.5"
Liquid static head included	0 psi
Longitudinal joint efficiency	1
Reinforcing Pad	
Material specification	SA-240 304 (II-D p. 86, ln. 44)
Diameter, D_p	11.625"

Thickness, t_e	0.375"
Is split	Yes
Butt welds tested to confirm full penetration	No
Butt welds located at least 45° from long seam	Yes
Joint efficiency	1
Welds	
Inner fillet, Leg_{41}	0.375"
Outer fillet, Leg_{42}	0.3125"
Nozzle to vessel groove weld	0.5"
Pad groove weld	0.375"

[1]Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0.875.

ASME B16.5-2013 Flange	
Description	NPS 6 Class 300 WN A182 F304
Bolt Material	SA-193 B8 1 Bolt (II-D p. 352, ln. 20)
Blind included	No
Rated MDMT	-320°F
Liquid static head	0 psi
MAWP rating	600 psi @ 200°F
MAP rating	720 psi @ 70°F
Hydrotest rating	1,100 psi @ 70°F
PWHT performed	No
Impact Tested	No
Circumferential joint radiography	Spot UW-11(b) Type 1
Notes	
Flange rated MDMT per UHA-51(d)(1)(a) = -320°F Bolts rated MDMT = -320°F	

UHA-51 Material Toughness Requirements Nozzle	
t_r = 400.53*3.0325 / (17,000*1 - 0.6*400.53) =	0.0725"
Stress ratio = t_r*E^* / (t_n - c) = 0.0725*1 / (0.245 - 0) =	0.2958
Impact test exempt per UHA-51(g) (coincident ratio = 0.2958)	
Rated MDMT =	-320°F
Material is exempt from impact testing at the Design MDMT of -200°F.	

UHA-51 Material Toughness Requirements Pad
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

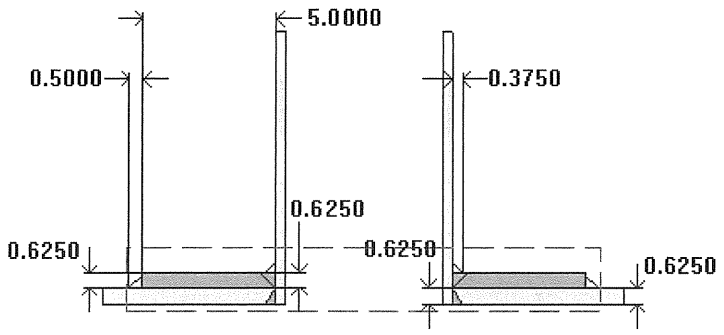
Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in^2)							UG-45 Summary (in)	
For P = 400 psi @ 200 °F The opening is adequately reinforced							The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
2.5782	3.034	0.4543	0.47	--	1.875	0.2347	0.245	0.245

UG-41 Weld Failure Path Analysis Summary (lb_f)						
All failure paths are stronger than the applicable weld loads						
Weld load W	Weld load W_{1-1}	Path 1-1 strength	Weld load W_{2-2}	Path 2-2 strength	Weld load W_{3-3}	Path 3-3 strength
43,317.51	51,594	89,131.86	17,812	167,271.89	57,194	132,931.09

UW-16 Weld Sizing Summary			
Weld description	Required weld size (in)	Actual weld size (in)	Status
Nozzle to pad fillet (Leg_{41})	0.196	0.2625	weld size is adequate
Pad to shell fillet (Leg_{42})	0.1875	0.2188	weld size is adequate

HANDHOLE (K1)

ASME Section VIII Division 1, 2015 Edition	
	
Note: round inside edges per UG-76(c)	
Location and Orientation	
Located on	SHELL RG 9
Orientation	180°
Nozzle center line offset to datum line	858"
End of nozzle to shell center	40.625"
Passes through a Category A joint	No
Nozzle	
Description	NPS 12 Sch 40S (Std)
Access opening	Yes
Material specification	SA-312 TP304 Wld pipe (II-D p. 90, ln. 11)
Inside diameter, new	12"
Pipe nominal wall thickness	0.375"
Pipe minimum wall thickness[1]	0.3281"
Corrosion allowance	0"
Projection available outside vessel, Lpr	4.88"
Projection available outside vessel to flange face, Lf	10"
Local vessel minimum thickness	0.625"
Liquid static head included	0 psi
Longitudinal joint efficiency	1
Reinforcing Pad	
Material specification	SA-240 304 (II-D p. 86, ln. 44)
Diameter, D_p	22.75"

Thickness, t_e	0.625"
Is split	Yes
Butt welds tested to confirm full penetration	No
Butt welds located at least 45° from long seam	Yes
Joint efficiency	1
Welds	
Inner fillet, Leg_{41}	0.375"
Outer fillet, Leg_{42}	0.5"
Nozzle to vessel groove weld	0.625"
Pad groove weld	0.625"

[1]Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0.875.

ASME B16.5-2013 Flange	
Description	NPS 12 Class 300 WN A182 F304
Bolt Material	SA-193 B8 1 Bolt (II-D p. 352, ln. 20)
Blind included	Yes
Rated MDMT	-320°F
Liquid static head	0 psi
MAWP rating	600 psi @ 200°F
MAP rating	720 psi @ 70°F
Hydrotest rating	1,100 psi @ 70°F
PWHT performed	No
Impact Tested	No
Circumferential joint radiography	Full UW-11(a) Type 1
Notes	
Flange rated MDMT per UHA-51(d)(1)(a) = -320°F Bolts rated MDMT = -320°F	

UHA-51 Material Toughness Requirements Nozzle
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

UHA-51 Material Toughness Requirements Pad
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

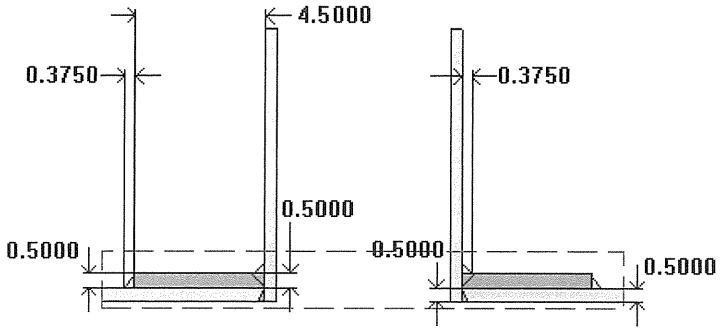
Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in^2)							UG-45 Summary (in)	
For P = 400 psi @ 200 °F The opening is adequately reinforced							The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
7.2875	7.6453	0.2125	0.7922	--	6.25	0.3906	0.1432	0.3281

UG-41 Weld Failure Path Analysis Summary (lb_f)						
All failure paths are stronger than the applicable weld loads						
Weld load W	Weld load W_{1-1}	Path 1-1 strength	Weld load W_{2-2}	Path 2-2 strength	Weld load W_{3-3}	Path 3-3 strength
141,765.25	148,656	261,849.29	28,031	433,072.96	158,031	360,360.31

UW-16 Weld Sizing Summary			
Weld description	Required weld size (in)	Actual weld size (in)	Status
Nozzle to pad fillet (Leg_{41})	0.25	0.2625	weld size is adequate
Pad to shell fillet (Leg_{42})	0.3125	0.35	weld size is adequate

HANDHOLE (K2)

ASME Section VIII Division 1, 2015 Edition	
	
Note: round inside edges per UG-76(c)	
Location and Orientation	
Located on	SHELL RG 6
Orientation	180°
Nozzle center line offset to datum line	627"
End of nozzle to shell center	31.5"
Passes through a Category A joint	No
Nozzle	
Description	NPS 12 Sch 40S (Std)
Access opening	Yes
Material specification	SA-312 TP304 Wld pipe (II-D p. 90, ln. 11)
Inside diameter, new	12"
Pipe nominal wall thickness	0.375"
Pipe minimum wall thickness[1]	0.3281"
Corrosion allowance	0"
Projection available outside vessel, Lpr	4.88"
Projection available outside vessel to flange face, Lf	10"
Local vessel minimum thickness	0.5"
Liquid static head included	0 psi
Longitudinal joint efficiency	1
Reinforcing Pad	
Material specification	SA-240 304 (II-D p. 86, ln. 44)
Diameter, D_p	21.75"

Thickness, t_e	0.5"
Is split	Yes
Butt welds tested to confirm full penetration	No
Butt welds located at least 45° from long seam	Yes
Joint efficiency	1
Welds	
Inner fillet, Leg_{41}	0.375"
Outer fillet, Leg_{42}	0.375"
Nozzle to vessel groove weld	0.5"
Pad groove weld	0.5"

[1]Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0.875.

ASME B16.5-2013 Flange	
Description	NPS 12 Class 300 WN A182 F304
Bolt Material	SA-193 B8 1 Bolt (II-D p. 352, ln. 20)
Blind included	Yes
Rated MDMT	-320°F
Liquid static head	0 psi
MAWP rating	600 psi @ 200°F
MAP rating	720 psi @ 70°F
Hydrotest rating	1,100 psi @ 70°F
PWHT performed	No
Impact Tested	No
Circumferential joint radiography	Full UW-11(a) Type 1
Notes	
Flange rated MDMT per UHA-51(d)(1)(a) = -320°F Bolts rated MDMT = -320°F	

UHA-51 Material Toughness Requirements Nozzle
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

UHA-51 Material Toughness Requirements Pad
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

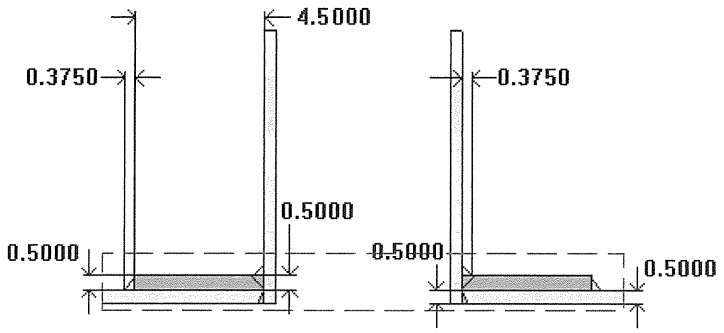
Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in^2)							UG-45 Summary (in)	
For P = 400 psi @ 200 °F The opening is adequately reinforced							The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
5.1012	6.3138	0.8988	0.6338	--	4.5	0.2812	0.1432	0.3281

UG-41 Weld Failure Path Analysis Summary (lb_f)						
All failure paths are stronger than the applicable weld loads						
Weld load W	Weld load W_{1-1}	Path 1-1 strength	Weld load W_{2-2}	Path 2-2 strength	Weld load W_{3-3}	Path 3-3 strength
85,171.5	108,300	212,300.49	22,988	358,970.65	115,800	273,760.35

UW-16 Weld Sizing Summary			
Weld description	Required weld size (in)	Actual weld size (in)	Status
Nozzle to pad fillet (Leg_{41})	0.25	0.2625	weld size is adequate
Pad to shell fillet (Leg_{42})	0.25	0.2625	weld size is adequate

HANDHOLE (K3)

ASME Section VIII Division 1, 2015 Edition	
	
Note: round inside edges per UG-76(c)	
Location and Orientation	
Located on	SHELL RG 4
Orientation	180°
Nozzle center line offset to datum line	429"
End of nozzle to shell center	31.5"
Passes through a Category A joint	No
Nozzle	
Description	NPS 12 Sch 40S (Std)
Access opening	Yes
Material specification	SA-312 TP304 Wld pipe (II-D p. 90, ln. 11)
Inside diameter, new	12"
Pipe nominal wall thickness	0.375"
Pipe minimum wall thickness[1]	0.3281"
Corrosion allowance	0"
Projection available outside vessel, Lpr	4.88"
Projection available outside vessel to flange face, Lf	10"
Local vessel minimum thickness	0.5"
Liquid static head included	0 psi
Longitudinal joint efficiency	1
Reinforcing Pad	
Material specification	SA-240 304 (II-D p. 86, ln. 44)
Diameter, D_p	21.75"

Thickness, t_e	0.5"
Is split	Yes
Butt welds tested to confirm full penetration	No
Butt welds located at least 45° from long seam	Yes
Joint efficiency	1
Welds	
Inner fillet, Leg_{41}	0.375"
Outer fillet, Leg_{42}	0.375"
Nozzle to vessel groove weld	0.5"
Pad groove weld	0.5"

[1]Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0.875.

ASME B16.5-2013 Flange	
Description	NPS 12 Class 300 WN A182 F304
Bolt Material	SA-193 B8 1 Bolt (II-D p. 352, ln. 20)
Blind included	Yes
Rated MDMT	-320°F
Liquid static head	0 psi
MAWP rating	600 psi @ 200°F
MAP rating	720 psi @ 70°F
Hydrotest rating	1,100 psi @ 70°F
PWHT performed	No
Impact Tested	No
Circumferential joint radiography	Full UW-11(a) Type 1
Notes	
Flange rated MDMT per UHA-51(d)(1)(a) = -320°F Bolts rated MDMT = -320°F	

UHA-51 Material Toughness Requirements Nozzle
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

UHA-51 Material Toughness Requirements Pad
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

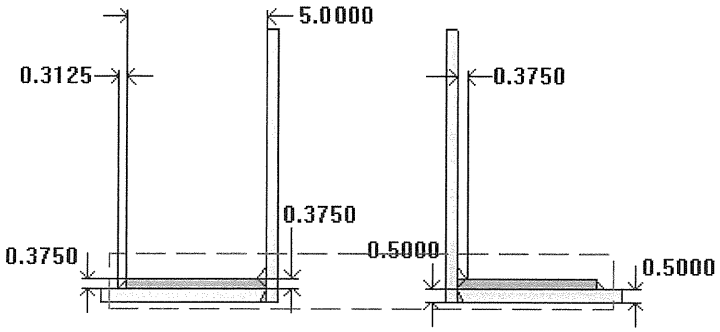
Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in^2)							UG-45 Summary (in)	
For P = 400 psi @ 200 °F The opening is adequately reinforced							The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
5.1012	6.3138	0.8988	0.6338	--	4.5	0.2812	0.1432	0.3281

UG-41 Weld Failure Path Analysis Summary (lb_f)						
All failure paths are stronger than the applicable weld loads						
Weld load W	Weld load W_{1-1}	Path 1-1 strength	Weld load W_{2-2}	Path 2-2 strength	Weld load W_{3-3}	Path 3-3 strength
85,171.5	108,300	212,300.49	22,988	358,970.65	115,800	273,760.35

UW-16 Weld Sizing Summary			
Weld description	Required weld size (in)	Actual weld size (in)	Status
Nozzle to pad fillet (Leg_{41})	0.25	0.2625	weld size is adequate
Pad to shell fillet (Leg_{42})	0.25	0.2625	weld size is adequate

HANDHOLE (K4)

ASME Section VIII Division 1, 2015 Edition

Note: round inside edges per UG-76(c)

Location and Orientation	
Located on	SHELL RG 2
Orientation	180°
Nozzle center line offset to datum line	177"
End of nozzle to shell center	31.5"
Passes through a Category A joint	No

Nozzle	
Description	NPS 12 Sch 40S (Std)
Access opening	Yes
Material specification	SA-312 TP304 Wld pipe (II-D p. 90, ln. 11)
Inside diameter, new	12"
Pipe nominal wall thickness	0.375"
Pipe minimum wall thickness[1]	0.3281"
Corrosion allowance	0"
Projection available outside vessel, Lpr	4.88"
Projection available outside vessel to flange face, Lf	10"
Local vessel minimum thickness	0.5"
Liquid static head included	0 psi
Longitudinal joint efficiency	1

Reinforcing Pad	
Material specification	SA-240 304 (II-D p. 86, ln. 44)
Diameter, D_p	22.75"

Thickness, t_e	0.375"
Is split	Yes
Butt welds tested to confirm full penetration	No
Butt welds located at least 45° from long seam	Yes
Joint efficiency	1
Welds	
Inner fillet, Leg_{41}	0.375"
Outer fillet, Leg_{42}	0.3125"
Nozzle to vessel groove weld	0.5"
Pad groove weld	0.375"

[1] Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0.875.

ASME B16.5-2013 Flange	
Description	NPS 12 Class 300 WN A182 F304
Bolt Material	SA-193 B8 1 Bolt (II-D p. 352, ln. 20)
Blind included	Yes
Rated MDMT	-320°F
Liquid static head	0 psi
MAWP rating	600 psi @ 200°F
MAP rating	720 psi @ 70°F
Hydrotest rating	1,100 psi @ 70°F
PWHT performed	No
Impact Tested	No
Circumferential joint radiography	Full UW-11(a) Type 1
Notes	
Flange rated MDMT per UHA-51(d)(1)(a) = -320°F Bolts rated MDMT = -320°F	

UHA-51 Material Toughness Requirements Nozzle
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

UHA-51 Material Toughness Requirements Pad
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

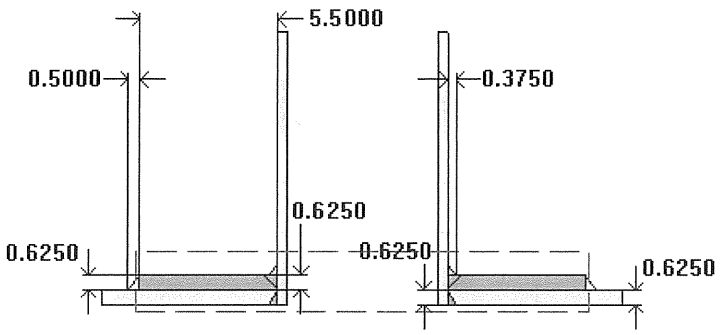
Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in^2)							UG-45 Summary (in)	
For P = 400 psi @ 200 °F The opening is adequately reinforced							The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
5.1012	5.5209	0.8988	0.6338	--	3.75	0.2383	0.1432	0.3281

UG-41 Weld Failure Path Analysis Summary (lb_f)						
All failure paths are stronger than the applicable weld loads						
Weld load W	Weld load W_{1-1}	Path 1-1 strength	Weld load W_{2-2}	Path 2-2 strength	Weld load W_{3-3}	Path 3-3 strength
85,171.5	92,442	196,185.1	22,988	321,919.49	99,942	257,644.96

UW-16 Weld Sizing Summary			
Weld description	Required weld size (in)	Actual weld size (in)	Status
Nozzle to pad fillet (Leg_{41})	0.25	0.2625	weld size is adequate
Pad to shell fillet (Leg_{42})	0.1875	0.2188	weld size is adequate

HANDHOLE (K5)

ASME Section VIII Division 1, 2015 Edition	
	
Note: round inside edges per UG-76(c)	
Location and Orientation	
Located on	SHELL RG 10
Orientation	180°
Nozzle center line offset to datum line	1,008"
End of nozzle to shell center	40.625"
Passes through a Category A joint	No
Nozzle	
Description	NPS 12 Sch 40S (Std)
Access opening	Yes
Material specification	SA-312 TP304 Wld pipe (II-D p. 90, ln. 11)
Inside diameter, new	12"
Pipe nominal wall thickness	0.375"
Pipe minimum wall thickness[1]	0.3281"
Corrosion allowance	0"
Projection available outside vessel, Lpr	4.88"
Projection available outside vessel to flange face, Lf	10"
Local vessel minimum thickness	0.625"
Liquid static head included	0 psi
Longitudinal joint efficiency	1
Reinforcing Pad	
Material specification	SA-240 304 (II-D p. 86, ln. 44)
Diameter, D_p	23.75"

Thickness, t_e	0.625"
Is split	Yes
Butt welds tested to confirm full penetration	No
Butt welds located at least 45° from long seam	Yes
Joint efficiency	1
Welds	
Inner fillet, Leg_{41}	0.375"
Outer fillet, Leg_{42}	0.5"
Nozzle to vessel groove weld	0.625"
Pad groove weld	0.625"

[1]Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0.875.

ASME B16.5-2013 Flange	
Description	NPS 12 Class 300 WN A182 F304
Bolt Material	SA-193 B8 1 Bolt (II-D p. 352, ln. 20)
Blind included	Yes
Rated MDMT	-320°F
Liquid static head	0 psi
MAWP rating	600 psi @ 200°F
MAP rating	720 psi @ 70°F
Hydrotest rating	1,100 psi @ 70°F
PWHT performed	No
Impact Tested	No
Circumferential joint radiography	Full UW-11(a) Type 1
Notes	
Flange rated MDMT per UHA-51(d)(1)(a) = -320°F Bolts rated MDMT = -320°F	

UHA-51 Material Toughness Requirements Nozzle
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

UHA-51 Material Toughness Requirements Pad
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

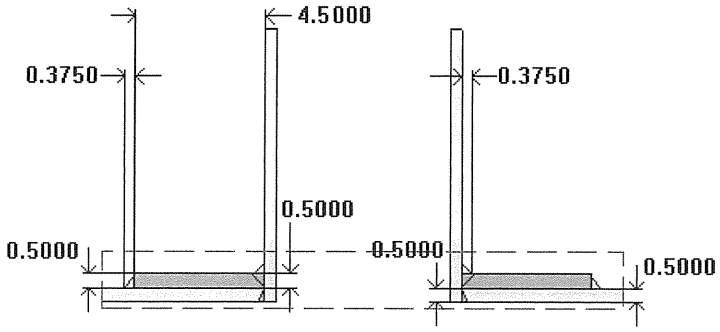
Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in^2)							UG-45 Summary (in)	
For P = 400 psi @ 200 °F The opening is adequately reinforced							The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
7.2875	8.1297	0.2125	0.7922	--	6.875	0.25	0.1432	0.3281

UG-41 Weld Failure Path Analysis Summary (lb_f)						
All failure paths are stronger than the applicable weld loads						
Weld load W	Weld load W_{1-1}	Path 1-1 strength	Weld load W_{2-2}	Path 2-2 strength	Weld load W_{3-3}	Path 3-3 strength
141,765.25	158,344	269,546.19	28,031	433,072.96	167,719	368,057.21

UW-16 Weld Sizing Summary			
Weld description	Required weld size (in)	Actual weld size (in)	Status
Nozzle to pad fillet (Leg_{41})	0.25	0.2625	weld size is adequate
Pad to shell fillet (Leg_{42})	0.3125	0.35	weld size is adequate

HANDHOLE (K6)

ASME Section VIII Division 1, 2015 Edition	
	
Note: round inside edges per UG-76(c)	
Location and Orientation	
Located on	SHELL RG 7
Orientation	180°
Nozzle center line offset to datum line	723"
End of nozzle to shell center	31.5"
Passes through a Category A joint	No
Nozzle	
Description	NPS 12 Sch 40S (Std)
Access opening	Yes
Material specification	SA-312 TP304 Wld pipe (II-D p. 90, ln. 11)
Inside diameter, new	12"
Pipe nominal wall thickness	0.375"
Pipe minimum wall thickness[1]	0.3281"
Corrosion allowance	0"
Projection available outside vessel, Lpr	4.88"
Projection available outside vessel to flange face, Lf	10"
Local vessel minimum thickness	0.5"
Liquid static head included	0 psi
Longitudinal joint efficiency	1
Reinforcing Pad	
Material specification	SA-240 304 (II-D p. 86, ln. 44)
Diameter, D_p	21.75"

Thickness, t_e	0.5"
Is split	Yes
Butt welds tested to confirm full penetration	No
Butt welds located at least 45° from long seam	Yes
Joint efficiency	1
Welds	
Inner fillet, Leg_{41}	0.375"
Outer fillet, Leg_{42}	0.375"
Nozzle to vessel groove weld	0.5"
Pad groove weld	0.5"

[1] Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0.875.

ASME B16.5-2013 Flange	
Description	NPS 12 Class 300 WN A182 F304
Bolt Material	SA-193 B8 1 Bolt (II-D p. 352, ln. 20)
Blind included	Yes
Rated MDMT	-320°F
Liquid static head	0 psi
MAWP rating	600 psi @ 200°F
MAP rating	720 psi @ 70°F
Hydrotest rating	1,100 psi @ 70°F
PWHT performed	No
Impact Tested	No
Circumferential joint radiography	Full UW-11(a) Type 1
Notes	
Flange rated MDMT per UHA-51(d)(1)(a) = -320°F Bolts rated MDMT = -320°F	

UHA-51 Material Toughness Requirements Nozzle
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

UHA-51 Material Toughness Requirements Pad
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

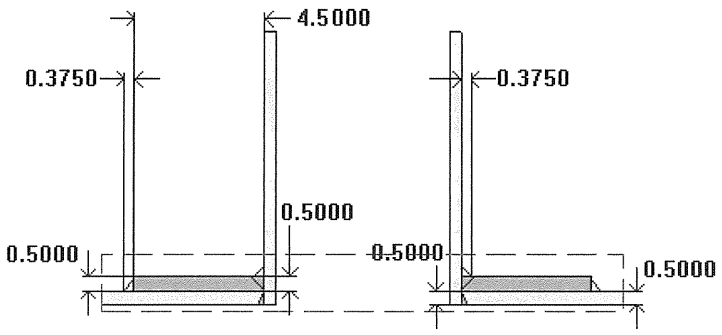
Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in^2)							UG-45 Summary (in)	
For P = 400 psi @ 200 °F The opening is adequately reinforced							The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
5.1012	6.3138	0.8988	0.6338	--	4.5	0.2812	0.1432	0.3281

UG-41 Weld Failure Path Analysis Summary (lb_f)						
All failure paths are stronger than the applicable weld loads						
Weld load W	Weld load W_{1-1}	Path 1-1 strength	Weld load W_{2-2}	Path 2-2 strength	Weld load W_{3-3}	Path 3-3 strength
85,171.5	108,300	212,300.49	22,988	358,970.65	115,800	273,760.35

UW-16 Weld Sizing Summary			
Weld description	Required weld size (in)	Actual weld size (in)	Status
Nozzle to pad fillet (Leg_{41})	0.25	0.2625	weld size is adequate
Pad to shell fillet (Leg_{42})	0.25	0.2625	weld size is adequate

HANDHOLE (K7)

ASME Section VIII Division 1, 2015 Edition	
	
Note: round inside edges per UG-76(c)	
Location and Orientation	
Located on	SHELL RG 5
Orientation	180°
Nozzle center line offset to datum line	525"
End of nozzle to shell center	31.5"
Passes through a Category A joint	No
Nozzle	
Description	NPS 12 Sch 40S (Std)
Access opening	Yes
Material specification	SA-312 TP304 Wld pipe (II-D p. 90, ln. 11)
Inside diameter, new	12"
Pipe nominal wall thickness	0.375"
Pipe minimum wall thickness[1]	0.3281"
Corrosion allowance	0"
Projection available outside vessel, Lpr	4.88"
Projection available outside vessel to flange face, Lf	10"
Local vessel minimum thickness	0.5"
Liquid static head included	0 psi
Longitudinal joint efficiency	1
Reinforcing Pad	
Material specification	SA-240 304 (II-D p. 86, ln. 44)
Diameter, D_p	21.75"

Thickness, t_e	0.5"
Is split	Yes
Butt welds tested to confirm full penetration	No
Butt welds located at least 45° from long seam	Yes
Joint efficiency	1
Welds	
Inner fillet, Leg_{41}	0.375"
Outer fillet, Leg_{42}	0.375"
Nozzle to vessel groove weld	0.5"
Pad groove weld	0.5"

[1]Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0.875.

ASME B16.5-2013 Flange	
Description	NPS 12 Class 300 WN A182 F304
Bolt Material	SA-193 B8 1 Bolt (II-D p. 352, ln. 20)
Blind included	Yes
Rated MDMT	-320°F
Liquid static head	0 psi
MAWP rating	600 psi @ 200°F
MAP rating	720 psi @ 70°F
Hydrotest rating	1,100 psi @ 70°F
PWHT performed	No
Impact Tested	No
Circumferential joint radiography	Full UW-11(a) Type 1
Notes	
Flange rated MDMT per UHA-51(d)(1)(a) = -320°F Bolts rated MDMT = -320°F	

UHA-51 Material Toughness Requirements Nozzle
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

UHA-51 Material Toughness Requirements Pad
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

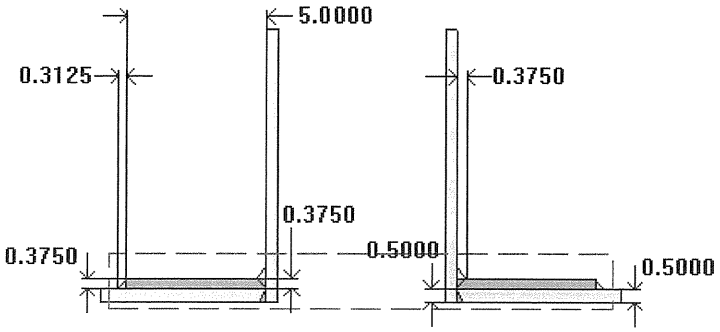
Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in^2)							UG-45 Summary (in)	
For P = 400 psi @ 200 °F The opening is adequately reinforced							The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
5.1012	6.3138	0.8988	0.6338	--	4.5	0.2812	0.1432	0.3281

UG-41 Weld Failure Path Analysis Summary (lb_f)						
All failure paths are stronger than the applicable weld loads						
Weld load W	Weld load W_{1-1}	Path 1-1 strength	Weld load W_{2-2}	Path 2-2 strength	Weld load W_{3-3}	Path 3-3 strength
85,171.5	108,300	212,300.49	22,988	358,970.65	115,800	273,760.35

UW-16 Weld Sizing Summary			
Weld description	Required weld size (in)	Actual weld size (in)	Status
Nozzle to pad fillet (Leg_{41})	0.25	0.2625	weld size is adequate
Pad to shell fillet (Leg_{42})	0.25	0.2625	weld size is adequate

HANDHOLE (K8)

ASME Section VIII Division 1, 2015 Edition	
	
Note: round inside edges per UG-76(c)	
Location and Orientation	
Located on	SHELL RG 3
Orientation	180°
Nozzle center line offset to datum line	297"
End of nozzle to shell center	31.5"
Passes through a Category A joint	No
Nozzle	
Description	NPS 12 Sch 40S (Std)
Access opening	Yes
Material specification	SA-312 TP304 Wld pipe (II-D p. 90, ln. 11)
Inside diameter, new	12"
Pipe nominal wall thickness	0.375"
Pipe minimum wall thickness[1]	0.3281"
Corrosion allowance	0"
Projection available outside vessel, Lpr	4.88"
Projection available outside vessel to flange face, Lf	10"
Local vessel minimum thickness	0.5"
Liquid static head included	0 psi
Longitudinal joint efficiency	1
Reinforcing Pad	
Material specification	SA-240 304 (II-D p. 86, ln. 44)
Diameter, D_p	22.75"

Thickness, t_e	0.375"
Is split	Yes
Butt welds tested to confirm full penetration	No
Butt welds located at least 45° from long seam	Yes
Joint efficiency	1
Welds	
Inner fillet, Leg_{41}	0.375"
Outer fillet, Leg_{42}	0.3125"
Nozzle to vessel groove weld	0.5"
Pad groove weld	0.375"

[1]Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0.875.

ASME B16.5-2013 Flange	
Description	NPS 12 Class 300 WN A182 F304
Bolt Material	SA-193 B8 1 Bolt (II-D p. 352, ln. 20)
Blind included	Yes
Rated MDMT	-320°F
Liquid static head	0 psi
MAWP rating	600 psi @ 200°F
MAP rating	720 psi @ 70°F
Hydrotest rating	1,100 psi @ 70°F
PWHT performed	No
Impact Tested	No
Circumferential joint radiography	Full UW-11(a) Type 1
Notes	
Flange rated MDMT per UHA-51(d)(1)(a) = -320°F Bolts rated MDMT = -320°F	

UHA-51 Material Toughness Requirements Nozzle
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

UHA-51 Material Toughness Requirements Pad
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

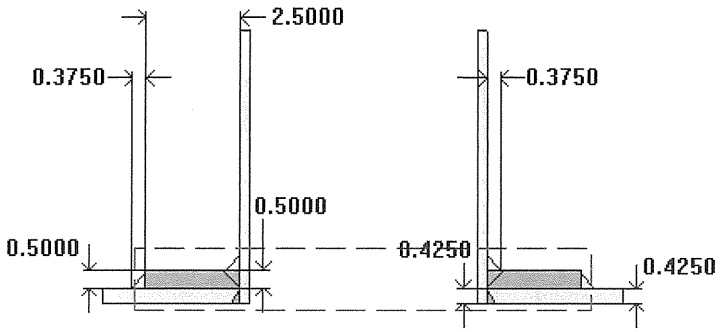
Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in^2)							UG-45 Summary (in)	
For P = 400 psi @ 200 °F The opening is adequately reinforced							The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
5.1012	5.5209	0.8988	0.6338	--	3.75	0.2383	0.1432	0.3281

UG-41 Weld Failure Path Analysis Summary (lb_f)						
All failure paths are stronger than the applicable weld loads						
Weld load W	Weld load W_{1-1}	Path 1-1 strength	Weld load W_{2-2}	Path 2-2 strength	Weld load W_{3-3}	Path 3-3 strength
85,171.5	92,442	196,185.1	22,988	321,919.49	99,942	257,644.96

UW-16 Weld Sizing Summary			
Weld description	Required weld size (in)	Actual weld size (in)	Status
Nozzle to pad fillet (Leg_{41})	0.25	0.2625	weld size is adequate
Pad to shell fillet (Leg_{42})	0.1875	0.2188	weld size is adequate

BOTTOMS OUT (L)

ASME Section VIII Division 1, 2015 Edition	
	
Note: round inside edges per UG-76(c)	
Location and Orientation	
Located on	BOTTOM HEAD
Orientation	0°
End of nozzle to datum line	-48"
Calculated as hillside	No
Distance to head center, R	0"
Passes through a Category A joint	No
Nozzle	
Description	NPS 6 Sch 40S (Std)
Access opening	No
Material specification	SA-312 TP304 Wld pipe (II-D p. 90, ln. 11)
Inside diameter, new	6.065"
Pipe nominal wall thickness	0.28"
Pipe minimum wall thickness[1]	0.245"
Corrosion allowance	0"
Projection available outside vessel, Lpr	19.3264"
Projection available outside vessel to flange face, Lf	23.2064"
Local vessel minimum thickness	0.425"
Liquid static head included	3.88 psi
Longitudinal joint efficiency	1
Reinforcing Pad	
Material specification	SA-240 304 (II-D p. 86, ln. 44)

Diameter, D_p	11.625"
Thickness, t_e	0.5"
Is split	Yes
Butt welds tested to confirm full penetration	No
Joint efficiency	0.75
Welds	
Inner fillet, Leg_{41}	0.375"
Outer fillet, Leg_{42}	0.375"
Nozzle to vessel groove weld	0.425"
Pad groove weld	0.5"

[1]Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0.875.

ASME B16.5-2013 Flange	
Description	NPS 6 Class 300 WN A182 F304
Bolt Material	SA-193 B8 1 Bolt (II-D p. 352, ln. 20)
Blind included	No
Rated MDMT	-320°F
Liquid static head	3.9 psi
MAWP rating	600 psi @ 200°F
MAP rating	720 psi @ 70°F
Hydrotest rating	1,100 psi @ 70°F
PWHT performed	No
Impact Tested	No
Circumferential joint radiography	Spot UW-11(b) Type 1
Notes	
Flange rated MDMT per UHA-51(d)(1)(a) = -320°F Bolts rated MDMT = -320°F	

UHA-51 Material Toughness Requirements Nozzle	
t_r = 404.41*3.0325 / (17,000*1 - 0.6*404.41) =	0.0732"
Stress ratio = t_r*E* / (t_n - c) = 0.0732*1 / (0.245 - 0) =	0.2987
Impact test exempt per UHA-51(g) (coincident ratio = 0.2987)	
Rated MDMT =	-320°F
Material is exempt from impact testing at the Design MDMT of -200°F.	

UHA-51 Material Toughness Requirements Pad
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

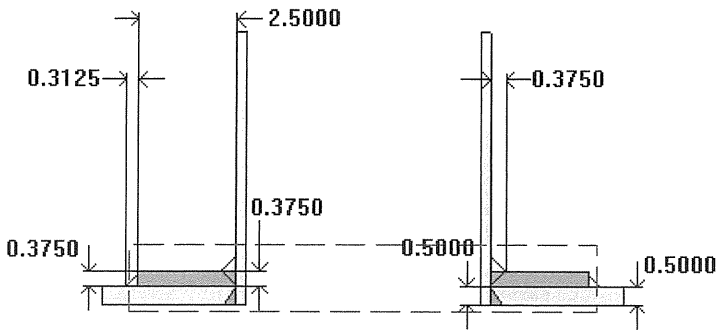
Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in^2)							UG-45 Summary (in)	
For P = 403.88 psi @ 200 °F The opening is adequately reinforced							The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
2.3195	2.8626	0.2581	0.4633	--	1.875	0.2662	0.245	0.245

UG-41 Weld Failure Path Analysis Summary (lb_f)						
All failure paths are stronger than the applicable weld loads						
Weld load W	Weld load W_{1-1}	Path 1-1 strength	Weld load W_{2-2}	Path 2-2 strength	Weld load W_{3-3}	Path 3-3 strength
41,704.64	52,090	100,316.42	16,838	174,972.72	56,850	132,564.41

UW-16 Weld Sizing Summary			
Weld description	Required weld size (in)	Actual weld size (in)	Status
Nozzle to pad fillet (Leg_{41})	0.196	0.2625	weld size is adequate
Pad to shell fillet (Leg_{42})	0.2125	0.2625	weld size is adequate

EQUALIZATION (M)

ASME Section VIII Division 1, 2015 Edition	
	
Note: round inside edges per UG-76(c)	
Location and Orientation	
Located on	SHELL RG 2
Orientation	90°
Nozzle center line offset to datum line	123"
End of nozzle to shell center	29.5"
Passes through a Category A joint	No
Nozzle	
Description	NPS 6 Sch 40S (Std)
Access opening	No
Material specification	SA-312 TP304 Wld pipe (II-D p. 90, ln. 11)
Inside diameter, new	6.065"
Pipe nominal wall thickness	0.28"
Pipe minimum wall thickness[1]	0.245"
Corrosion allowance	0"
Projection available outside vessel, Lpr	4.12"
Projection available outside vessel to flange face, Lf	8"
Local vessel minimum thickness	0.5"
Liquid static head included	0 psi
Longitudinal joint efficiency	1
Reinforcing Pad	
Material specification	SA-240 304 (II-D p. 86, ln. 44)
Diameter, D_p	11.625"

Thickness, t_e	0.375"
Is split	Yes
Butt welds tested to confirm full penetration	No
Butt welds located at least 45° from long seam	Yes
Joint efficiency	1
Welds	
Inner fillet, Leg_{41}	0.375"
Outer fillet, Leg_{42}	0.3125"
Nozzle to vessel groove weld	0.5"
Pad groove weld	0.375"

[1]Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0.875.

ASME B16.5-2013 Flange	
Description	NPS 6 Class 300 WN A182 F304
Bolt Material	SA-193 B8 1 Bolt (II-D p. 352, ln. 20)
Blind included	No
Rated MDMT	-320°F
Liquid static head	0 psi
MAWP rating	600 psi @ 200°F
MAP rating	720 psi @ 70°F
Hydrotest rating	1,100 psi @ 70°F
PWHT performed	No
Impact Tested	No
Circumferential joint radiography	Spot UW-11(b) Type 1
Notes	
Flange rated MDMT per UHA-51(d)(1)(a) = -320°F Bolts rated MDMT = -320°F	

UHA-51 Material Toughness Requirements Nozzle	
t_r = 400.53*3.0325 / (17,000*1 - 0.6*400.53) =	0.0725"
Stress ratio = t_r*E* / (t_n - c) = 0.0725*1 / (0.245 - 0) =	0.2958
Impact test exempt per UHA-51(g) (coincident ratio = 0.2958)	
Rated MDMT =	-320°F
Material is exempt from impact testing at the Design MDMT of -200°F.	

UHA-51 Material Toughness Requirements Pad
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

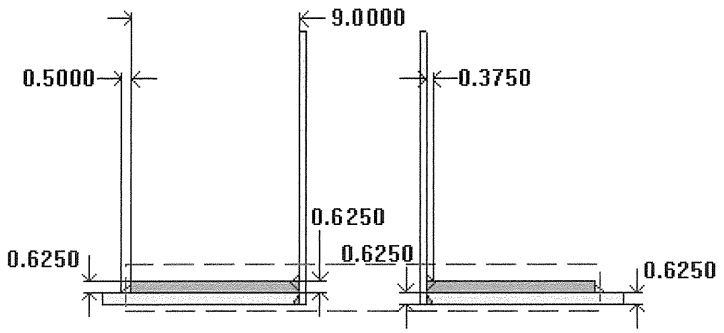
Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in^2)							UG-45 Summary (in)	
For P = 400 psi @ 200 °F The opening is adequately reinforced							The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
2.5782	3.034	0.4543	0.47	--	1.875	0.2347	0.245	0.245

UG-41 Weld Failure Path Analysis Summary (lb_f)						
All failure paths are stronger than the applicable weld loads						
Weld load W	Weld load W_{1-1}	Path 1-1 strength	Weld load W_{2-2}	Path 2-2 strength	Weld load W_{3-3}	Path 3-3 strength
43,317.51	51,594	89,131.86	17,812	167,271.89	57,194	132,931.09

UW-16 Weld Sizing Summary			
Weld description	Required weld size (in)	Actual weld size (in)	Status
Nozzle to pad fillet (Leg_{41})	0.196	0.2625	weld size is adequate
Pad to shell fillet (Leg_{42})	0.1875	0.2188	weld size is adequate

MANWAY (N1)

ASME Section VIII Division 1, 2015 Edition	
	
Note: round inside edges per UG-76(c)	
Location and Orientation	
Located on	SHELL RG 11
Orientation	180°
Nozzle center line offset to datum line	1,085"
End of nozzle to shell center	42.625"
Passes through a Category A joint	No
Nozzle	
Access opening	Yes
Material specification	SA-240 304 (II-D p. 86, ln. 44)
Inside diameter, new	19.25"
Nominal wall thickness	0.375"
Corrosion allowance	0"
Projection available outside vessel, Lpr	5.62"
Projection available outside vessel to flange face, Lf	12"
Local vessel minimum thickness	0.625"
Liquid static head included	0 psi
Longitudinal joint efficiency	1
Reinforcing Pad	
Material specification	SA-240 304 (II-D p. 86, ln. 44)
Diameter, D_p	38"
Thickness, t_e	0.625"

Is split	Yes
Butt welds tested to confirm full penetration	No
Butt welds located at least 45° from long seam	Yes
Joint efficiency	1
Welds	
Inner fillet, Leg_{41}	0.375"
Outer fillet, Leg_{42}	0.5"
Nozzle to vessel groove weld	0.625"
Pad groove weld	0.625"

ASME B16.5-2013 Flange	
Description	NPS 20 Class 300 WN A182 F304
Bolt Material	SA-193 B8 1 Bolt (II-D p. 352, ln. 20)
Blind included	Yes
Rated MDMT	-320°F
Liquid static head	0 psi
MAWP rating	600 psi @ 200°F
MAP rating	720 psi @ 70°F
Hydrotest rating	1,100 psi @ 70°F
PWHT performed	No
Impact Tested	No
Circumferential joint radiography	Full UW-11(a) Type 1
Bore diameter, B (specified by purchaser)	19.25"
Notes	
Flange rated MDMT per UHA-51(d)(1)(a) = -320°F Bolts rated MDMT = -320°F	

UHA-51 Material Toughness Requirements Nozzle
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

UHA-51 Material Toughness Requirements Pad
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in^2)							UG-45 Summary (in)	
For P = 400 psi @ 200 °F The opening is adequately reinforced							The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
11.6903	12.4821	0.3409	0.5631	--	11.25	0.3281	0.1948	0.375

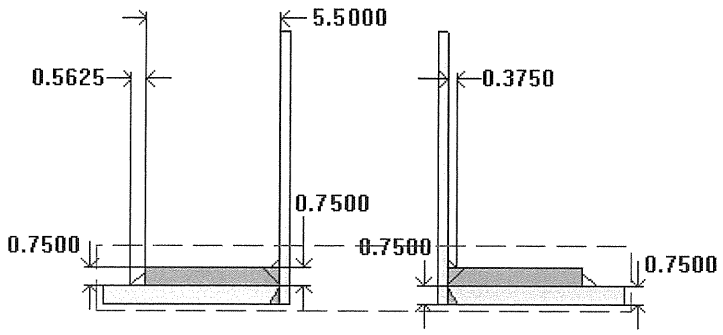
UG-41 Weld Failure Path Analysis Summary (lb_f)						
All failure paths are stronger than the applicable weld loads						
Weld load W	Weld load W_{1-1}	Path 1-1 strength	Weld load W_{2-2}	Path 2-2 strength	Weld load W_{3-3}	Path 3-3 strength
227,254.3	242,824	454,323.38	23,449	696,648.17	252,199	583,079.59

UW-16 Weld Sizing Summary			
Weld description	Required weld size (in)	Actual weld size (in)	Status
Nozzle to pad fillet (Leg_{41})	0.25	0.2625	weld size is adequate
Pad to shell fillet (Leg_{42})	0.3125	0.35	weld size is adequate

% Forming strain - UHA-44(a)(2)

$$EFE = (50*t / R_f)*(1 - R_f / R_o)$$
$$= (50*0.375 / 9.8125)*(1 - 9.8125 / \infty)$$
$$= 1.9108\%$$

MANWAY (N2)

ASME Section VIII Division 1, 2015 Edition

Note: round inside edges per UG-76(c)

Location and Orientation	
Located on	CONE RG 8
Orientation	90°
Nozzle center line offset to datum line	813"
End of nozzle to shell center	44"
Longitudinal axis is	perpendicular to the vessel longitudinal axis
Passes through a Category A joint	No
Nozzle	
Access opening	Yes
Material specification	SA-240 304 (II-D p. 86, ln. 44)
Inside diameter, new	19.25"
Nominal wall thickness	0.375"
Corrosion allowance	0"
Opening chord length	19.8424"
Projection available outside vessel, Lpr	8.8469"
Projection available outside vessel to flange face, Lf	15.2269"
Local vessel minimum thickness	0.75"
User input radial limit of reinforcement	19.5"
Liquid static head included	0 psi
Longitudinal joint efficiency	1
Reinforcing Pad	
Material specification	SA-240 304 (II-D p. 86, ln. 44)

Diameter, D_p	31.6155"
Thickness, t_e	0.75"
Is split	Yes
Butt welds tested to confirm full penetration	No
Joint efficiency	0.75
Welds	
Inner fillet, Leg_{41}	0.375"
Outer fillet, Leg_{42}	0.5625"
Nozzle to vessel groove weld	0.75"
Pad groove weld	0.75"

ASME B16.5-2013 Flange	
Description	NPS 20 Class 300 WN A182 F304
Bolt Material	SA-193 B8 1 Bolt (II-D p. 352, ln. 20)
Blind included	Yes
Rated MDMT	-320°F
Liquid static head	0 psi
MAWP rating	600 psi @ 200°F
MAP rating	720 psi @ 70°F
Hydrotest rating	1,100 psi @ 70°F
PWHT performed	No
Impact Tested	No
Circumferential joint radiography	Full UW-11(a) Type 1
Bore diameter, B (specified by purchaser)	19.25"
Notes	
Flange rated MDMT per UHA-51(d)(1)(a) = -320°F Bolts rated MDMT = -320°F	

UHA-51 Material Toughness Requirements Nozzle
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

UHA-51 Material Toughness Requirements Pad
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in^2)							UG-45 Summary (in)	
For P = 400 psi @ 200 °F The opening is adequately reinforced							The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
10.5578	11.4275	4.1748	0.6082	--	6.1875	0.457	0.1948	0.375

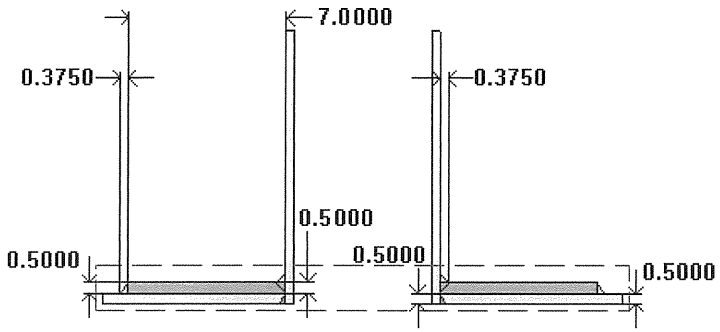
UG-41 Weld Failure Path Analysis Summary (lb_f)						
All failure paths are stronger than the applicable weld loads						
Weld load W	Weld load W_{1-1}	Path 1-1 strength	Weld load W_{2-2}	Path 2-2 strength	Weld load W_{3-3}	Path 3-3 strength
130,928.17	145,054	435,600.43	26,226	812,887.1	156,304	622,476.11

UW-16 Weld Sizing Summary			
Weld description	Required weld size (in)	Actual weld size (in)	Status
Nozzle to pad fillet (Leg_{41})	0.25	0.2625	weld size is adequate
Pad to shell fillet (Leg_{42})	0.375	0.3938	weld size is adequate

% Forming strain - UHA-44(a)(2)

$$EFE = (50*t / R_f)*(1 - R_f / R_o)$$
$$= (50*0.375 / 9.8125)*(1 - 9.8125 / \infty)$$
$$= 1.9108\%$$

MANWAY (N3)

ASME Section VIII Division 1, 2015 Edition	
	
Note: round inside edges per UG-76(c)	
Location and Orientation	
Located on	SHELL RG 6
Orientation	90°
Nozzle center line offset to datum line	600"
End of nozzle to shell center	33.5"
Passes through a Category A joint	No
Nozzle	
Access opening	Yes
Material specification	SA-240 304 (II-D p. 86, ln. 44)
Inside diameter, new	19.25"
Nominal wall thickness	0.375"
Corrosion allowance	0"
Projection available outside vessel, Lpr	5.62"
Projection available outside vessel to flange face, Lf	12"
Local vessel minimum thickness	0.5"
Liquid static head included	0 psi
Longitudinal joint efficiency	1
Reinforcing Pad	
Material specification	SA-240 304 (II-D p. 86, ln. 44)
Diameter, D_p	34"
Thickness, t_e	0.5"
Is split	Yes

Butt welds tested to confirm full penetration	No
Butt welds located at least 45° from long seam	Yes
Joint efficiency	1
Welds	
Inner fillet, Leg_{41}	0.375"
Outer fillet, Leg_{42}	0.375"
Nozzle to vessel groove weld	0.5"
Pad groove weld	0.5"

ASME B16.5-2013 Flange	
Description	NPS 20 Class 300 WN A182 F304
Bolt Material	SA-193 B8 1 Bolt (II-D p. 352, ln. 20)
Blind included	Yes
Rated MDMT	-320°F
Liquid static head	0 psi
MAWP rating	600 psi @ 200°F
MAP rating	720 psi @ 70°F
Hydrotest rating	1,100 psi @ 70°F
PWHT performed	No
Impact Tested	No
Circumferential joint radiography	Full UW-11(a) Type 1
Bore diameter, B (specified by purchaser)	19.25"
Notes	
Flange rated MDMT per UHA-51(d)(1)(a) = -320°F Bolts rated MDMT = -320°F	

UHA-51 Material Toughness Requirements Nozzle
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

UHA-51 Material Toughness Requirements Pad
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in^2)							UG-45 Summary (in)	
For P = 400 psi @ 200 °F The opening is adequately reinforced							The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
8.1832	9.1735	1.4418	0.4505	--	7	0.2812	0.1948	0.375

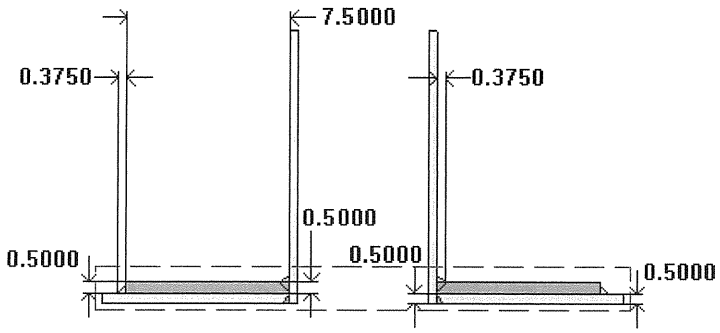
UG-41 Weld Failure Path Analysis Summary (lb_f)						
All failure paths are stronger than the applicable weld loads						
Weld load W	Weld load W_{1-1}	Path 1-1 strength	Weld load W_{2-2}	Path 2-2 strength	Weld load W_{3-3}	Path 3-3 strength
135,951	154,634	358,112.11	19,322	580,409.24	162,134	428,748.86

UW-16 Weld Sizing Summary			
Weld description	Required weld size (in)	Actual weld size (in)	Status
Nozzle to pad fillet (Leg_{41})	0.25	0.2625	weld size is adequate
Pad to shell fillet (Leg_{42})	0.25	0.2625	weld size is adequate

% Forming strain - UHA-44(a)(2)

$$EFE = (50*t / R_f)*(1 - R_f / R_o)$$
$$= (50*0.375 / 9.8125)*(1 - 9.8125 / \infty)$$
$$= 1.9108\%$$

MANWAY (N4)

ASME Section VIII Division 1, 2015 Edition	
	
Note: round inside edges per UG-76(c)	
Location and Orientation	
Located on	SHELL RG 4
Orientation	90°
Nozzle center line offset to datum line	362"
End of nozzle to shell center	33.5"
Passes through a Category A joint	No
Nozzle	
Access opening	Yes
Material specification	SA-240 304 (II-D p. 86, ln. 44)
Inside diameter, new	19.25"
Nominal wall thickness	0.375"
Corrosion allowance	0"
Projection available outside vessel, Lpr	5.62"
Projection available outside vessel to flange face, Lf	12"
Local vessel minimum thickness	0.5"
Liquid static head included	0 psi
Longitudinal joint efficiency	1
Reinforcing Pad	
Material specification	SA-240 304 (II-D p. 86, ln. 44)
Diameter, D_p	35"
Thickness, t_e	0.5"
Is split	Yes

Butt welds tested to confirm full penetration	No
Butt welds located at least 45° from long seam	Yes
Joint efficiency	1
Welds	
Inner fillet, Leg_{41}	0.375"
Outer fillet, Leg_{42}	0.375"
Nozzle to vessel groove weld	0.5"
Pad groove weld	0.5"

ASME B16.5-2013 Flange	
Description	NPS 20 Class 300 WN A182 F304
Bolt Material	SA-193 B8 1 Bolt (II-D p. 352, ln. 20)
Blind included	Yes
Rated MDMT	-320°F
Liquid static head	0 psi
MAWP rating	600 psi @ 200°F
MAP rating	720 psi @ 70°F
Hydrotest rating	1,100 psi @ 70°F
PWHT performed	No
Impact Tested	No
Circumferential joint radiography	Full UW-11(a) Type 1
Bore diameter, B (specified by purchaser)	19.25"
Notes	
Flange rated MDMT per UHA-51(d)(1)(a) = -320°F Bolts rated MDMT = -320°F	

UHA-51 Material Toughness Requirements Nozzle
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

UHA-51 Material Toughness Requirements Pad
Rated MDMT per UHA-51(d)(1)(a), (carbon content does not exceed 0.10%) = -320°F
Material is exempt from impact testing at the Design MDMT of -200°F.

Reinforcement Calculations for Internal Pressure

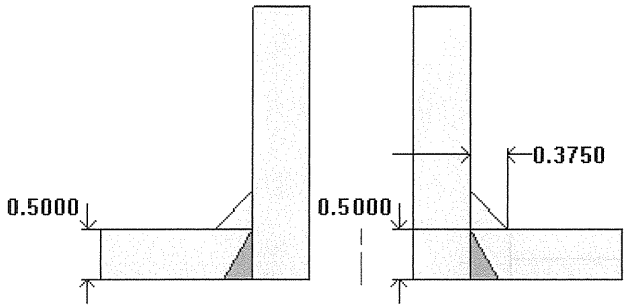
UG-37 Area Calculation Summary (in^2)							UG-45 Summary (in)	
For P = 400 psi @ 200 °F The opening is adequately reinforced							The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
8.1832	9.6735	1.4418	0.4505	--	7.5	0.2812	0.1948	0.375

UG-41 Weld Failure Path Analysis Summary (lb_f)						
All failure paths are stronger than the applicable weld loads						
Weld load W	Weld load W_{1-1}	Path 1-1 strength	Weld load W_{2-2}	Path 2-2 strength	Weld load W_{3-3}	Path 3-3 strength
135,951	164,634	363,884.79	19,322	580,409.24	172,134	434,521.53

UW-16 Weld Sizing Summary			
Weld description	Required weld size (in)	Actual weld size (in)	Status
Nozzle to pad fillet (Leg_{41})	0.25	0.2625	weld size is adequate
Pad to shell fillet (Leg_{42})	0.25	0.2625	weld size is adequate

% Forming strain - UHA-44(a)(2)

$$EFE = (50*t / R_f)*(1 - R_f / R_o)$$
$$= (50*0.375 / 9.8125)*(1 - 9.8125 / \infty)$$
$$= 1.9108\%$$

ASME Section VIII Division 1, 2015 Edition	
	
Note: round inside edges per UG-76(c)	
Location and Orientation	
Located on	SHELL RG 1
Orientation	225°
Nozzle center line offset to datum line	-6"
End of nozzle to shell center	29.75"
Passes through a Category A joint	No
Nozzle	
Access opening	No
Material specification	SA-182 F304 <= 5 (II-D p. 86, ln. 34)
Inside diameter, new	1"
Nominal wall thickness	0.56"
Corrosion allowance	0"
Projection available outside vessel, Lpr	7.56"
Projection available outside vessel to flange face, Lf	8.25"
Local vessel minimum thickness	0.5"
Liquid static head included	2.4 psi
Longitudinal joint efficiency	1
Welds	
Inner fillet, Leg_{41}	0.375"
Nozzle to vessel groove weld	0.5"

ASME B16.5-2013 Flange	
Description	NPS 1 Class 300 LWN A182 F304
Bolt Material	SA-193 B8 1 Bolt (II-D p. 352, ln. 20)
Blind included	No
Rated MDMT	-320°F
Liquid static head	2.38 psi
MAWP rating	600 psi @ 200°F
MAP rating	720 psi @ 70°F
Hydrotest rating	1,100 psi @ 70°F
PWHT performed	No
Impact Tested	No
Notes	
Flange rated MDMT per UHA-51(d)(1)(a) = -320°F Bolts rated MDMT = -320°F	

UHA-51 Material Toughness Requirements Nozzle	
t_r = 402.93*0.5 / (20,000*1 - 0.6*402.93) =	0.0102"
Stress ratio = t_r*E* / (t_n - c) = 0.0102*1 / (0.56 - 0) =	0.0182
Impact test exempt per UHA-51(g) (coincident ratio = 0.0182)	
Rated MDMT =	-320°F
Material is exempt from impact testing at the Design MDMT of -200°F.	

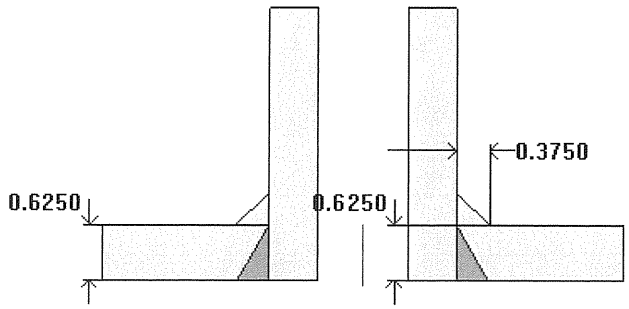
Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in^2)							UG-45 Summary (in)	
For P = 402.4 psi @ 200 °F							The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							0.1348	0.56

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (in)	Actual weld throat size (in)	Status
Nozzle to shell fillet (Leg_{41})	0.25	0.2625	weld size is adequate

This opening does not require reinforcement per UG-36(c)(3)(a)

ASME Section VIII Division 1, 2015 Edition	
	
Note: round inside edges per UG-76(c)	
Location and Orientation	
Located on	SHELL RG 10
Orientation	225°
Nozzle center line offset to datum line	930"
End of nozzle to shell center	38.625"
Passes through a Category A joint	No
Nozzle	
Access opening	No
Material specification	SA-182 F304 <= 5 (II-D p. 86, ln. 34)
Inside diameter, new	1"
Nominal wall thickness	0.56"
Corrosion allowance	0"
Projection available outside vessel, Lpr	7.31"
Projection available outside vessel to flange face, Lf	8"
Local vessel minimum thickness	0.625"
Liquid static head included	0 psi
Longitudinal joint efficiency	1
Welds	
Inner fillet, Leg_{41}	0.375"
Nozzle to vessel groove weld	0.625"

ASME B16.5-2013 Flange	
Description	NPS 1 Class 300 LWN A182 F304
Bolt Material	SA-193 B8 1 Bolt (II-D p. 352, ln. 20)
Blind included	No
Rated MDMT	-320°F
Liquid static head	0 psi
MAWP rating	600 psi @ 200°F
MAP rating	720 psi @ 70°F
Hydrotest rating	1,100 psi @ 70°F
PWHT performed	No
Impact Tested	No
Notes	
Flange rated MDMT per UHA-51(d)(1)(a) = -320°F Bolts rated MDMT = -320°F	

UHA-51 Material Toughness Requirements Nozzle	
t_r = 400.53*0.5 / (20,000*1 - 0.6*400.53) =	0.0101"
Stress ratio = t_r*E* / (t_n - c) = 0.0101*1 / (0.56 - 0) =	0.0181
Impact test exempt per UHA-51(g) (coincident ratio = 0.0181)	
Rated MDMT =	-320°F
Material is exempt from impact testing at the Design MDMT of -200°F.	

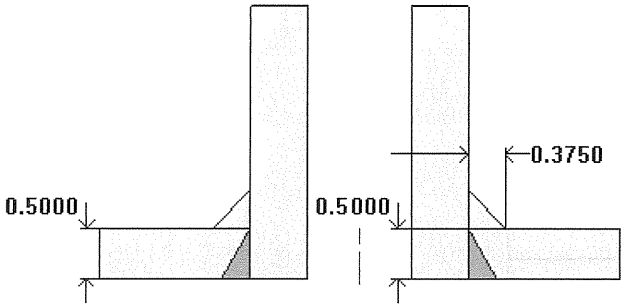
Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in^2)							UG-45 Summary (in)	
For P = 400 psi @ 200 °F							The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							0.1348	0.56

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	**Required weld throat size (in)**	**Actual weld throat size (in)**	**Status**
Nozzle to shell fillet (Leg_{41})	0.25	0.2625	weld size is adequate

This opening does not require reinforcement per UG-36(c)(3)(a)

ASME Section VIII Division 1, 2015 Edition	
	
Note: round inside edges per UG-76(c)	
Location and Orientation	
Located on	SHELL RG 6
Orientation	225°
Nozzle center line offset to datum line	675"
End of nozzle to shell center	29.5"
Passes through a Category A joint	No
Nozzle	
Access opening	No
Material specification	SA-182 F304 <= 5 (II-D p. 86, ln. 34)
Inside diameter, new	1"
Nominal wall thickness	0.56"
Corrosion allowance	0"
Projection available outside vessel, Lpr	7.31"
Projection available outside vessel to flange face, Lf	8"
Local vessel minimum thickness	0.5"
Liquid static head included	0 psi
Longitudinal joint efficiency	1
Welds	
Inner fillet, Leg_{41}	0.375"
Nozzle to vessel groove weld	0.5"

ASME B16.5-2013 Flange	
Description	NPS 1 Class 300 LWN A182 F304
Bolt Material	SA-193 B8 1 Bolt (II-D p. 352, ln. 20)
Blind included	No
Rated MDMT	-320°F
Liquid static head	0 psi
MAWP rating	600 psi @ 200°F
MAP rating	720 psi @ 70°F
Hydrotest rating	1,100 psi @ 70°F
PWHT performed	No
Impact Tested	No
Notes	
Flange rated MDMT per UHA-51(d)(1)(a) = -320°F Bolts rated MDMT = -320°F	

UHA-51 Material Toughness Requirements Nozzle	
t_r = 400.53*0.5 / (20,000*1 - 0.6*400.53) =	0.0101"
Stress ratio = t_r*E* / (t_n - c) = 0.0101*1 / (0.56 - 0) =	0.0181
Impact test exempt per UHA-51(g) (coincident ratio = 0.0181)	
Rated MDMT =	-320°F
Material is exempt from impact testing at the Design MDMT of -200°F.	

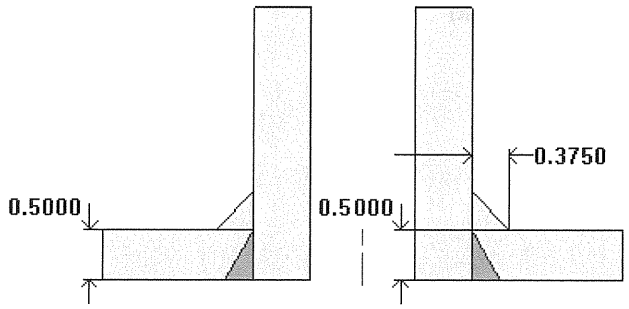
Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in^2)							UG-45 Summary (in)	
For P = 400 psi @ 200 °F							The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							0.1348	0.56

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	**Required weld throat size (in)**	**Actual weld throat size (in)**	**Status**
Nozzle to shell fillet (Leg_{41})	0.25	0.2625	weld size is adequate

This opening does not require reinforcement per UG-36(c)(3)(a)

ASME Section VIII Division 1, 2015 Edition	
	
Note: round inside edges per UG-76(c)	
Location and Orientation	
Located on	SHELL RG 5
Orientation	225°
Nozzle center line offset to datum line	477"
End of nozzle to shell center	29.5"
Passes through a Category A joint	No
Nozzle	
Access opening	No
Material specification	SA-182 F304 <= 5 (II-D p. 86, ln. 34)
Inside diameter, new	1"
Nominal wall thickness	0.56"
Corrosion allowance	0"
Projection available outside vessel, Lpr	7.31"
Projection available outside vessel to flange face, Lf	8"
Local vessel minimum thickness	0.5"
Liquid static head included	0 psi
Longitudinal joint efficiency	1
Welds	
Inner fillet, Leg_{41}	0.375"
Nozzle to vessel groove weld	0.5"

ASME B16.5-2013 Flange	
Description	NPS 1 Class 300 LWN A182 F304
Bolt Material	SA-193 B8 1 Bolt (II-D p. 352, ln. 20)
Blind included	No
Rated MDMT	-320°F
Liquid static head	0 psi
MAWP rating	600 psi @ 200°F
MAP rating	720 psi @ 70°F
Hydrotest rating	1,100 psi @ 70°F
PWHT performed	No
Impact Tested	No
Notes	
Flange rated MDMT per UHA-51(d)(1)(a) = -320°F Bolts rated MDMT = -320°F	

UHA-51 Material Toughness Requirements Nozzle	
t_r = 400.53*0.5 / (20,000*1 - 0.6*400.53) =	0.0101"
Stress ratio = t_r*E* / (t_n - c) = 0.0101*1 / (0.56 - 0) =	0.0181
Impact test exempt per UHA-51(g) (coincident ratio = 0.0181)	
Rated MDMT =	-320°F
Material is exempt from impact testing at the Design MDMT of -200°F.	

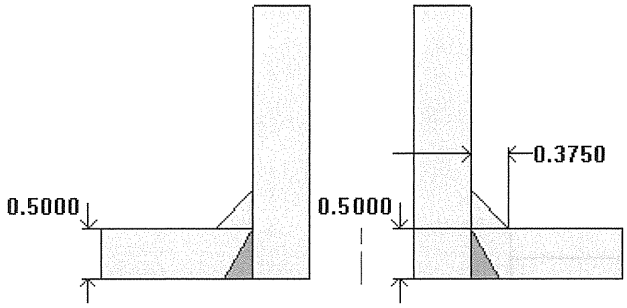
Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in^2)							UG-45 Summary (in)	
For P = 400 psi @ 200 °F							The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							0.1348	0.56

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (in)	Actual weld throat size (in)	Status
Nozzle to shell fillet (Leg_{41})	0.25	0.2625	weld size is adequate

This opening does not require reinforcement per UG-36(c)(3)(a)

ASME Section VIII Division 1, 2015 Edition	
	
Note: round inside edges per UG-76(c)	
Location and Orientation	
Located on	SHELL RG 3
Orientation	225°
Nozzle center line offset to datum line	237"
End of nozzle to shell center	29.5"
Passes through a Category A joint	No
Nozzle	
Access opening	No
Material specification	SA-182 F304 <= 5 (II-D p. 86, ln. 34)
Inside diameter, new	1"
Nominal wall thickness	0.56"
Corrosion allowance	0"
Projection available outside vessel, Lpr	7.31"
Projection available outside vessel to flange face, Lf	8"
Local vessel minimum thickness	0.5"
Liquid static head included	0 psi
Longitudinal joint efficiency	1
Welds	
Inner fillet, Leg_{41}	0.375"
Nozzle to vessel groove weld	0.5"

ASME B16.5-2013 Flange	
Description	NPS 1 Class 300 LWN A182 F304
Bolt Material	SA-193 B8 1 Bolt (II-D p. 352, ln. 20)
Blind included	No
Rated MDMT	-320°F
Liquid static head	0 psi
MAWP rating	600 psi @ 200°F
MAP rating	720 psi @ 70°F
Hydrotest rating	1,100 psi @ 70°F
PWHT performed	No
Impact Tested	No
Notes	
Flange rated MDMT per UHA-51(d)(1)(a) = -320°F Bolts rated MDMT = -320°F	

UHA-51 Material Toughness Requirements Nozzle	
t_r = 400.53*0.5 / (20,000*1 - 0.6*400.53) =	0.0101"
Stress ratio = t_r*E* / (t_n - c) = 0.0101*1 / (0.56 - 0) =	0.0181
Impact test exempt per UHA-51(g) (coincident ratio = 0.0181)	
Rated MDMT =	-320°F
Material is exempt from impact testing at the Design MDMT of -200°F.	

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in^2)							UG-45 Summary (in)	
For P = 400 psi @ 200 °F							The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							0.1348	0.56

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (in)	Actual weld throat size (in)	Status
Nozzle to shell fillet (Leg_{41})	0.25	0.2625	weld size is adequate

This opening does not require reinforcement per UG-36(c)(3)(a)

"A" PIPING

ASME Section VIII Division 1, 2015 Edition	
Inputs - (Detailed Geometry)	
Identifier	"A" PIPING
Inner Diameter	3.068"
Thickness	0.216"
Description	NPS 3 Sch 40S (Std)
Corrosion	0"
Distance from Center of Pipe to Center of Vessel	45"
Angular Position	0.00°
Liquid Weight	3.20 lb/ft
Loading Conditions	
Present When Vessel is Empty	Yes
Present During Test	No
Include in Lift Weight	Yes
Top of Piping Run	
Attached to Nozzle	Yes
Top Nozzle	REFLUX INLET (A)
Top Elevation from Datum	1,075"
Bottom of Piping Run	
Attached to Nozzle	No
Bottom Elevation from Datum	38"
Piping Supports	
Number of Supports	4
Distance from Bottom of Pipe to Lowest Support	207.4"
Space Between Supports	207.4"
Percentage of Pipe Weight Supported at Each	25%

"B" PIPING

ASME Section VIII Division 1, 2015 Edition	
Inputs - (Detailed Geometry)	
Identifier	"B" PIPING
Inner Diameter	10.02"
Thickness	0.365"
Description	NPS 10 Sch 40S (Std)
Corrosion	0"
Distance from Center of Pipe to Center of Vessel	50"
Angular Position	90.00°
Liquid Weight	0.00 lb/ft
Loading Conditions	
Present When Vessel is Empty	Yes
Present During Test	No
Include in Lift Weight	Yes
Top of Piping Run	
Attached to Nozzle	No
Top Elevation from Datum	1,212"
Bottom of Piping Run	
Attached to Nozzle	No
Bottom Elevation from Datum	36"
Piping Supports	
Number of Supports	6
Distance from Bottom of Pipe to Lowest Support	168"
Space Between Supports	168"
Percentage of Pipe Weight Supported at Each	16.67%

"C" PIPING

ASME Section VIII Division 1, 2015 Edition	
Inputs - (Detailed Geometry)	
Identifier	"C" PIPING
Inner Diameter	10.02"
Thickness	0.365"
Description	NPS 10 Sch 40S (Std)
Corrosion	0"
Distance from Center of Pipe to Center of Vessel	50"
Angular Position	270.00°
Liquid Weight	34.17 lb/ft
Loading Conditions	
Present When Vessel is Empty	Yes
Present During Test	No
Include in Lift Weight	Yes
Top of Piping Run	
Attached to Nozzle	Yes
Top Nozzle	TOP FEED (C)
Top Elevation from Datum	813"
Bottom of Piping Run	
Attached to Nozzle	No
Bottom Elevation from Datum	36"
Piping Supports	
Number of Supports	4
Distance from Bottom of Pipe to Lowest Support	155.4"
Space Between Supports	155.4"
Percentage of Pipe Weight Supported at Each	25%

"D" PIPING

ASME Section VIII Division 1, 2015 Edition	
Inputs - (Detailed Geometry)	
Identifier	"D" PIPING
Inner Diameter	3.068"
Thickness	0.216"
Description	NPS 3 Sch 40S (Std)
Corrosion	0"
Distance from Center of Pipe to Center of Vessel	36"
Angular Position	0.00°
Liquid Weight	3.20 lb/ft
Loading Conditions	
Present When Vessel is Empty	Yes
Present During Test	No
Include in Lift Weight	Yes
Top of Piping Run	
Attached to Nozzle	Yes
Top Nozzle	BOTTOM FEED (D)
Top Elevation from Datum	607"
Bottom of Piping Run	
Attached to Nozzle	No
Bottom Elevation from Datum	36"
Piping Supports	
Number of Supports	3
Distance from Bottom of Pipe to Lowest Support	142.75"
Space Between Supports	142.75"
Percentage of Pipe Weight Supported at Each	33.33%

"E" PIPING

ASME Section VIII Division 1, 2015 Edition	
Inputs - (Detailed Geometry)	
Identifier	"E" PIPING
Inner Diameter	7.981"
Thickness	0.322"
Description	NPS 8 Sch 40S (Std)
Corrosion	0"
Distance from Center of Pipe to Center of Vessel	40"
Angular Position	45.00°
Liquid Weight	21.68 lb/ft
Loading Conditions	
Present When Vessel is Empty	Yes
Present During Test	No
Include in Lift Weight	Yes
Top of Piping Run	
Attached to Nozzle	Yes
Top Nozzle	TO E-205 (E)
Top Elevation from Datum	389"
Bottom of Piping Run	
Attached to Nozzle	No
Bottom Elevation from Datum	36"
Piping Supports	
Number of Supports	1
Distance from Bottom of Pipe to Lowest Support	176.5"
Space Between Supports	0"
Percentage of Pipe Weight Supported at Each	100%

"F" PIPING

ASME Section VIII Division 1, 2015 Edition	
Inputs - (Detailed Geometry)	
Identifier	"F" PIPING
Inner Diameter	7.981"
Thickness	0.322"
Description	NPS 8 Sch 40S (Std)
Corrosion	0"
Distance from Center of Pipe to Center of Vessel	40"
Angular Position	180.00°
Liquid Weight	21.68 lb/ft
Loading Conditions	
Present When Vessel is Empty	Yes
Present During Test	No
Include in Lift Weight	Yes
Top of Piping Run	
Attached to Nozzle	Yes
Top Nozzle	FROM E-205 (F)
Top Elevation from Datum	365"
Bottom of Piping Run	
Attached to Nozzle	No
Bottom Elevation from Datum	36"
Piping Supports	
Number of Supports	1
Distance from Bottom of Pipe to Lowest Support	164.5"
Space Between Supports	0"
Percentage of Pipe Weight Supported at Each	100%

ASME Section VIII Division 1, 2015 Edition	
Inputs	
Distance from Bottom of Bed to Datum	165"
Bed Depth	144"
Bed Diameter	42"
Bed Density	15.00 lb/ft^3
Liquid Holdup	0.00% of dry weight
Weight	
Estimated Bed Weight, Empty	1,731.8 lb
Estimated Bed Weight, Operating	1,731.8 lb
Loading Conditions	
Included in Vessel Lift Weight	Yes
Present When Vessel is Empty	Yes
Present During Test	Yes

ASME Section VIII Division 1, 2015 Edition	
Inputs	
Distance from Bottom of Bed to Datum	417"
Bed Depth	120"
Bed Diameter	42"
Bed Density	12.00 lb/ft^3
Liquid Holdup	0.00% of dry weight
Weight	
Estimated Bed Weight, Empty	1,154.5 lb
Estimated Bed Weight, Operating	1,154.5 lb
Loading Conditions	
Included in Vessel Lift Weight	Yes
Present When Vessel is Empty	Yes
Present During Test	Yes

ASME Section VIII Division 1, 2015 Edition	
Inputs	
Distance from Bottom of Bed to Datum	615"
Bed Depth	120"
Bed Diameter	42"
Bed Density	12.00 lb/ft^3
Liquid Holdup	0.00% of dry weight
Weight	
Estimated Bed Weight, Empty	1,154.5 lb
Estimated Bed Weight, Operating	1,154.5 lb
Loading Conditions	
Included in Vessel Lift Weight	Yes
Present When Vessel is Empty	Yes
Present During Test	Yes

Packed Bed #4

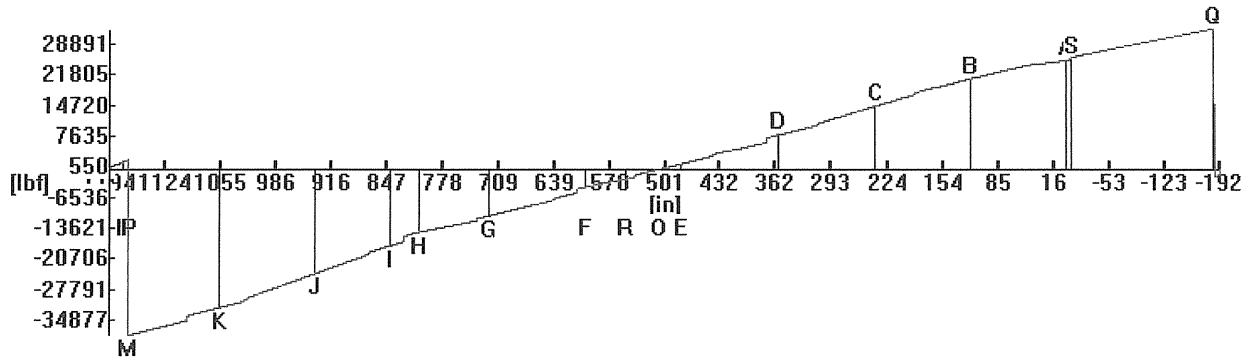
ASME Section VIII Division 1, 2015 Edition	
Inputs	
Distance from Bottom of Bed to Datum	840"
Bed Depth	180"
Bed Diameter	60"
Bed Density	12.00 lb/ft^3
Liquid Holdup	0.00% of dry weight
Weight	
Estimated Bed Weight, Empty	3,534.3 lb
Estimated Bed Weight, Operating	3,534.3 lb
Loading Conditions	
Included in Vessel Lift Weight	Yes
Present When Vessel is Empty	Yes
Present During Test	Yes

Liquid Level bounded by BOTTOM HEAD

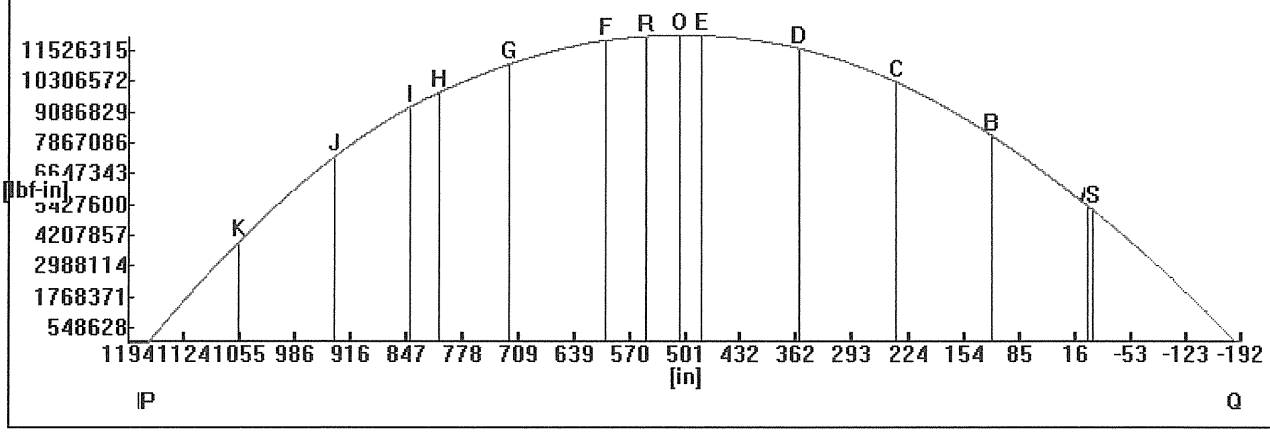
ASME Section VIII Division 1, 2015 Edition	
Location from Datum (in)	60
Operating Liquid Specific Gravity	1

Vessel Information		
Vessel Lift Weight	74,537.8 lb	
Center of Gravity to Datum	537.6144"	
Lift Points		
	Top	**Bottom**
to Datum	1,156.6875"	-197.4955"
From C.G.	619.0731"	735.1098"

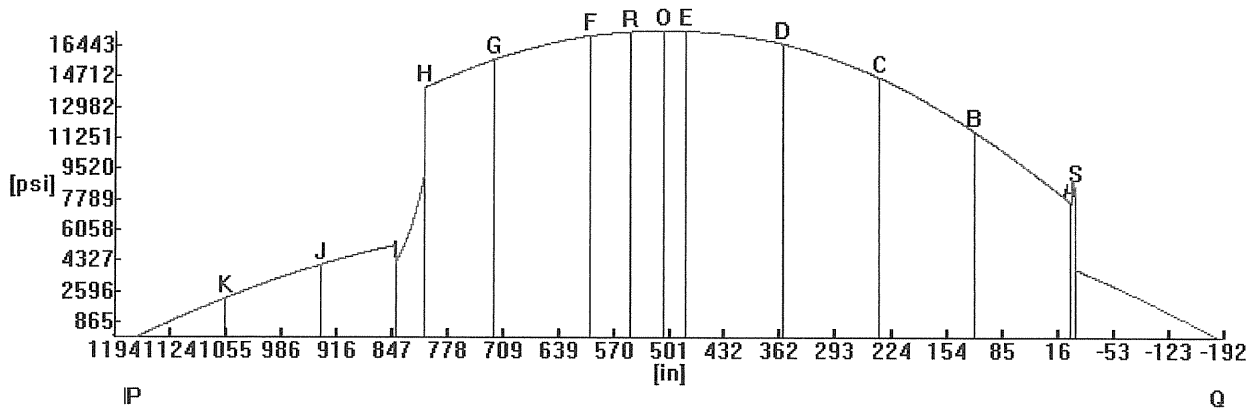
Shear	
Maximum Magnitude Shear:	-38,419 lb_f



Bending Moment	
Maximum |Moment|:	12,136,186 lb_f-in



Bending Stress	
Maximum Stress:	17,309 psi



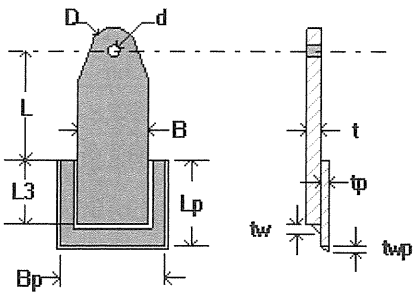
Tabulated Results						
Label	Component Name	Component Type	Elevation from bottom (in)	Shear at Elev (lbf)	Moment at Elev (lbf-in)	Stress at Elev (psi)
A	SHELL RG 1	Cylinder	0	25,041	5,372,094	7,662
B	SHELL RG 2	Cylinder	120	20,838	8,160,634	11,639
C	SHELL RG 3	Cylinder	240	14,436	10,293,848	14,681
D	SHELL RG 4	Cylinder	360	7,841	11,614,505	16,565
E	SHELL RG 5	Cylinder	480	1,244	12,119,319	17,285
F	SHELL RG 6	Cylinder	600	-4,121	11,928,008	17,012
G	SHELL RG 7	Cylinder	720	-10,812	10,982,092	15,663
H	CONE RG 8	Transition	807	-14,606	9,857,197	14,058
I	SHELL RG 9	Cylinder	843	-17,827	9,273,722	4,192
J	SHELL RG 10	Cylinder	936	-24,219	7,317,984	4,098
K	SHELL RG 11	Cylinder	1,056	-32,077	3,927,020	2,199
L	TOP HEAD	Ellipsoidal Head	1,176	1,616	-48,113	27
M	Max on SHELL RG 11	Shear Max	1,168.6	-38,419	-58,111	33
N	Max on SHELL RG 5	Moment Max	507.2	0	12,136,186	17,309
O	Max on SHELL RG 5	Stress Max	507.2	0	12,136,186	17,309
P	Left/Top Lift Point	--	1,168.8	2,031	-61,244	34
Q	Right/Bottom Lift Point	--	-183.9955	32,433	37,810	28
R	Center of Gravity	--	549.8	-2,326	12,089,839	17,243
S	Skirt / vessel weld seam	--	-5.17	25,232	5,242,138	8,495

Note: The right/bottom end of the vessel corresponds to the right end of the graphs above.

Elevations on the graphs are absolute; elevations are taken as if the datum were at the seam of the bottom/right vessel closure.

COMPRESS does not investigate allowable bending stress for the vessel at lifting condition, as per ASME or AISC rules, or other criteria. The designer should determine appropriate allowable stress values in coordination with the vessel rigging contractor and the vessel owner, following sound engineering principles and safe practices, with allowance for safety and impact factors.

LIFTING LUGS

Geometry Inputs	
	
Attached To	SHELL RG 11
Material	SA-240-340
Distance of Lift Point From Datum	1,182"
Angular Position	0° and 180°
Length, L	18"
Width, B	12"
Thickness, t	1.25"
Hole Diameter, d	2"
Pin Diameter, Dp	1.6766"
Diameter at Pin, D	8"
Load Angle from Vertical, ϕ	0°
Has Brace Plate	No
Welds	
Size, t_w	0.75"
Reinforcement Pad	
Width, B_p	18"
Length, L_p	15"
Thickness, t_p	0.625"
Weld Size, t_{wp}	0.5"
Weld Length, L_3	12"

Intermediate Values	
Load Factor	1.5000
Vessel Weight (new, incl. Load Factor), W	105,924.4 lb
Lug Weight (new), W_{lug}	371.1 lb (Qty=2)
Distance from Center of Gravity to Top Lug, l_1	640.6445"
Distance from Center of Gravity to Tail Lug, l_2	738.851"
Distance from Vessel Center Line to Tail Lug, l_3	29.5"
Allowable Stress, Tensile, σ_t	18,000 psi
Allowable Stress, Shear, σ_s	12,000 psi
Allowable Stress, Bearing, σ_p	27,000 psi
Allowable Stress, Bending, σ_b	19,800 psi
Allowable Stress, Weld Shear, $\tau_{allowable}$	12,000 psi
Allowable Stress set to 1/3 Sy per ASME B30.20	No

Summary Values	
Required Lift Pin Diameter, d_{reqd}	1.6762"
Required Lug Thickness, t_{reqd}	1.17"
Lug Stress Ratio, σ_{ratio}	0.87
Weld Shear Stress Ratio, τ_{ratio}	0.84
Lug Design	Acceptable
Local Stresses WRC 107	Acceptable
Maximum Out of Plane Lift Angle - Weak Axis Bending	3.71°

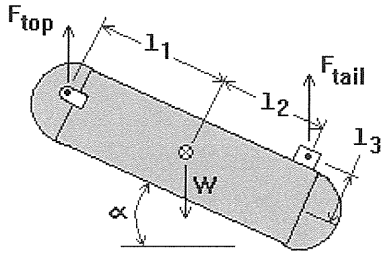
COMPRESS recommends a spreader beam be used to prevent weak axis bending of the top lugs.
No consideration is given for any bracing plate from the lug to the vessel.

Lift Forces

Lift force on lugs during rotational lift ($0° \le \alpha \le 90°$):

$2*F_{top} = W*(l_2*\cos(\alpha) + l_3*\sin(\alpha)) / (l_1*\cos(\alpha) + l_2*\cos(\alpha) + l_3*\sin(\alpha))$

$F_{tail} = W - (2*F)$



α [°]	F_{top}[lbf]	F_{tail}[lbf]
0	28,366	49,192
15	28,506	48,912
30	28,666	48,592
45	28,881	48,162
60	29,245	47,435
75	30,184	45,556
90	52,962	0
8[1]	28,440	49,044
6[2]	28,421	49,082
7[3]	28,431	49,063
[1]Lift angle at maximum lug stress.		
[2]Lift angle at maximum weld stress.		
[3]Lift angle at maximum pad weld stress.		
Shell angle at lift lug	0.00°	

Lug Pin Diameter - Shear stress

d_{reqd} = $(2*F_v / (\pi*\sigma_s))^{0.5}$
= $(2*52{,}962 / (\pi*12{,}000))^{0.5}$ = 1.6762"

d_{reqd} / D_p = 1.6762 / 1.6766 = 1.00 Acceptable

σ = F_v / A
= $F_v / (2*(0.25*\pi*D_p^2))$
= $52{,}962 / (2*(0.25*\pi*1.6766^2))$ = 11,994 psi

σ / σ_s = 11,994 / 12,000 = 1 Acceptable

Lug Thickness - Tensile stress

t_{reqd} = $F_v / ((D - d)*\sigma_t)$
= $52{,}962 / ((8 - 2)*18{,}000)$ = 0.4904"

t_{reqd} / t = 0.4904 / 1.25 = 0.39 Acceptable

σ = F_v / A
= $F_v / ((D - d)*t)$
= $52{,}962 / ((8 - 2)*1.25)$ = 7,062 psi

σ / σ_t = 7,062 / 18,000 = 0.39 Acceptable

Lug Thickness - Bearing stress

t_{reqd} = $F_v / (D_p * \sigma_p)$
= 52,962 / (1.6766*27,000) = 1.17"

t_{reqd} / t = 1.17 / 1.25 = 0.94 Acceptable

σ = $F_v / A_{bearing}$
= $F_v / (D_p * (t))$
= 52,962 / (1.6766*(1.25)) = 25,271 psi

σ / σ_p = 25,271 / 27,000 = 0.94 Acceptable

Lug Thickness - Shear stress

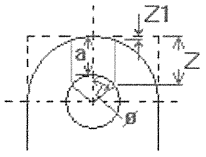
t_{reqd} = $[F_v / \sigma_s] / (2 * L_{shear})$
= (52,962 / 12,000) / (2*3.2112) = 0.6872"

t_{reqd} / t = 0.6872 / 1.25 = 0.55 Acceptable

τ = F_v / A_{shear}
= $F_v / (2 * t * L_{shear})$
= 52,962 / (2*1.25*3.2112) = 6,597 psi

τ / σ_s = 6,597 / 12,000 = 0.55 Acceptable

Shear stress length (per Pressure Vessel and Stacks, A. Keith Escoe)



ϕ = $55 * D_p / d$
= 55*1.6766 / 2
= 46.107°

Z = $0.5*(D - d) + 0.5*D_p*(1 - \cos(\phi))$
= 0.5*(8 - 2) + 0.5*1.6766*(1 - cos(46.107))
= 3.2571"

Z1 = $0.5*D - \text{sqr}(0.25*D*D - (0.5*D_p*\sin(\phi))^2)$
= $0.5*8 - \text{sqr}(0.25*8*8 - (0.5*1.6766*\sin(46.107))^2)$
= 0.0459"

L_{shear} = Z - Z1
= 3.2112"

Lug Plate Stress

Lug stress, tensile + bending, during rotational lift:

$\sigma_{ratio} = [F_{ten} / (A_{ten}*\sigma_t)] + [M_{bend} / (Z_{bend}*\sigma_b)] \le 1$

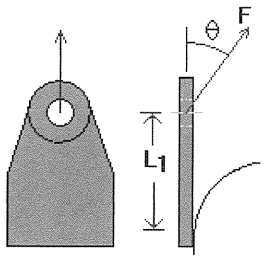
$= [(F_{top}(\alpha)*\sin(\alpha)) / (t*B*\sigma_t)] + [(6*F_{top}(\alpha)*L*\cos(\alpha)) / (t*B^2*\sigma_b)] \le 1$

$= 28{,}440*\sin(8.0) / (1.25*12*18{,}000) + 6*(28{,}440)*18*\cos(8.0) / (1.25*12^2*19{,}800)$

$= \underline{0.87}$ Acceptable

Weak Axis Bending Stress

Maximum lift cable angle from vertical $\theta = 3.71°$



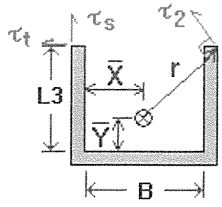
$\sigma_b = M / Z = (F*\sin(\theta)*L_1) / Z$

$F*\cos(\theta) = 0.5*W \Rightarrow F = 0.5*W / \cos(\theta)$

$\theta = \arctan((2*\sigma_b*Z) / (W*L_1))$

$\theta = \arctan((2*19{,}800*(12*1.25^2/6)) / (105{,}924*18)) = 3.71°$

Weld Stress



Weld stress, direct and torsional shear, during rotational lift:

Direct shear:

Maximum weld shear stress occurs at lift angle 6.00°; lift force = 28,421 lb_f

$A_{weld} = 0.707*t_w*(2*L_3 + B)$

$= 0.707*0.75*(2*12 + 12) = 19.089 \text{ in}^2$

$\tau_t = F_{lug}*\cos(\alpha) / A_{weld}$

$= 28{,}421*\cos(6.0) / 19.089 = 1{,}481 \text{ psi}$

τ_s = F_{lug}*sin(α) / A_{weld}

= 28,421*sin(6.0) / 19.089 = 156 psi

Torsional shear:

Weld centroid:

Y_{bar} = L_3^2 / (2*L_3 + B)

= 12^2 / (2*12 + 12) = 4"

Second polar moment of area:

J = 0.707*t_w*((8*L_3^3 + 6*L_3*B^2 + B^3) / 12 - L_3^4 / (2*L_3 + B))

= 0.707*0.75* ((8*12^3 + 6*12*12^2 + 12^3) / 12 - 12^4 / (2*12 + 12)) = 839.92 in^4

Radial distance from centroid to weld:

r = sqr($(X_{bar})^2$ + (L_3 - Y_{bar})^2)

= sqr((0.5*12)^2 + (12 - 4)^2) = 10"

θ_r = arctan((L_3 - Y_{bar}) / (X_{bar}))

= arctan(8 / 6) = 53.13°

τ_2 = M * r / J

= [F(α)*cos(α)*(L + L_3 - Y_{bar})] * r / J

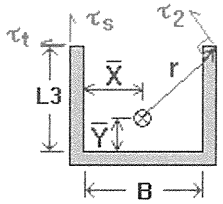
= (28,421*cos(6.0)*26)*10 / 839.9160

= 8,750 psi

τ_{ratio} = sqr((τ_t + τ_2*sin(θ_r))^2 + (τ_s + τ_2*cos(θ_r))^2) / $\tau_{allowable}$ ≤ 1

= sqr ((1,481 + 8,750*sin(53.13))^2 + (156 + 8,750*cos(53.13))^2) / 12,000

= 0.84 Acceptable



Pad Weld Stress

Direct shear:

Maximum weld shear stress occurs at lift angle 7.00°; lift force = 28,431 lb_f

A_{weld} = 0.707*t_{wp}*(2*L_p + B_p)

= 0.707*0.5*(2*15 + 18) = 16.968 in^2

τ_t = F_{lug}*cos(α) / A_{weld}

= 28,431*cos(7.0) / 16.968 = 1,663 psi

= F_{lug}*sin(α) / A_{weld}

τ_s

$= \quad 28{,}431*\sin(7.0) / 16.968 \quad = 204$ psi

Torsional shear:

Weld centroid:

$Y_{barp} = L_p^2 / (2*L_p + B_p)$
$= 15^2 / (2*15 + 18) \quad = 4.6875"$

Second polar moment of area:

$J_p = 0.707*t_{wp}*((8*L_p^3 + 6*L_p*B_p^2 + B_p^3) / 12 - L_p^4 / (2*L_p + B_p))$
$= 0.707*0.5* ((8*15^3 + 6*15*18^2 + 18^3) / 12 - 15^4 / (2*15 + 18)) \qquad = 1453.35 \text{ in}^4$

Radial distance from centroid to weld:

$r_p = \text{sqr}((X_{barp})^2 + (L_p - Y_{barp})^2)$
$= \text{sqr}((0.5*18)^2 + (15 - 4.6875)^2) \quad = 13.6875"$

$\theta_r = \arctan((L_p - Y_{barp}) / (X_{barp}))$
$= \arctan(10.3125 / 9) \qquad = 48.89°$

$\tau_2 = M * r_p / J_p$
$= [F(\alpha)*\cos(\alpha)*(L + L_p - Y_{barp})] * r_p / J_p$
$= (28{,}431*\cos(7.0)*28.3125)*13.6875 / 1453.3490$
$= 7{,}524$ psi

$\tau_{ratio} = \text{sqr}((\tau_t + \tau_2*\sin(\theta_r))^2 + (\tau_s + \tau_2*\cos(\theta_r))^2) / \tau_{allowable} \le 1$
$= \text{sqr} ((1{,}663 + 7{,}524*\sin(48.89))^2 + (204 + 7{,}524*\cos(48.89))^2) / 12{,}000$
$= 0.75 \qquad$ Acceptable

WRC 107 Analysis

Maximum stress ratio occurs at lift angle = 90.00° with lift force = 52,962 lb_f

Geometry	
Height (radial)	1.25"
Width (circumferential)	12"
Length	12"
Fillet Weld Size:	0.75"
Located On	SHELL RG 11 (12" from top end)
Location Angle	0.00° and 180.00°
Reinforcement Pad	
Thickness	0.625"
Width	18"
Length	15"

Weld Size	0.5"

Applied Loads	
Radial load, P_r	0 lb_f
Circumferential moment, M_c	0 lb_f-in
Circumferential shear, V_c	0 lb_f
Longitudinal moment, M_L	66,202.7 lb_f-in
Longitudinal shear, V_L	52,962.19 lb_f
Torsion moment, M_t	0 lb_f-in
Internal pressure, P	0 psi
Mean shell radius, R_m	30.3125"
Design factor	3

Maximum stresses due to the applied loads at the lug edge

$\gamma = R_m / T = 30.3125 / 1.25 = 24.25$

$C_1 = 6.75$, $C_2 = 6.75$ in

Local circumferential pressure stress = $P*R_i / T = 0$ psi

Local longitudinal pressure stress = $P*R_i / (2*T) = 0$ psi

Maximum combined stress $(P_L+P_b+Q) = 3{,}138$ psi
Allowable combined stress $(P_L+P_b+Q) = \pm 3*S = \pm 60{,}000$ psi

The maximum combined stress (P_L+P_b+Q) is within allowable limits.

Maximum local primary membrane stress $(P_L) = -695$ psi
Allowable local primary membrane stress $(P_L) = \pm 1.5*S = \pm 30{,}000$ psi

The maximum local primary membrane stress (P_L) is within allowable limits.

Stresses at the lug edge per WRC Bulletin 107										
Figure	value	β	A_u	A_l	B_u	B_l	C_u	C_l	D_u	D_l
3C*	2.4297	0.2227	0	0	0	0	0	0	0	0
4C*	3.5078	0.2227	0	0	0	0	0	0	0	0
1C	0.0726	0.2227	0	0	0	0	0	0	0	0
2C-1	0.0424	0.2227	0	0	0	0	0	0	0	0
3A*	1.0211	0.2227	0	0	0	0	0	0	0	0
1A	0.0839	0.2227	0	0	0	0	0	0	0	0
3B*	2.6836	0.2227	-695	-695	695	695	0	0	0	0
1B-1	0.0302	0.2227	-1,137	1,137	1,137	-1,137	0	0	0	0
Pressure stress*			0	0	0	0	0	0	0	0
Total circumferential stress			-1,832	442	1,832	-442	0	0	0	0
Primary membrane circumferential stress*			-695	-695	695	695	0	0	0	0
3C*	2.4297	0.2227	0	0	0	0	0	0	0	0
4C*	3.5078	0.2227	0	0	0	0	0	0	0	0
1C-1	0.0786	0.2227	0	0	0	0	0	0	0	0
2C	0.042	0.2227	0	0	0	0	0	0	0	0
4A*	1.6996	0.2227	0	0	0	0	0	0	0	0
2A	0.044	0.2227	0	0	0	0	0	0	0	0
4B*	0.9788	0.2227	-253	-253	253	253	0	0	0	0
2B-1	0.0498	0.2227	-1,876	1,876	1,876	-1,876	0	0	0	0
Pressure stress*			0	0	0	0	0	0	0	0
Total longitudinal stress			-2,129	1,623	2,129	-1,623	0	0	0	0
Primary membrane longitudinal stress*			-253	-253	253	253	0	0	0	0
Shear from M_t			0	0	0	0	0	0	0	0
Circ shear from V_c			0	0	0	0	0	0	0	0
Long shear from V_L			0	0	0	0	-1,569	-1,569	1,569	1,569
Total Shear stress			0	0	0	0	-1,569	-1,569	1,569	1,569
Combined stress (P_L+P_b+Q)			-2,129	1,623	2,129	-1,623	3,138	3,138	3,138	3,138
* denotes primary stress.										

Maximum stresses due to the applied loads at the pad edge

$\gamma = R_m / T = 30.3125 / 0.625 = 48.5$

$C_1 = 9.5$, $C_2 = 8$ in

Local circumferential pressure stress = $P^*R_i / T = 0$ psi

Local longitudinal pressure stress = $P^*R_i / (2^*T) = 0$ psi

Maximum combined stress (P_L+P_b+Q) = 5,296 psi
Allowable combined stress (P_L+P_b+Q) = ±3*S = ±60,000 psi

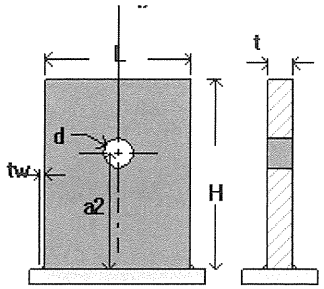
The maximum combined stress (P_L+P_b+Q) is within allowable limits.

Maximum local primary membrane stress (P_L) = -1,358 psi
Allowable local primary membrane stress (P_L) = ±1.5*S = ±30,000 psi

The maximum local primary membrane stress (P_L) is within allowable limits.

Stresses at the pad edge per WRC Bulletin 107										
Figure	value	β	A_u	A_l	B_u	B_l	C_u	C_l	D_u	D_l
3C*	2.5562	0.286	0	0	0	0	0	0	0	0
4C*	5.1696	0.2998	0	0	0	0	0	0	0	0
1C	0.0619	0.3013	0	0	0	0	0	0	0	0
2C-1	0.0138	0.3013	0	0	0	0	0	0	0	0
3A*	1.636	0.296	0	0	0	0	0	0	0	0
1A	0.0602	0.3341	0	0	0	0	0	0	0	0
3B*	3.65	0.2795	-1,358	-1,358	1,358	1,358	0	0	0	0
1B-1	0.0142	0.2858	-1,667	1,667	1,667	-1,667	0	0	0	0
Pressure stress*			0	0	0	0	0	0	0	0
Total circumferential stress			-3,025	309	3,025	-309	0	0	0	0
Primary membrane circumferential stress*			-1,358	-1,358	1,358	1,358	0	0	0	0
3C*	2.3682	0.2998	0	0	0	0	0	0	0	0
4C*	5.3573	0.286	0	0	0	0	0	0	0	0
1C-1	0.0353	0.2912	0	0	0	0	0	0	0	0
2C	0.0304	0.2912	0	0	0	0	0	0	0	0
4A*	4.7213	0.296	0	0	0	0	0	0	0	0
2A	0.0248	0.3277	0	0	0	0	0	0	0	0
4B*	1.8325	0.2795	-672	-672	672	672	0	0	0	0
2B-1	0.0242	0.2956	-2,746	2,746	2,746	-2,746	0	0	0	0
Pressure stress*			0	0	0	0	0	0	0	0
Total longitudinal stress			-3,418	2,074	3,418	-2,074	0	0	0	0
Primary membrane longitudinal stress*			-672	-672	672	672	0	0	0	0
Shear from M_t			0	0	0	0	0	0	0	0
Circ shear from V_c			0	0	0	0	0	0	0	0
Long shear from V_L			0	0	0	0	-2,648	-2,648	2,648	2,648
Total Shear stress			0	0	0	0	-2,648	-2,648	2,648	2,648
Combined stress (P_L+P_b+Q)			-3,418	2,074	3,418	-2,074	5,296	5,296	5,296	5,296
* denotes primary stress.										

TAILING LUG

Geometry Inputs	
	
Attached To	Skirt Base Ring #1
Material	SA-516-70
Orientation	Longitudinal
Distance of Lift Point From Datum	-197.4955"
Angular Position	90°
Length, L	10"
Height, H	13"
Thickness, t	0.8851"
Hole Diameter, d	2"
Pin Diameter, Dp	1.625"
Load Eccentricity, a_1	0"
Distance from Load to Shell or Pad, a_2	8"
Load Angle Normal to Vessel, β	0°
Load Angle from Vertical, ϕ	0°
Welds	
Size, t_w	0.375"

Intermediate Values	
Load Factor	1.5000
Vessel Weight (new, incl. Load Factor), W	105,924.4 lb
Lug Weight (new), W_{lug}	32.2 lb
Distance from Center of Gravity to Top Lug, l_1	640.6445"
Distance from Center of Gravity to Tail Lug, l_2	738.851"
Distance from Vessel Center Line to Tail Lug, l_3	29.5"
Allowable Stress, Tensile, σ_t	22,800 psi
Allowable Stress, Shear, σ_s	15,200 psi
Allowable Stress, Bearing, σ_p	34,200 psi
Allowable Stress, Bending, σ_b	25,080 psi
Allowable Stress, Weld Shear, $\tau_{allowable}$	15,200 psi
Allowable Stress set to 1/3 Sy per ASME B30.20	No

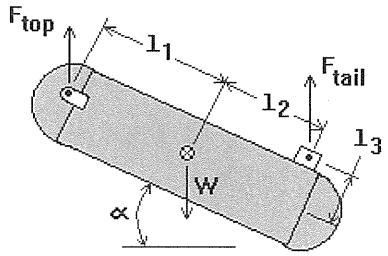
Summary Values	
Required Lift Pin Diameter, d_{reqd}	1.4354"
Required Lug Thickness, t_{reqd}	0.8851"
Lug Stress Ratio, σ_{ratio}	0.33
Weld Shear Stress Ratio, τ_{ratio}	0.68
Lug Design	Acceptable
Base ring loading	Acceptable

Lift Forces

Lift force on lugs during rotational lift ($0° \le \alpha \le 90°$):

$2*F_{top} = W*(l_2*\cos(\alpha) + l_3*\sin(\alpha)) / (l_1*\cos(\alpha) + l_2*\cos(\alpha) + l_3*\sin(\alpha))$

$F_{tail} = W - (2*F)$



α [°]	F_{top}[lbf]	F_{tail}[lbf]
0	28,366	49,192
15	28,506	48,912
30	28,666	48,592
45	28,881	48,162
60	29,245	47,435
75	30,184	45,556
90	52,962	0
42[1]	28,831	48,263
69[2]	29,664	46,596
[1]Lift angle at maximum lug stress.		
[2]Lift angle at maximum weld stress.		

Lug loading at $\alpha = 0°$	
Total lift force	
$F = F_{top} / \cos(\phi)$	
$F = 49,192 / \cos(0.0) =$	49,192 lb_f
Tensile force (parallel to lug normal)	
$F_t = F*\cos(\beta)$	
$F_t = 49,192*\cos(0.0) =$	49,192 lb_f
Shear force (parallel to lug weld)	
$F_s = F*\sin(\beta)$	
$F_s = 49,192*\sin(0.0) =$	0 lb_f

Lug Pin Diameter - Shear stress

$d_{reqd} = (2*F / (\pi*\sigma_s))^{0.5}$
$= (2*49,192 / (\pi*15,200))^{0.5} = \underline{1.4354"}$

$d_{reqd} / D_p = 1.4354 / 1.625 = 0.88$ Acceptable

$\sigma = F / A$
$= F / (2*(0.25*\pi*D_p^2))$
$= 49,192 / (2*(0.25*\pi*1.625^2)) = 11,859$ psi

$\sigma / \sigma_s = 11,859 / 15,200 = 0.78$ Acceptable

Lug Thickness - Tensile stress

$t_{reqd} = F_r / ((L - d)*\sigma_t)$
$= 49,192 / ((10 - 2)*22,800) = 0.2697"$

t_{reqd} / t = 0.2697 / 0.8851 = 0.30 Acceptable

σ = F_r / A
= $F_r / ((L - d)*t)$
= 49,192 / ((10 - 2)*0.8851) = 6,947 psi

σ / σ_t = 6,947 / 22,800 = 0.3 Acceptable

Lug Thickness - Bearing stress

t_{reqd} = $F / (D_p*\sigma_p)$
= 49,192 / (1.625*34,200) = 0.8851"

t_{reqd} / t = 0.8851 / 0.8851 = 1.00 Acceptable

σ = $F / A_{bearing}$
= $F / (D_p*(t))$
= 49,192 / (1.625*(0.8851)) = 34,200 psi

σ / σ_p = 34,200 / 34,200 = 1 Acceptable

Lug Thickness - Shear stress

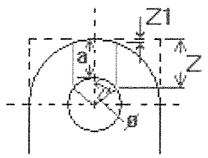
t_{reqd} = $[F_v / \sigma_s] / (2*L_{shear})$
= (49,192 / 15,200) / (2*4.2349) = 0.3821"

t_{reqd} / t = 0.3821 / 0.8851 = 0.43 Acceptable

τ = F_v / A_{shear}
= $F_v / (2*t*L_{shear})$
= 49,192 / (2*0.8851*4.2349) = 6,562 psi

τ / σ_s = 6,562 / 15,200 = 0.43 Acceptable

Shear stress length (per Pressure Vessel and Stacks, A. Keith Escoe)



ϕ = $55*D_p / d$
= 55*1.625 / 2
= 44.6875°
L_{shear} = $(H - a2 - 0.5*d) + 0.5*D_p*(1 - \cos(\phi))$

= (13 - 8 - 0.5*2) + 0.5*1.625*(1 - cos(44.6875))

= 4.2349"

Lug Plate Stress

Lug stress tensile + bending during lift:

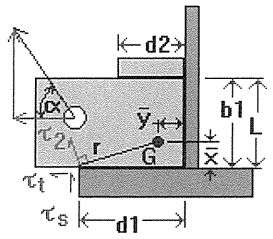
σ_{ratio} = $[F_{ten} / (A_{ten}*\sigma_t)] + [M_{bend} / (Z_{bend}*\sigma_b)] \le 1$

= $[(F_{tail}(\alpha)*\cos(\alpha)) / (t*L*\sigma_t)] + [(6*\text{abs}(F_{tail}(\alpha)*\sin(\alpha)*Hght - F_{tail}(\alpha)*\cos(\alpha)*a_1)) / (t*L^2*\sigma_b)] \le 1$

= 48,263*cos(42.0) / (0.8851*10*22,800) + 6*abs(48,263*sin(42.0)*1.75 - 48,263*cos(42.0)*0) / (0.8851*10²*25,080)

= 0.33 Acceptable

Weld Stress



Weld stress, tensile, bending and shear during lift:

Direct shear:

Maximum shear stress occurs at lift angle 69.00°; lift force = 46,596 lb_f

F_{lug} = $F_{top} / \cos(\phi)$

= 46,596 / cos(0.0) = 46,596 lb_f

A_{weld} = $2*(0.707)*t_w*(d_1 + b_1 + d_2 + t)$

= $2*(0.707)*0.375*(6.5 + 10 + 6.25 + 0.8851)$ = 12.5325 in^2

τ_t = $F_{tail}*\cos(\alpha) / A_{weld}$

= 46,596*cos(69.0) / 12.5325 = 1,332 psi

τ_s = $F_{tail}*\sin(\alpha) / A_{weld}$

= 46,596*sin(69.0) / 12.5325 = 3,471 psi

Torsional shear:

Weld areas

A_i = $0.707*t_w*L_i$

A_1 = 0.707*0.375*6.5 = 1.7233 in^2

A_2 = 0.707*0.375*10 = 2.6513 in^2

A_3 = 0.707*0.375*6.25 = 1.657 in^2

$A_{weld\ torsion}$ = ΣA_i = 6.0316 in^2

Weld centroid locations

x_1 = 0"
y_1 = 3.25"
x_2 = 5"
y_2 = 0"
x_3 = 10"
y_3 = 3.125"
X_{bar} = $\Sigma (A_i*x_i) / \Sigma A_i$
Y_{bar} = $\Sigma (A_i*y_i) / \Sigma A_i$
X_{bar} = (1.7233*0 + 2.6513*5 + 1.657*10) / 6.0316 = 4.9451"
Y_{bar} = (1.7233*3.25 + 2.6513*0 + 1.657*3.125) / 6.0316 = 1.7871"

Radius to centroid locations

r_i = sqr($(X_{bar} - x_i)^2 + (Y_{bar} - y_i)^2$)
r_1 = sqr($(4.9451 - 0)^2 + (1.7871 - 3.25)^2$) = 5.1569"
r_2 = sqr($(4.9451 - 5)^2 + (1.7871 - 0)^2$) = 1.7879"
r_3 = sqr($(4.9451 - 10)^2 + (1.7871 - 3.125)^2$) = 5.229"

Radial distance from centroid to weld:

r = sqr($\Delta X^2 + \Delta Y^2$)
= sqr($4.9451^2 + 4.7129^2$) = 6.8312"

θ_r = arctan($\Delta Y / \Delta X$)
= arctan(4.7129 / 4.9451) = 43.62°

Polar Moment of Area

J_i = $0.707*t_w*(L_i^3) / 12$

J_1 = $0.707*0.375*(6.5^3) / 12$ = 6.0675 in^4

J_2 = $0.707*0.375*(10^3) / 12$ = 22.0938 in^4

J_3 = $0.707*0.375*(6.25^3) / 12$ = 5.394 in^4

J = $2*\Sigma (J_i + A_i*r_i^2)$ Parallel axis theorem (weld on both sides of lug)

J = $2*[6.0675 + 1.7233*(5.1569)^2 + (22.0938 + 2.6513*(1.7879)^2) + (5.3940 + 1.657*(5.229)^2)]$ = 266.33 in^4

Secondary shear

τ_2 = M * r / J
= $[F(\alpha)*\cos(\alpha)*(X - X_{bar}) - F(\alpha)*\sin(\alpha)*(Y - Y_{bar})] * r / J$
= (46,596*cos(69.0)*(5 - 4.9451) - 46,596*sin(69.0)*(8 - 1.7871))*6.8312 / 266.3341

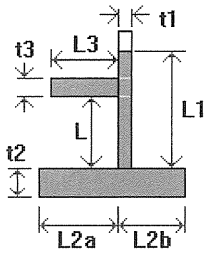
$= \quad -6{,}909 \text{ psi}$

$\tau_{ratio} = \text{sqr}((\tau_t + \tau_2 * \cos(\theta_r))^2 + (\tau_s + \tau_2 * \sin(\theta_r))^2) / \tau_{allowable} \le 1$

$= \text{sqr} ((1{,}332 + 6{,}909 * \cos(43.62))^2 + (3{,}471 + 6{,}909 * \sin(43.62))^2) / 15{,}200$

$= \underline{0.68}$ Acceptable

Base Ring Sectional Properties

Base Ring Geometry	
	
t_1	1"
L_1	12.9732"
t_2	1.5"
L_{2a}	6.5"
L_{2b}	2"
t_3	2.25"
L_3	6.25"

Effective skirt length:

$R_m = (D_i + t_1) * 0.5$

$= (41 + 1) * 0.5 \quad = 21"$

$L_1 = t_3 + (3) * \text{Min}(0.78 * \text{sqr}(R_m * t_1), 16 * t_1)$

$= 2.25 + (3) * 0.78 * \text{sqr}(21 * 1) \quad = 12.9732"$

Section Area:

$A_1 = t_1 * L_1 \quad = 1 * 12.9732 \quad = 12.9732 \text{ in}^2$

$A_2 = t_2 * L_2 \quad = 1.5 * (6.5 + 2) \quad = 12.75 \text{ in}^2$

$A_3 = t_3 * L_3 \quad = 2.25 * 6.25 \quad = 14.0625 \text{ in}^2$

$A_{total} = A_1 + A_2 + A_3 \quad = 12.9732 + 12.75 + 14.0625 \quad = 39.7857 \text{ in}^2$

Centroid, C:

$h_1 = L_{2a} + 0.5 * t_1 \quad = 6.5 + 0.5 * 1 \quad = 7"$

$h_2 = 0.5 * (L_{2a} + L_{2b}) \quad = 0.5 * (6.5 + 2) \quad = 4.25"$

$h_3 = 0.5 * L_3 - (L_3 - L_{2a}) \quad = 0.5 * 6.25 - (6.25 - 6.5) \quad = 3.375"$

$C = ((A_1 * h_1) + (A_2 * h_2) + (A_3 * h_3)) / A_{total}$

$= ((12.9732 * 7) + (12.75 * 4.25) + (14.0625 * 3.375)) / 39.7857 \quad = 4.8374"$

Moment of Inertia, I:

$I_1 = (L_1 * t_1^3) / 12 + A_1 * (h_1 - C)^2$

$= (12.9732 * 1^3) / 12 + 12.9732 * (7 - 4.8374)^2 \quad = 61.8 \text{in}^4$

$I_2 = t_2 * (L_{2a} + L_{2b})^3 / 12 + A_2 * (h_2 - C)^2$

$= 1.5*(6.5 + 2)^3 / 12 + 12.75*(4.25 - 4.8374)^2 = 81.2 \text{ in}^4$

$I_3 = (t_3*L_3^3) / 12 + A_3*(h_3 - C)^2$

$= (2.25*6.25^3) / 12 + 14.0625*(3.375 - 4.8374)^2 = 75.9 \text{ in}^4$

$I_{ring} = I_1 + I_2 + I_3$

$= 61.7526 + 81.1655 + 75.8522 = 218.8 \text{in}^4$

Section Modulus, Z:

$Z = I_{ring} / C_{max} = 218.7703 / 4.8374 = 45.224 \text{ in}^3$

Base Ring Loads without stiffener beam

Base Ring Load

$W_r = W = F_{tail} = 49{,}192 \text{ lb}_f$

Base Ring Loading

Reference: Roark's Formulas for Stress & Strain - 6th Edition. Table 17, Case 20

For thin ring sections $k_1 = k_2 = 1$

Change in vertical diameter, $D_V = (-W)*R^3*(\pi*k_1 / 8 - k_2^2 / \pi) / (E * I)$

Internal Moment, $M_A = W*R*(k_2 - 0.5) / (2*\pi)$

Internal Force, $N_A = 0.75*W / \pi$

Internal Shear Force, $V_A = 0$

Ring loading, $W_r = 49{,}192 \text{ lb}_f$

$D_{Vr} = -49{,}192*23.1626^3*(\pi*1 / 8 - 1^2 / \pi) / (29{,}000{,}000*218.7703) = -0.0072"$

$M_{Ar} = 49{,}192*23.1626*(1 - 0.5) / (2*\pi) = 90671.2225 \text{ lbf-in}$

$N_{Ar} = 0.75*49{,}192 / \pi = 11{,}744 \text{ lb}_f$

Load Equations

$LT_M = W*R*(1 - \cos(x) - 0.5*x*\sin(x)) / \pi$

$LT_N = -W*(x*\sin(x)) / (2*\pi)$

$LT_V = W*(\sin(x) - x*\cos(x)) / (2*\pi)$

$M = M_A - N_A*R*(1 - \cos(x)) + V_A*R*\sin(x) + LT_M$

$N = N_A*\cos(x) + V_A*\sin(x) + LT_N$

$V = -N_A*\sin(x) + V_A*\cos(x) + LT_V$

Load Table for Load W_r						
x [°]	**LT_M [in-lbf]**	**LT_N [lbf]**	**LT_V [lbf]**	**M [in-lbf]**	**N [lbf]**	**V [lbf]**
180	0.00	-0.00	0.00	90671.22	11743.68	0.00
150	1115.22	-2049.66	364.45	55343.52	8120.67	-5507.39
120	16883.04	-7100.23	2680.90	-28452.57	-1228.39	-7489.43
90	77832.84	-12297.95	7829.12	-103509.60	-12297.95	-3914.56
60	215108.52	-14200.45	14978.85	-102240.76	-20072.29	4808.53
30	439402.51	-10248.29	21665.12	22489.32	-20418.62	15793.28
0	725369.78	-0.00	24595.90	272013.67	-11743.68	24595.90

(0 ° at lug)

Maximum Stress in Base Ring Section

Allowable Base Ring Stresses

F_a = 0.6*F_y = 22,800 psi
F_b = 0.66*F_y = 25,080 psi
F_s = 0.4*F_y = 15,200 psi

Base Ring Stresses

Maximum combined stress occurs at 0.00 degrees

f_a	= N / A =	-11,744 / 39.7857	=	-295 psi	
f_b	= M / Z =	272,014 / 45.2244	=	6,015 psi	
$f_a / F_a + f_b / F_b$	= 0.25				Acceptable

Maximum shear stress occurs at 0.00 degrees

f_s	= V / A =	24,596 / 39.7857	=	618 psi	
f_s / F_s	= 0.04				Acceptable

SECTION 7
HYDROSTATIC TRAVELER w/CHART AND PNEUMATIC TRAVELER

Spitzer | Curtis Kelly

Hydro Traveler

Section 1 (Quality Manager or Designee Completes)

Job No. 2132 • Hydrostatic Test of ☒ Pressure Vessel ☐ Process Piping • Required Test Pressure: 520 psi.

Hydro in Accordance with: LWI-039 and ASME Section VIII Div. 1 ☒ Div. 2 ☐ B31.3 ☐ Other: _____

Pressure Hold Time 1 hr • No. Gauges Required ☒ 1, ☐ 2 • Chart Recorder Required ☒ Pressure and Temp ☒

Section 2 (Quality Manager or Designee Completes)

Item No.	Job No./Serial No./Drawing No./ Spool No.	Description of Items Tested	Pass/Fail
T-501	2132	42" ID x 60" ID x 98'-0" Seam/Seam Demethanizer	Pass

Section 3 (Hydro Department Completes)

Gauge No. 1 Serial Number: R-1K-15 Gauge Range: 0-1000 Calibration Date: 6/13/17 - 12/13/17

Gauge No. 2 Serial Number: _____ Gauge Range: _____ Calibration Date: _____

Chart Recorder Serial Number: 242E-102312C Chart Recorder Range: 0-1000 Calibration Date: 6/30/17 - 12/30/17

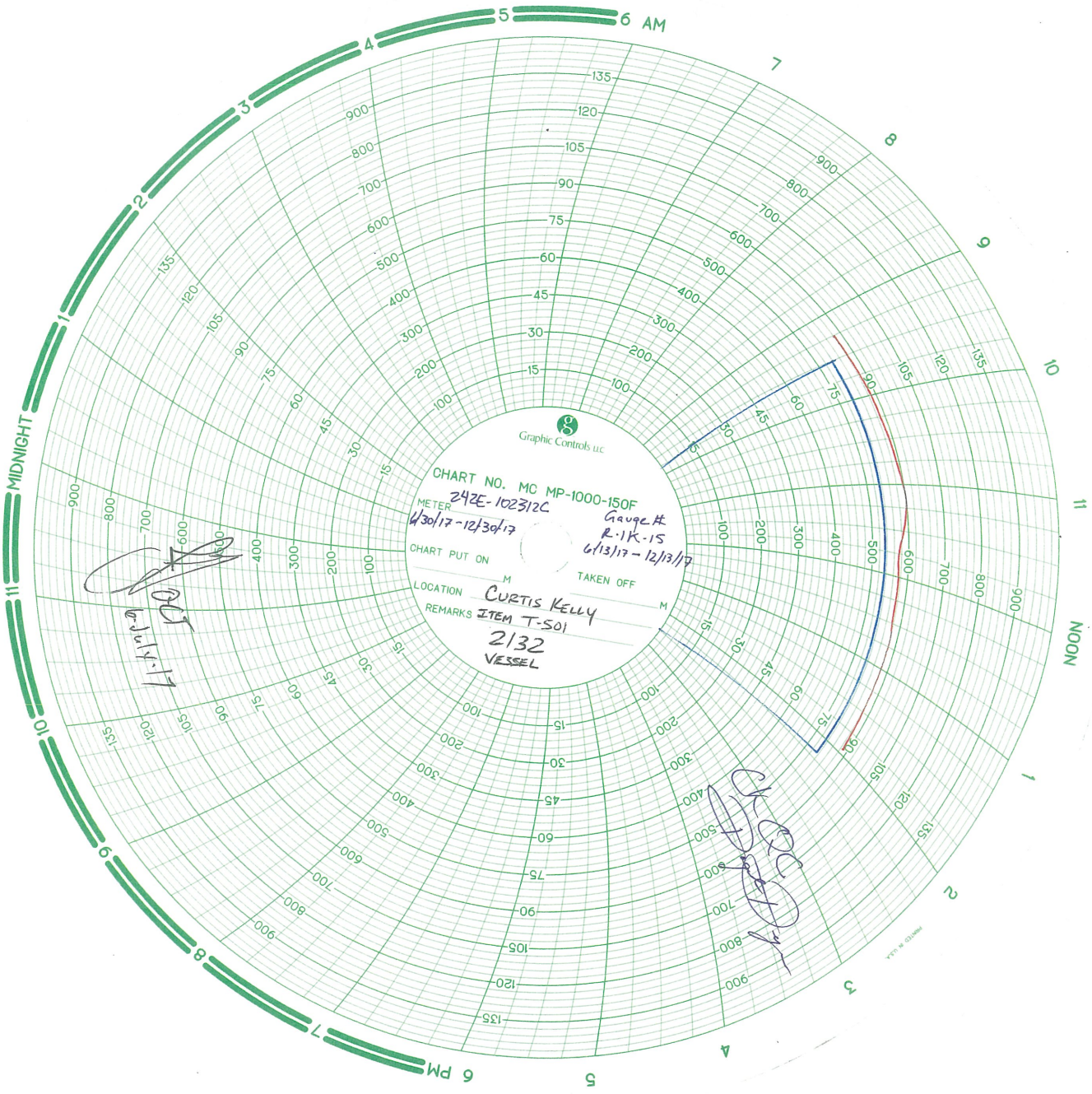
Section 4 (Witness(s) Complete)

Test Conducted By: [signature] Date: 7/6/17

SII QC Rep: Raul Saenz Date: 7/6/17 (Start of Test) SII QC Rep: Raul Saenz Date: 7/6/17 (End of Test)

Customer Rep: [signature] Date: 6-24-17 Customer Rep: _____ Date: _____

Quality Manager: [signature] Date: 7/24/17 Authorized Inspector: [signature] Date: 7.6.17


Graphic Controls LLC
CHART NO. MC MP-1000-150F
METER 242E-10231C
Gauge # R-1K-15
CHART PUT ON 6/30/17 - 12/30/17
6/13/17 - 12/13/17
TAKEN OFF
LOCATION CURTIS KELLY
REMARKS ITEM T-501
2132
VESSEL
MIDNIGHT
6 AM
NOON
6 PM

Spitzer | Curtis Kelly

Hydro Traveler

Section 1 (Quality Manager or Designee Completes)

Job No. 2132 • Hydrostatic Test of ☐ Pressure Vessel ☒ Process Piping • Required Test Pressure: 600 psi.

Hydro in Accordance with: LWI-039 and ASME Section VIII Div. 1 ☐ Div. 2 ☐ B31.3 ☒ Other: _____

Pressure Hold Time 1hr • No. Gauges Required ☒ 1, ☐ 2 • Chart Recorder Required ☒ Pressure and Temp ☒

Section 2 (Quality Manager or Designee Completes)

Item No.	Job No./Serial No./Drawing No./ Spool No.	Description of Items Tested	Pass/Fail
J-447	2132	Downcomer "A"	Pass
		Downcomer "B"	Pass
		Downcomer "C"	Pass
		Downcomer "D"	Pass
		Downcomer "E"	Pass
		Downcomer "F"	Pass

Section 3 (Hydro Department Completes)

Gauge No. 1 Serial Number: R-1K-15 Gauge Range: 0-1000 Calibration Date: 6-13-17 - 12-13-17

Gauge No. 2 Serial Number: _____ Gauge Range: _____ Calibration Date: _____

Chart Recorder Serial Number: 242E-102312C Chart Recorder Range: 0-1000 Calibration Date: 6-30-17 - 12-30-17

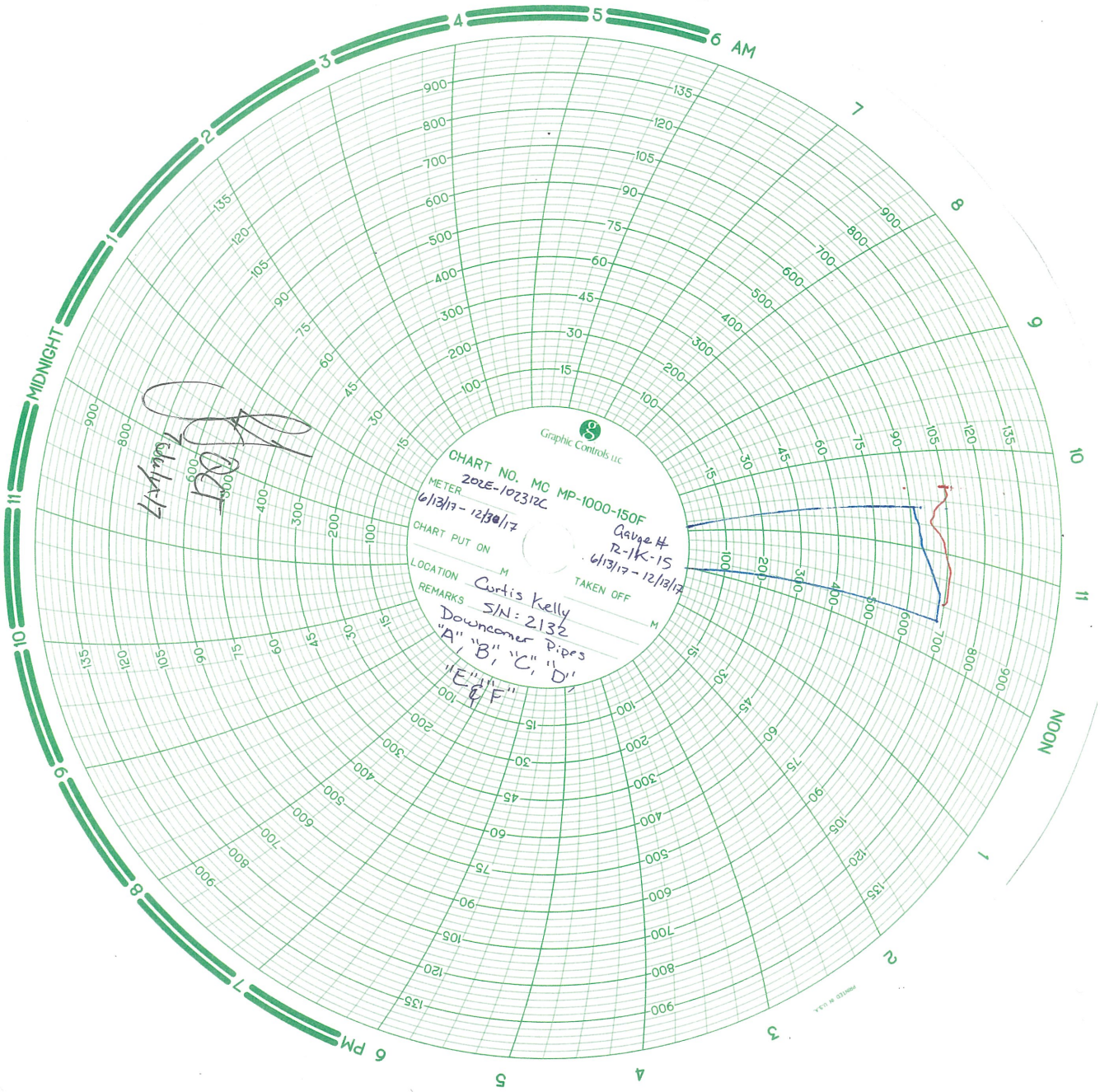
Section 4 (Witness(s) Complete)

Test Conducted By: Nega Allen Date: 7/7/17

SII QC Rep: Raul Saenz Date: 7/7/17 (Start of Test) SII QC Rep: Raul Saenz Date: 7/7/17 (End of Test)

Customer Rep: _____ Date: 7-July-17 Customer Rep: _____ Date: _____

Quality Manager: _____ Date: 7/24/17 Authorized Inspector: _____ Date: _____


Graphic Controls LLC
CHART NO. MC MP-1000-150F
2026-102312C
METER
6/13/17 - 12/13/17
CHART PUT ON
M
LOCATION Curtis Kelly
REMARKS S/N: 2132
Downcomer Pipes
"A" "B" "C" "D"
"E" & "F"
Gauge #
R-1K-15
6/13/17 - 12/13/17
TAKEN OFF
M
MIDNIGHT
6 AM
NOON
6 PM
Tested 12-14-17

Certificate of Calibration

Report number FASTCAL-C02982

INDUSTRIAL INSTRUMENT CO. OF HOUSTON 3511 PINEMONT DR. SUITE A-1 HOUSTON, TX 77018

Manufacturer	Model	Gauge Number	Serial Number	Calibration Date	Expiration Date
Ashcroft	1259 - 1K	R-1K-15	R-1K-15	6/13/2017	12/13/2017

Model Uncertainty
+/- ASME 1A of span (1%)

All instrument calibrations are verified for accuracy before they are shipped. The recommended calibration interval for this instrument is 12 months from the date of verification. Your particular quality assurance requirements may supersede this recommendation.

As Received Condition: In tolerance **As Left Condition:** In tolerance

Laboratory ambient conditions throughout this calibration were:

Temperature 74F

Reference Standards used in this calibration are traceable to the National Institute of Standards and Technology of the United States, through the following report numbers:

Manufacturer	Model	Serial Number	Report Number	Due Date	Reference Uncertainty
Crystal Engineering	10KPSIXP2I	261028	157238	28-Oct-17	0-20% of FS: ±(0.02% of FS); 20%-100% of FS: ±(0.1% of Rdg)

This certificate shall not be reproduced except in full, without written approval.

Laboratory Representative

Test Results

Report number FASTCAL-C02982
SN - R-1K-15
As Received Test Results 1000 PSI

Reference Reading	Gauge Reading	Allowable Tolerance	Difference	Difference (% of FS)	Condition
0	0	10	0	0.00%	Pass
199	200	10	1	0.10%	Pass
399	400	10	1	0.10%	Pass
599	600	10	1	0.10%	Pass
799	800	10	1	0.10%	Pass
1000	1000	10	0	0.00%	Pass
800	800	10	0	0.00%	Pass
600	600	10	0	0.00%	Pass
400	400	10	0	0.00%	Pass
200	200	10	0	0.00%	Pass
0	0	10	0	0.00%	Pass

As Left Test Results 1000 PSI

Reference Reading	Gauge Reading	Allowable Tolerance	Difference	Difference (% of FS)	Condition
0	0	10	0	0.00%	Pass
199	200	10	1	0.10%	Pass
399	400	10	1	0.10%	Pass
599	600	10	1	0.10%	Pass
799	800	10	1	0.10%	Pass
1000	1000	10	0	0.00%	Pass
800	800	10	0	0.00%	Pass
600	600	10	0	0.00%	Pass
400	400	10	0	0.00%	Pass
200	200	10	0	0.00%	Pass
0	0	10	0	0.00%	Pass

AR Head correction: 0 PSI
AL Head correction: 0 PSI

CERTIFIED CALIBRATION REPORT

INDUSTRIAL INSTRUMENT COMPANY

3511 PINEMONT DR. SUITE A-1 HOUSTON TEXAS 77018 PHONE (713) 861-9556

PRESSURE GAUGES / PRESSURE-TEMP.RECORDERS / DEADWEIGHTS TESTERS / CHART DRIVES / RENTALS

CUSTOMER CURTIS KELLY

DATE TESTED 6-30-17

INVOICE NO. 2376 **CERTIFICATE NO.** CE511

CERTIFIED PRESSURE / TEMPERATURE RECORDER
CALIBRATION CERTIFICATE

CUSTOMER ORDER NO. N/A

SERIAL NO. 242E-102312C

INSTRUMENT TYPE:

	READING NUMBERS	APPLIED PRESSURE	ACTUAL READING	DIFFERENCE
1.	1000#	200	200	+/-0
2.		400	400	+/-0
3.		600	600	+/-0
4.		800	800	+/-0
5.		1000	1000	+/-0
6.				
7.				
8.				
9.				
10.				

ROOM TEMP AT TEST 74-DEGREES-F.

THE ABOVE INSTRUMENT HAS BEEN CALIBRATED TO A STANDARD TRACEABLE TO N.I.S.T. AND THE READINGS ARE CORRECT WITHIN (+/-1%)OF THE INDICATED READINGS.

SUPERVISOR OF INSPECTION
KEVIN BATTARBEE

DATE TESTED 06-30-17

DATE DUE 12-30-17

The standards used in this certification have measurement traceability to the National Institute of Standards and Technology (NIST).
The calibrations were performed to customer requirements using standards that have been calibrated at an ISO 9002-2015 accredited laboratory.

STANDARDS UTILIZED

Manufacturer	Model	Serial Number	Report Number	Due Date	Reference Uncertainty
Crystal Engineering	10KPSIXP2I	261028	31630:25727	28-Oct-17	0-20% of FS:+/-(.02% of FS);20%-100% of FS: (+/-.1% of Rdg.
McDaniel	30,000 PSI	12387A	28042:24656	27-June-17	0.5% of Span

INDUSTRIAL INSTRUMENT COMPANY OF HOUSTON
3511 PINEMONT DR. SUITE A-1 HOUSTON, TX. 77018 (713)861-9556

CERTIFIED CALIBRATION REPORT
(TEMPERATURE) DEGREES F.

INDUSTRIAL INSTRUMENT COMPANY HEREBY CERTIFIES THAT THE EQUIPMENT ITEMIZED BELOW HAS BEEN CALIBRATED TO MEET MANUFACTURER'S STANDARDS.

COMPANY NAME: CURTIS KELLY

MANUFACTURER: BARTON RECORDER SERIAL NO. 242E-102312C

CERTIFICATE NO. CE512

DESCRIPTION: 0-150-TEMP.F

CALIBRATED BY: KEVIN BATTARBEE

CALIBRATION DATE: 06-30-17

DATE DUE: 12-30-17

TEMPERATURE DEG.F	TEST READING	INSTRUMENT READING	FINAL
0-150-F			
	40	40	40
	100	100	100
	140	140	140

STANDARDS UTILIZED:

Manufacturer	Model	Serial Number	Report Number	Due Date	Reference Uncertainty
Tegam, Inc.	819A	T-281778	30365:25333	10-28-2017	+/-0.18F Deg.
Vaisala	HMP75	M0550086	H33-16050184	02-06-2018	+/-0 .18F Deg.

TEMPERATURE 74-DEGREES AT TEST

THE STANDARDS USED IN THIS CALIBRATION ARE TRACEABLE TO THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST).
THE CALIBRATIONS PERFORMED TO CUSTOMER REQUIREMENTS USING STANDARDS THAT HAVE BEEN CALIBRATED AT AN ISO/IEC 17025 ACCREDITED LABORATORY.

A and M Technical Services Inc.

4102 Lauder Road, Houston, Texas 77039
P.O. Box 690347, Houston, Texas 77269
Phone (281) 227-0588, Fax (281) 227-0590

Spitzer HFD/Curtis Kelly

13863 Industrial Rd.
Houston, Texas 77015
Attn.: Maria Rubio
Maria.Rubio@spitzerind.com

Report No 16-3141

Revision: 0
Date: October 11, 2016
P.O. No.: 0000428
713-230-5321

Sample: water marked 10-4-16

Chloride ion conc.: 36.5 PPM
Hydrogen ion conc.: 7.0 PH

Tested by Corning Model 925 Chloride Analyzer to comply with ASTM D-512 method B.

Anthony Rudnicki MS
Chief Metallurgist

ANAB ACCREDITED ISO/IEC 17025 TESTING LABORATORY

ISO 9001:2008 Certificate File Number 802083
ISO/IEC 17025:2005 Certificate File Number AT-2057
All test specimens will be discarded after one month
Thank You for Your Business

Spitzer Industries | Curtis Kelly A Spitzer Company

Pneumatic Leak Test Traveler

Section 1 (Quality Manager or Designee Completes)

Job No.:2132 • Pneumatic Test of ☐ Pressure Vessel ☐ Process Piping • Required Test Pressure: 15 psi.

Hydro in Accordance with: LWI-043 and ASME Section VIII Div. 1 ☒ Div. 2 ☐ B31.3 ☐ Other: _____

Pressure Hold Time 5 Minutes min • No. Gauges Required ☒ 1, ☐ 2 • Chart Recorder Required ☐ Pressure and Temp ☐

Section 2 (Quality Manager or Designee Completes)

Item No.	Job No./Serial No./Drawing No./ Spool No.	Description of Items Tested	Pass/Fail	Date:
IT # T-501	2132	Reinforcement Pad for "A"	Pass	6/9/17
		Reinforcement Pad for "B"	Pass	6/9/17
		Reinforcement Pad for "C"	Pass	6/26/17
		Reinforcement Pad for "D"	Pass	3/29/17
		Reinforcement Pad for "E"	Pass	3/29/17
		Reinforcement Pad for "F"	Pass	3/29/17
		Reinforcement Pad for "G"	Pass	3/29/17
		Reinforcement Pad for "H"	Pass	3/29/17
		Reinforcement Pad for "J"	Pass	3/29/17
		Reinforcement Pad for "K1"	Pass	3/29/17
		Reinforcement Pad for "K2"	Pass	3-29-17
		Reinforcement Pad for "K3"	Pass	3/29/17
		Reinforcement Pad for "K4"	Pass	3/29/17
		Reinforcement Pad for "K5"	Pass	6/9/17
		Reinforcement Pad for "K6"	Pass	3/29/17
		Reinforcement Pad for "K7"	Pass	3-29-17
		Reinforcement Pad for "K8"	Pass	3/29/17
		Reinforcement Pad for "L"	Pass	6/26/17
		Reinforcement Pad for "M"	Pass	3/29/17
		Reinforcement Pad for "N1"	Pass	6/9/17
		Reinforcement Pad for "N2"	Pass	6/26/17
		Reinforcement Pad for "N3"	Pass	3-29-17
		Reinforcement Pad for "N4"	Pass	3/29/17

Section 3 (Hydro Department Completes)

Gauge No. 1 Serial Number: 27 Gauge Range: 0-60# Calibration Date: 5/10/17 Due 5-16-17

Gauge No. 2 Serial Number: 27 Gauge Range: 0-60# Calibration Date: 5-31-17 Due 11-30-17

Chart Recorder Serial Number: _____ Chart Recorder Range: _____ Calibration Date: _____

Section 4 (Witness(s) Complete)

Test Conducted By: Hope Allen Date: 3/29/17

SII QC Rep (Start of Test): Doyle Dyer Date: 3/29/17 SII QC Rep (End of Test): Doyle Dyer Date: 6/26/17

Customer Rep: _____ Date: _____ Customer Rep: _____ Date: _____

Quality Manager: _____ Date: 6/29/17 Authorized Inspector: _____ Date: _____

Certificate of Calibration

Report number FASTCAL-C02966

INDUSTRIAL INSTRUMENT CO. OF HOUSTON 3511 PINEMONT DR. SUITE A-1 HOUSTON, TX 77018

Manufacturer	Model	Gauge Number	Serial Number	Calibration Date	Expiration Date
Ashcroft	ASHCROFT 60	27	27	5/31/2017	11/30/2017

Model Uncertainty
+/- ASME 1A of span (1%)

All instrument calibrations are verified for accuracy before they are shipped. The recommended calibration interval for this instrument is 12 months from the date of verification. Your particular quality assurance requirements may supersede this recommendation.

As Received Condition: In tolerance **As Left Condition:** In tolerance

Laboratory ambient conditions throughout this calibration were:

Temperature 74F

Reference Standards used in this calibration are traceable to the National Institute of Standards and Technology of the United States, through the following report numbers:

Manufacturer	Model	Serial Number	Report Number	Due Date	Reference Uncertainty
Crystal Engineering	5KPSIXP2I	255979	4676123	27-Jun-17	0-20% of FS: ±(0.02% of FS); 20%-100% of FS: ±(0.1% of Rdg)

This certificate shall not be reproduced except in full, without written approval.

Laboratory Representative

Test Results

Report number FASTCAL-C02966

SN - 27

As Received Test Results **60 PSI**

Reference Reading	Gauge Reading	Allowable Tolerance	Difference	Difference (% of FS)	Condition
0.0	0	0.6	0.0	0.00%	Pass
15.2	15	0.6	-0.2	-0.33%	Pass
30.4	30	0.6	-0.4	-0.67%	Pass
45.0	45	0.6	0.0	0.00%	Pass
60.0	60	0.6	0.0	0.00%	Pass
44.9	45	0.6	0.1	0.17%	Pass
30.0	30	0.6	0.0	0.00%	Pass
15.0	15	0.6	0.0	0.00%	Pass
0.0	0	0.6	0.0	0.00%	Pass

As Left Test Results **60 PSI**

Reference Reading	Gauge Reading	Allowable Tolerance	Difference	Difference (% of FS)	Condition
0.0	0	0.6	0.0	0.00%	Pass
15.2	15	0.6	-0.2	-0.33%	Pass
30.4	30	0.6	-0.4	-0.67%	Pass
45.0	45	0.6	0.0	0.00%	Pass
60.0	60	0.6	0.0	0.00%	Pass
44.9	45	0.6	0.1	0.17%	Pass
30.0	30	0.6	0.0	0.00%	Pass
15.0	15	0.6	0.0	0.00%	Pass
0.0	0	0.6	0.0	0.00%	Pass

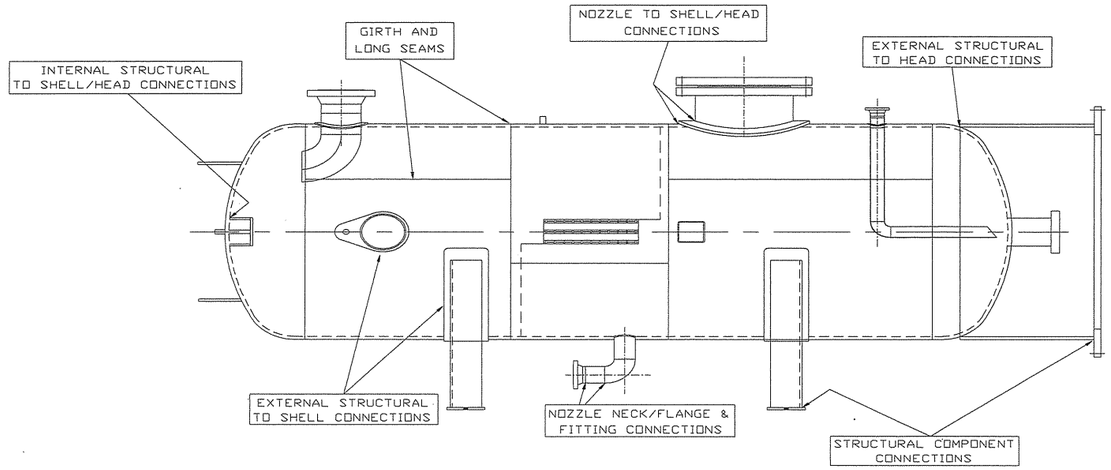
AR Head correction: 0.0 PSI

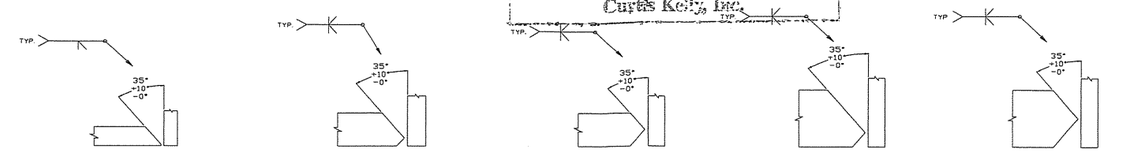
AL Head correction: 0.0 PSI

SECTION 8
WELD MAP / WPS MAP

Spitzer INDUSTRIES | Curtis Kelly A SPITZER COMPANY

APPROVED FOR CONSTRUCTION
WJ 2132 12/29/16
Curtis Kelly, Inc.





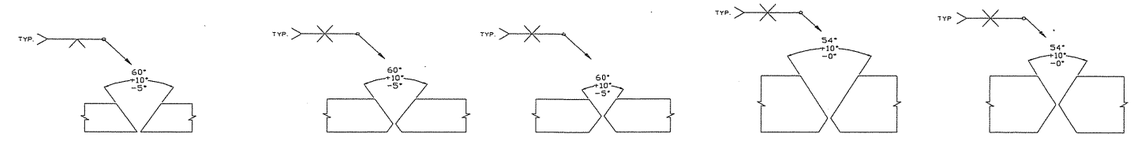
SINGLE BEVEL (INSIDE OR OUTSIDE) THRU 1.500" NOZZLE JOINT DETAILS

75/25 DOUBLE BEVEL (INSIDE OR OUTSIDE) OVER 1.500" THRU < 3.0" NOZZLE JOINT DETAILS

50/50 DOUBLE BEVEL

75/25 DOUBLE BEVEL (INSIDE OR OUTSIDE) 3.00" THICK & ABOVE NOZZLE JOINT DETAILS

50/50 DOUBLE BEVEL



SINGLE VEE JOINT (INSIDE OR OUTSIDE) THRU 1.500" THICK SEAM JOINT DETAILS

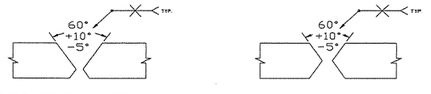
75/25 DOUBLE VEE (INSIDE OR OUTSIDE) OVER 1.500" THRU < 3.0" THICK SEAM JOINT DETAILS

50/50 DOUBLE VEE

75/25 DOUBLE VEE (INSIDE OR OUTSIDE) 3.00" THICK & ABOVE SEAM JOINT DETAILS

50/50 DOUBLE VEE

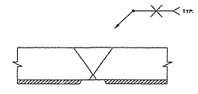
NOTES:
1. LONG SEAM JOINTS (THRU 1.500") MAY ALSO BE CONSTRUCTED USING A DOUBLE VEE JOINT DETAIL AS ILLUSTRATED BELOW.



75/25 DOUBLE VEE JOINT (INSIDE OR OUTSIDE)

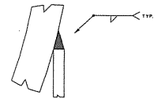
50/50 DOUBLE VEE JOINT

CORROSION RESISTANT WELD OVERLAY MAY NOT REPRESENT ALL TYPES AVAILABLE.



CLAD OVERLAY

TYPICAL FULL THICKNESS FILLET JOINT DETAIL.



HEAD/SKIRT JOINT

SN J-2132, DEMETHANIZER, ITEM NO. T-501, WPS USAGE MAP Rev. 1

GIRTH & LONG SEAMS		
WPS	PROCESS(ES)	REMARKS
AS-P8-P8-A-36 Rev. 1	SAW	With backing or back-gouge only.
62D Rev. 4	FCAW	With backing or back-gouge only.
---	---	---

NOZZLE TO SHELL/HEAD CONNECTIONS		
WPS	PROCESS(ES)	REMARKS
AS-P8-P8-A-36 Rev. 1	SAW	With backing or back-gouge only.
62D Rev. 4	FCAW	With backing or back-gouge only.
---	---	---

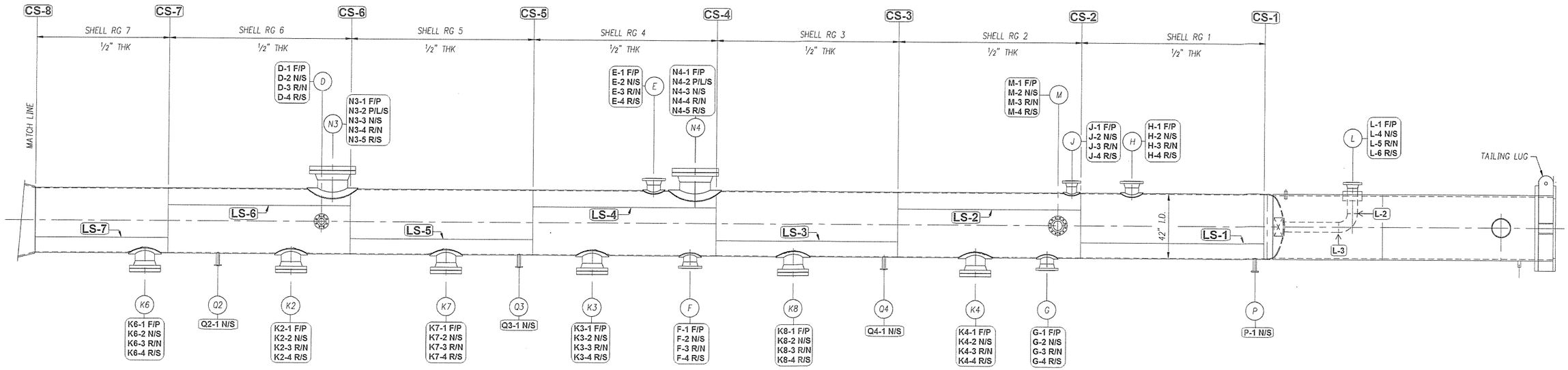
NOZZLE NECK/FLANGE & FITTING CONNECTIONS		
WPS	PROCESS(ES)	REMARKS
69 Rev. 10	GTAW	For use on single side full penetration welds.
62D Rev. 4	FCAW	With backing or back-gouge only.
AS-P8-P8-A-36 Rev. 1	SAW	With backing or back-gouge only.

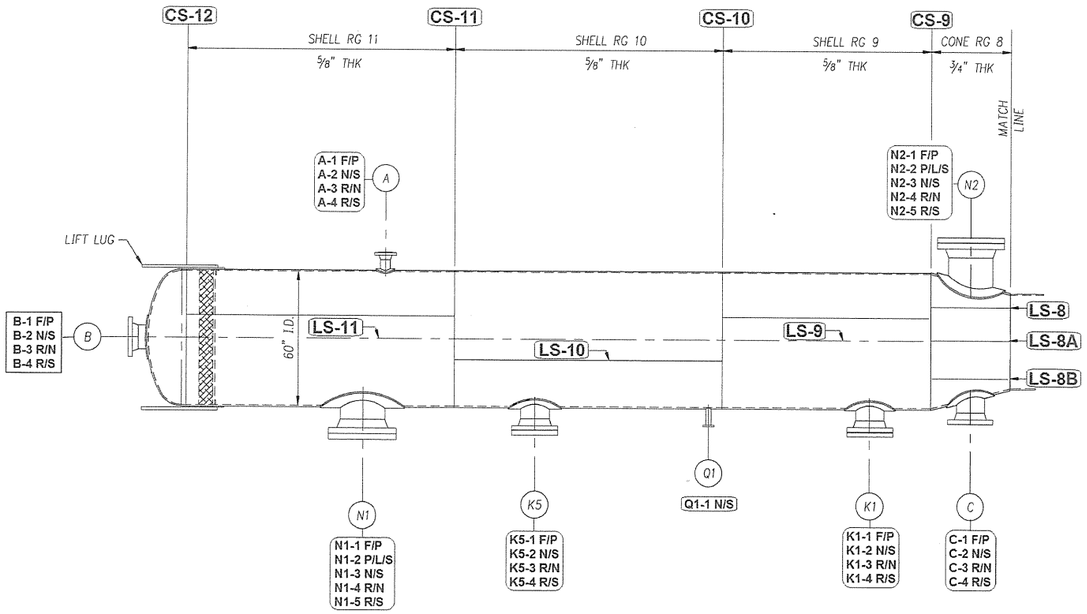
EXTERNAL STRUCTURAL TO SHELL/HEAD CONNECTIONS		
WPS	PROCESS(ES)	REMARKS
AS-P8-P8-A-36 Rev. 1	SAW	With backing or back-gouge only.
62D Rev. 4	FCAW	With backing or back-gouge only.
AS-P1-P1-F-A-26 Rev. 7	FCAW/SAW	With backing or back-gouge only. For Skirt Long Seam (Carbon to Carbon Steel)

INTERNAL STRUCTURAL SHELL/HEAD CONNECTIONS		
WPS	PROCESS(ES)	REMARKS
69 Rev. 10	GTAW	For use on single side full penetration welds.
62D Rev. 4	FCAW	With backing or back-gouge only.
---	---	---

STRUCTURAL TO STRUCTURAL COMPONENT CONNECTIONS		
WPS	PROCESS(ES)	REMARKS
62D Rev. 4	FCAW	With backing or back-gouge only.
64 Rev. 9	FCAW	With backing or back-gouge only. For Stainless to Carbon Steel Connections.
114IT Rev. 1	FCAW	With backing or back-gouge only. For Carbon to Carbon Steel Connections.

See QC generated Weld Maps for weld identification and locations. In case of conflict, weld joints shown on drawings supersede those shown in this WPS Usage Map.
TBQ = To Be Qualified.





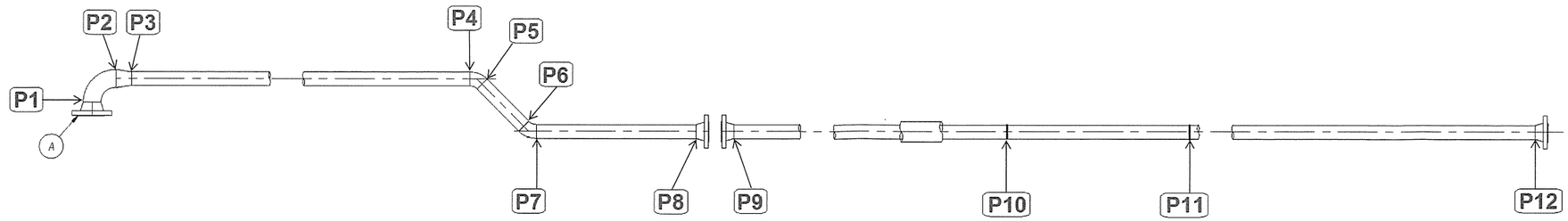
Rev. 0

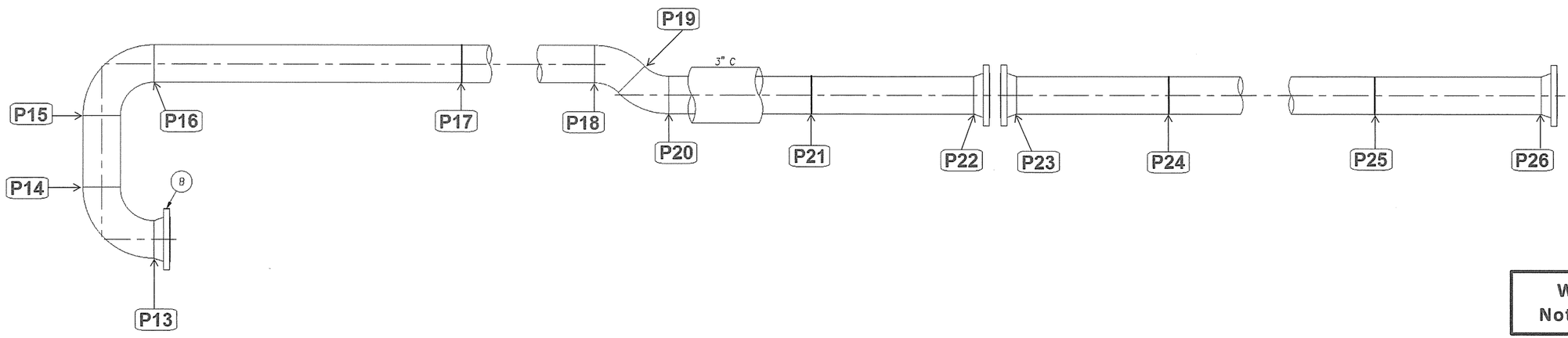
Weld Map Only
Not for Fabrication

F/P - FLANGE TO PIPE
P/L/S - PIPE LONG SEAM
N/S - NOZZLE TO SHELL
R/N - REINFORCEMENT PAD TO NOZZLE NECK
R/S - REINFORCEMENT PAD TO SHELL

CURTIS KELLY, INC.
HOUSTON, TEXAS

DESCRIPTION :	42" I.D. x 60" I.D. x 98'-0" SEAM / SEAM DEMETHANIZER ITEM: T-501		
CUSTOMER:	UOP RUSSELL LLC UOP JOB J-447		
SCALE :		DATE	P.O. No. : 4500739178
DRAWN :			FILE No. :
CHECK :			DWG. NO. 2132
APVD :			





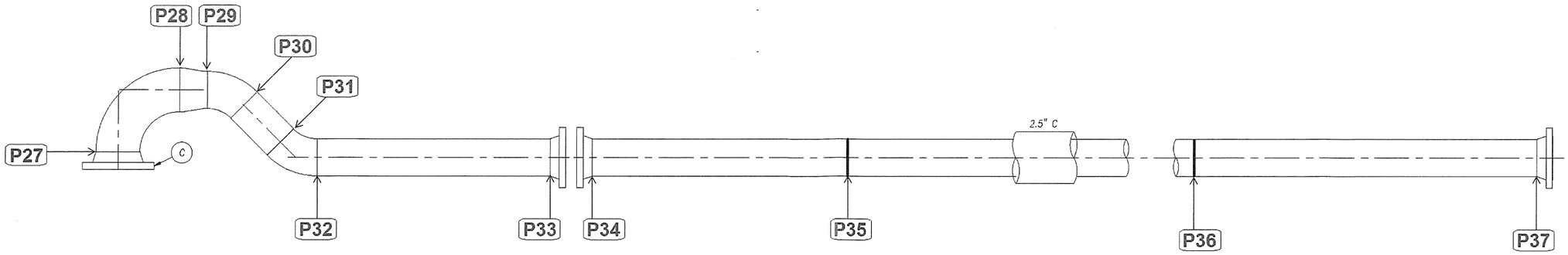
Rev. 0

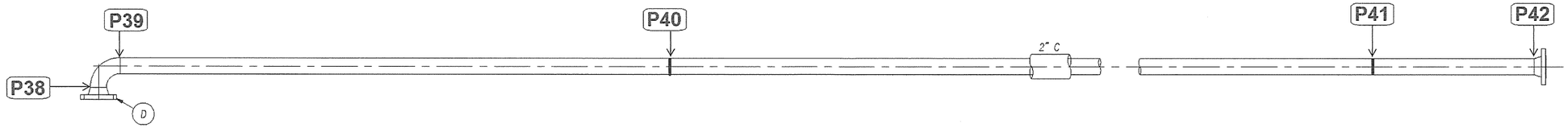
Weld Map Only
Not for Fabrication

CURTIS KELLY, INC.
HOUSTON, TEXAS

DESCRIPTION :	42" I.D. x 60" I.D. x 98'-0" SEAM / SEAM DEMETHANIZER ITEM: T-501
CUSTOMER:	UOP RUSSELL LLC UOP JOB J-447

SCALE :		DATE	P.O. No. : 4500739178
DRAWN :			FILE No. :
CHECK :			DWG. NO. 2132
APVD :			





Rev. 0

Weld Map Only
Not for Fabrication

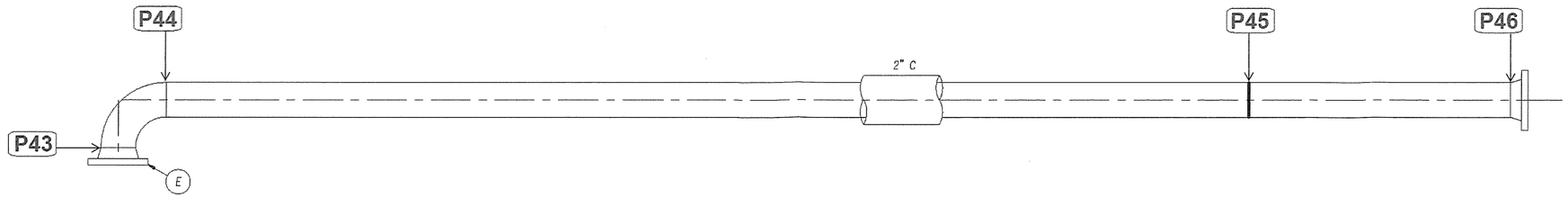
CURTIS KELLY, INC.

HOUSTON, TEXAS

DESCRIPTION : 42" I.D. x 60" I.D. x 98'-0" SEAM / SEAM
DEMETHANIZER
ITEM: T-501

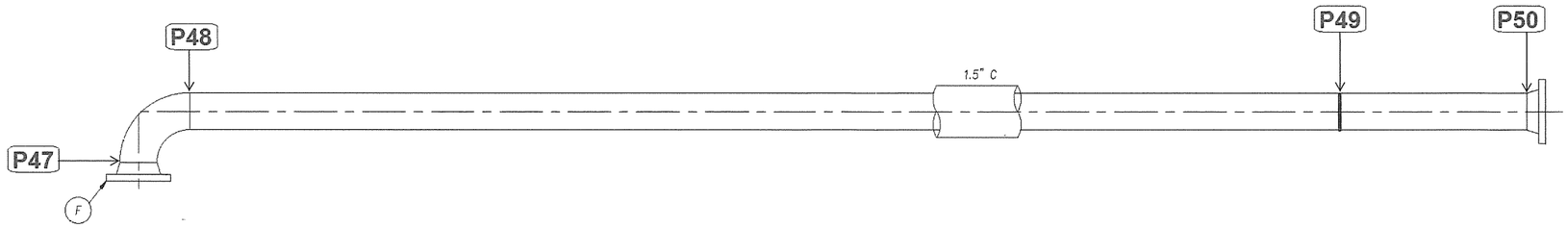
CUSTOMER: UOP RUSSELL LLC
UOP JOB J-447

SCALE :		DATE	P.O. No. : 4500739178
DRAWN :			FILE No. :
CHECK :			DWG. NO. 2132
APVD :			



DETAIL OF 8" DOWNCOMER

ONE (1) REQ'D @ NOZZLE MK "E"



DETAIL OF 8" DOWNCOMER

ONE (1) REQ'D @ NOZZLE MK "F"

Rev. 0

Weld Map Only
Not for Fabrication

CURTIS KELLY, INC.
HOUSTON, TEXAS

DESCRIPTION :	42" I.D. x 60" I.D. x 98'-0" SEAM / SEAM DEMETHANIZER ITEM: T-501
CUSTOMER:	UOP RUSSELL LLC UOP JOB J-447
SCALE : N.T.S.	DATE
DRAWN :	
CHECK :	
APVD :	
P.O. No. : 4500739178	
FILE No. :	
DWG. NO. 2132	

SECTION 9
WELDER QUALIFICATION RECORDS

THE SPITZER COMPANIES

QW-484B – WELDING OPERATOR PERFORMANCE QUALIFICATIONS

Welding operator's name ABEL ZAVALETZ Identification No. 5

Test Description (Information Only)

Identification of WPS followed AS-P10H-P10H-F-A-10 ☒ Test Coupon ☐ Production weld

Specification and type/grade or UNS number of base metal(s) SA240-S31803 Thickness: 1.00"

Base Metal P- or S- Number 10H to P- or S- Number 10H Position (2G, 6G, 3F, etc.) 1G

☒ Plate ☐ Pipe (enter diameter, if pipe or tube Plate

Filler metal (SFA) specification 5.9 Filler metal or electrode classification ER2209 (P2000 FLUX)

Testing Conditions and Qualification Limits When Using Automatic Welding Equipment

Welding Variables (QW-361.1)	Actual values	Range qualified
Type of welding (automatic)	-	-
Welding process	-	-
Filler metal used (Yes / No) (EBW or LBW)	-	-
Type of laser for LBW (CO_2 to YAG, etc.)	-	-
Continuous drive or inertia welding (FW)	-	-
Vacuum or out of vacuum (EBW)	-	-

Testing Conditions and Qualification Limits When Using Machine Welding Equipment

Welding Variables (QW-361.2)	Actual values	Range qualified
Type of welding (machine)	Machine	Machine
Welding process	SAW	SAW
Direct or remote visual control	Direct	Direct
Automatic arc voltage control (GTAW)	N/A	-
Automatic joint tracking	None	-
Position qualified (2G, 6G, 3F, etc.)	1G	1G
Consumable inserts (GTAW or PAW)	None Used	None
Backing (with/without)	with	With Backing or back gouge
Single or multiple passes per side	Multiple	Multiple

RESULTS

Visual Examination of Completed Weld (QW-302.4) **Satisfactory**

☐Transverse face and root bends [QW-462.3 (a)]; ☐Longitudinal bends [QW-462.3 (b)]; ☒Side bends (QW-462.2)

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

☐Plate bend specimen, corrosion-resistant weld metal overlay [QW-462.5 (d)];

☐ Pipe specimen macro test for fusion [QW-462.5 (b)]; ☐ Plate specimen macro test for fusion [QW-462.5 (e)];

Type	Result	Type	Result	Type	Result
Side Bend	Satisfactory			-	-
Side Bend	Satisfactory			-	-

Alternative radiographic examination results (QW-191) N/A

Fillet weld -- Fracture test (QW-181.2) N/A Length and percent of defects -

☐ Fillet welds in plate [QW-462.4(b)] ☐ Fillet welds in pipe [QW-462.4(c)

Macro examination (QW-184) - Fillet size (in.): - X - Concavity/convexity (in.): -

Other tests

Film or specimens evaluated by: N/A Company -

Mechanical tests conducted by: Accu Test Laboratory Laboratory Test Number 525220.00

Welding supervised by Billy Free

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

Manufacturer or Contractor **The Spitzer Companies**

Date: 10/3/2011 Certified by:

THE SPITZER COMPANIES

QW-484B – WELDING OPERATOR PERFORMANCE QUALIFICATIONS

Welding operator's name ABEL ZAVALETZ Identification No. 5

Test Description (Information Only)

Identification of WPS followed AS-P1-S-A-148 Rev.2 ☐ Test Coupon ☒ Production weld

Specification and type/grade or UNS number of base metal(s) SA516-70 NORMALIZED Thickness: 0.625""

Base Metal P- or S- Number 1 to P- or S- Number 1 Position (2G, 6G, 3F, etc.) 1G

☒ Plate ☐ Pipe (enter diameter, if pipe or tube Plate

Filler metal (SFA) specification 5.17 Filler metal or electrode classification EM14K

Testing Conditions and Qualification Limits When Using Automatic Welding Equipment

Welding Variables (QW-361.1)	Actual values	Range qualified
Type of welding (automatic)	-	-
Welding process	-	-
Filler metal used (Yes / No) (EBW or LBW)	-	-
Type of laser for LBW (CO_2 to YAG, etc.)	-	-
Continuous drive or inertia welding (FW)	-	-
Vacuum or out of vacuum (EBW)	-	-

Testing Conditions and Qualification Limits When Using Machine Welding Equipment

Welding Variables (QW-361.2)	Actual values	Range qualified
Type of welding (machine)	Machine	Machine
Welding process	SAW	SAW
Direct or remote visual control	Direct	Direct
Automatic arc voltage control (GTAW)	N/A	-
Automatic joint tracking	None	-
Position qualified (2G, 6G, 3F, etc.)	1G	1G
Consumable inserts (GTAW or PAW)	None Used	None
Backing (with/without)	with	With Backing or back gouge
Single or multiple passes per side	Multiple	Multiple

RESULTS

Visual Examination of Completed Weld (QW-302.4) **Satisfactory**

☐ Transverse face and root bends [QW-462.3 (a)]; ☐ Longitudinal bends [QW-462.3 (b)]; ☐ Side bends (QW-462.2)

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

☐ Plate bend specimen, corrosion-resistant weld metal overlay [QW-462.5 (d)];

☐ Pipe specimen macro test for fusion [QW-462.5 (b)]; ☐ Plate specimen macro test for fusion [QW-462.5 (e)];

Type	Result	Type	Result	Type	Result
-	-			-	-
-	-			-	-

Alternative radiographic examination results (QW-191) Satisfactory

Fillet weld -- Fracture test (QW-181.2) N/A Length and percent of defects -

☐ Fillet welds in plate [QW-462.4(b)] ☐ Fillet welds in pipe [QW-462.4(c)

Macro examination (QW-184) - Fillet size (in.): - X - Concavity/convexity (in.): -

Other tests -

Film or specimens evaluated by: E. Brillantes / Ramon Flores Company Agd / The Spitzer Companies

Mechanical tests conducted by: N/A Laboratory Test Number N/A

Welding supervised by Reynaldo Saenz

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

Manufacturer or Contractor **The Spitzer Companies**

Date: 1/10/2015 Certified by:

QW-484 SUGGESTED FORMAT FOR MANUFACTURER'S RECORD OF WELDER / WELDING OPERATOR QUALIFICATION TESTS

Welders Name: Abel Zavaleta [illegible] Stamp No.: 5

Using WPS No.: 62 Rev. No.: 4
the above welder is qualified for the following ranges.

VARIABLE	Actual Values Used in Qualification	Qualification Range
Process & GMAW transfer mode	FCAW	FCAW
Process Type	Semi Automatic	Semi Automatic
Backing	weld metal	weld metal
Material Spec. P-No. to P-No.	P8 to P8	P1 thru P11,P34,P41~P47
Thickness - Groove	0.5" more than 3 layers	max to be welded
Thickness - Fillet	N/A	all
Diameter - Groove	plate	over 2.875" -F over 24" F,V
Diameter - Fillet	N/A	all
Filler Metal - Spec. No.	SFA 5.22	F6
Filler Metal - F No.	F-6	F6
Dep. Weld Metal Thk. Range-groove	.5"	max to be welded
Dep. Weld Metal Thk. Range-Fillet	N/A	all
Position	3G	F,V,>24"od / F 2.875" ~ 24" F,V,H -fillets
Weld Progression	uphill	uphill
Gas Type	100% argon	any inert shielding gas
Electrical Char. - Current	DC	DC
Electrical Char. - Polarity	Str.	Str.

GUIDED BEND TEST RESULTS QW-462.2, QW462.3 (a), QW-462.3 (b)

Type and Fig. No.	Result
none	

Visual examination results (QW-302.4) - satisfactory
Radiographic test results (QW-304 and QW-305) - satisfactory
Fillet Weld - Fracture test - N/A Length & percent of defects - N/A in.
Macro test fusion - N/A Fillet leg size - N/A in. x N/A in. Concave / convex-N/A in.
Welding test conducted by - Curtis Kelly, Inc.
Mechanical / Radiographic test conducted by - H &G Inspection #06-1801-1

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

Date: 01/20/06

Organization: CURTIS KELLY, INC.
By: Phillip Dunavel

QW-484B SUGGESTED FORMAT B FOR WELDING OPERATOR PERFORMANCE QUALIFICATIONS (WOPQ)
(See QW-301, Section IX, ASME Boiler and Pressure Vessel Code)

Welding operator's name Abel Zavaleta Identification no. "5"

Test Description (*Information Only*)

Identification of WPS followed 133 ☐ Test coupon ☑ Production weld

Specification of base metal(s) SA-240-304 Thickness .75"

Base metal P or S-Number 8 to P or S-Number 8 Position (2G, 6G, 3F, etc.) 1G

☑ Plate ☐ Pipe (enter diameter if pipe or tube):

Filler metal (SFA) specification 5.9 Filler metal or electrode classification ER-308L

Testing Conditions and Qualification Limits When Using Automatic Welding Equipment

Welding Variables (QW-361.1)	Actual Values	Range Qualified
Type of welding (Automatic)		
Welding process		
Filler metal (EBW or LBW)		
Type of laser for LBW (CO_2 to YAG, etc.)		
Continuous drive or inertia welding (FW)		
Vacuum or out of vacuum (EBW)		

Testing Conditions and Qualification Limits When Using Machine Welding Equipment

Welding Variables (QW-361.2)	Actual Values	Range Qualified
Type of welding (machine)	Machine	Machine
Welding process	SAW	SAW
Direct or remote visual control	Direct Visual Control	Direct Visual Contol
Automatic arc voltage control (GTAW)	N/A	N/A
Automatic joint tracking	NO	NO
Position qualified (2G, 6G, 3F, etc.)	1G	1G
Consumable inserts (GTAW or PAW)	N/A	N/A
Backing (metal, weld metal, etc.)	Weld Metal	Weld Metal
Single or multiple passes per side	Multiple	Multiple

RESULTS

Visual Examination of Completed Weld (QW-302.4) Satisfactory

☐ 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 for 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) Satisfactory - Test No: 06-0203-1

Fillet weld — fracture test (QW-180) Length and percent of defects

Macro examination (QW-184) Fillet size (in.) × Concavity/convexity (in.)

Other tests

Film or specimens evaluated by Mark Cagle Company H & G Services

Mechanical tests conducted by Laboratory test no.

Welding supervised by Curtis Kelly, Inc.

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

Organization CURTIS KELLY INC.

Date 3-02-06 By Phillip Howard

/03)

THE SPITZER COMPANIES

QW-484A – WELDER PERFORMANCE QUALIFICATIONS (WPQ)

Welders Name **Pedro Sanchez** Identification No. **E**

Test Description

Identification of WPS followed **255** ☑ Test Coupon ☐ Production weld

Specification and type/grade or UNS number of base metal(s) **SA516-70N** Thickness: **.5"**

Testing Conditions and Qualification Limits

Welding Variables (QW-350)	Actual values	Range qualified
Welding process (es)	FCAW	FCAW
Type (i.e., manual, semi-automatic) used	Semi-automatic	Semi-automatic
Backing (with/without, metal, weld metal, double-welded, etc.)	Without backing	Without backing
☒ Plate ☐ Pipe (enter diameter, if pipe or tube)	½"	>or= 2 7/8" O.D.
Base metal P- or S-Number to P-or S-Number	P1 TO P1	P1-P11,P34,P41-P49
Filler metal or electrode specification(s) (SFA) (info only)	5.20	
Filler metal or electrode classification(s) (info only)	E71T-1	
Filler metal F-Number(s)	F6	F6
Consumable insert (GTAW or PAW)		
Filler type (solid/metal or flux cored/powder (GTAW or PAW)	None	None
Deposit thickness for each process	Flux cored	Solid&/Flux cored
Process 1: FCAW 3 layers minimum ☒ Yes ☐ No	½"	Unlimited
Process 2: 3 layers minimum ☐ Yes ☐ No	N/A	N/A
Position qualified (2G, 6G, 3F, etc.)	3G	F,V(Fillet-F,H,&V)
Vertical progression (uphill or downhill)	Uphill	Uphill
Type of fuel gas (OFW)	N/A	With or without
Inert gas backing (GTAW, PAW, GMAW)	N/A	N/A
Transfer mode (spray/globular or pulse to short circuit –GMAW)	SHORT CIRCUITING	SHORT CIRCUITING
GTAW current type/polarity (AC, DCEP, DCEN)	N/A	N/A

RESULTS

Visual Examination of Completed Weld (QW-302.4) Acceptable per Troy Gilmer

☐Transverse face and root bends [QW-462.3 (a)]; ☐Longitudinal bends [QW-462.3 (b)]; ☐Side bends (QW-462.2)

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

☐Plate bend specimen, corrosion-resistant weld metal overlay [QW-462.5 (d)];

☐ Pipe specimen macro test for fusion [QW-462.5 (b)]; ☐ Plate specimen macro test for fusion [QW-462.5 (e)];

Type	Result	Type	Result	Type	Result

Alternative radiographic examination results (QW-191) **Goolsby Testing Inc. 10-10-2010**

Fillet weld -- Fracture test (QW-180) _____ Length and percent of defects _____

☐ Fillet welds in plate [QW-462.4(b)] ☐ Fillet welds in pipe [QW-462.4(c)

Macro examination (QW-184) _____ Fillet size (in.): _____ X _____ Concavity/convexity (in.): _____

Other tests _____

Film or specimens evaluated by: Travis Rankin Company **Goolsby testing Inc.**

Mechanical tests conducted by: _____ Laboratory Test Number _____

Welding supervised by **Pete Guillory**

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

Manufacturer or Contractor **Curtis Kelly Inc.**

Date: **12-Oct.-10** Certified by: *Troy Gilmer*

Spitzer INDUSTRIES

QW-484A – WELDER PERFORMANCE QUALIFICATIONS (WPQ)

Welders Name **Pedro Sanchez** Identification No. **E**

Test Description

Identification of WPS followed **AS-P1-S-F-A-43 Rev. 1D** ☒ Test Coupon ☐ Production weld

Specification and type/grade or UNS number of base metal(s) **SA36** Thickness: **1.00"**

Testing Conditions and Qualification Limits

Welding Variables (QW-350)	Actual values	Range qualified
Welding process (es)	FCAW	FCAW
Type (i.e., manual, semi-automatic) used	Semi-Automatic	Semi-Automatic
Backing (with/without, metal, weld metal, double-welded, etc.)	With Backing	W/Backing or Back Gouge
☒ Plate ☐ Pipe (enter diameter, if pipe or tube)	Plate	2.875" & Up
Base metal P- or S-Number to P-or S-Number	P1 to P1	P1 thru P11 & P4X
Filler metal or electrode specification(s) (SFA) (info only)	5.20	As Applicable
Filler metal or electrode classification(s) (info only)	E71T-1	As Applicable
Filler metal F-Number(s)	6	6
Consumable insert (GTAW or PAW)	N/A	N/A
Filler type (solid/metal or flux cored/powder (GTAW or PAW)	N/A	N/A
Deposit thickness for each process		
Process 1: FCAW 3 layers minimum ☒ Yes ☐ No	1.00"	0.187" Max to be welded
Process 2: - 3 layers minimum ☐ Yes ☐ No	-	-
Position qualified (2G, 6G, 3F, etc.)	1G	Flat
Vertical progression (uphill or downhill)	Up	N/A
Type of fuel gas (OFW)	N/A	N/A
Inert gas backing (GTAW, PAW, GMAW)	None	With/without
Transfer mode (spray/globular or pulse to short circuit –GMAW)	N/A	N/A
GTAW current type/polarity (AC, DCEP, DCEN)	DCEP	DCEP

RESULTS

Visual Examination of Completed Weld (QW-302.4) **Accepted**

☐Transverse face and root bends [QW-462.3 (a)]; ☐Longitudinal bends [QW-462.3 (b)]; ☒Side bends (QW-462.2)

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

☐Plate bend specimen, corrosion-resistant weld metal overlay [QW-462.5 (d)];

☐ Pipe specimen macro test for fusion [QW-462.5 (b)]; ☐ Plate specimen macro test for fusion [QW-462.5 (e)];

Type	Result	Type	Result	Type	Result
Side Bends	Acceptable	Side Bends	Acceptable		
Side Bends	Acceptable	Side Bends	Acceptable		

Alternative radiographic examination results (QW-191)

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

☐ Fillet welds in plate [QW-462.4(b)] ☐ Fillet welds in pipe [QW-462.4(c)

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

Other tests **N/A**

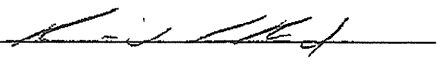
Film or specimens evaluated by: **N/A** Company **N/A**

Mechanical tests conducted by: ____ Laboratory Test Number ____

Welding supervised by **Raul Saenz**

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

Manufacturer or Contractor **The Spitzer Companies**

Date: **1/17/2015** Certified by: 

Spitzer INDUSTRIES

QW-484A – WELDER PERFORMANCE QUALIFICATIONS (WPQ)

Welders Name: **Ignacio Correa Arreda** Identification No.: **EE**

Test Description

Identification of WPS followed: **AS-P1-S-F-A-43 Rev. 1D** ☒ Test Coupon ☐ Production weld

Specification and type/grade or UNS number of base metal(s): **SA36** Thickness: **1.00"**

Testing Conditions and Qualification Limits

Welding Variables (QW-350)	Actual values	Range qualified
Welding process (es)	FCAW	FCAW
Type (i.e., manual, semi-automatic) used	Semi-Automatic	Semi-Automatic
Backing (with/without, metal, weld metal, double-welded, etc.)	With Backing	W/Backing or Back Gouge
☒ Plate ☐ Pipe (enter diameter, if pipe or tube)	Plate	2.875" & Up
Base metal P- or S-Number to P-or S-Number	P1 to P1	P1 thru P11 & P4X
Filler metal or electrode specification(s) (SFA) (info only)	5.20	As Applicable
Filler metal or electrode classification(s) (info only)	E71T-1	As Applicable
Filler metal F-Number(s)	6	6
Consumable insert (GTAW or PAW)	N/A	N/A
Filler type (solid/metal or flux cored/powder (GTAW or PAW)	N/A	N/A
Deposit thickness for each process		
Process 1: FCAW 3 layers minimum ☒ Yes ☐ No	1.00"	0.187" Max to be welded
Process 2: - 3 layers minimum ☐ Yes ☐ No	-	-
Position qualified (2G, 6G, 3F, etc.)	1G	Flat
Vertical progression (uphill or downhill)	Up	N/A
Type of fuel gas (OFW)	N/A	N/A
Inert gas backing (GTAW, PAW, GMAW)	None	With/without
Transfer mode (spray/globular or pulse to short circuit –GMAW)	N/A	N/A
GTAW current type/polarity (AC, DCEP, DCEN)	DCEP	DCEP

RESULTS

Visual Examination of Completed Weld (QW-302.4): **Accepted**

☐Transverse face and root bends [QW-462.3 (a)]; ☐Longitudinal bends [QW-462.3 (b)]; ☒Side bends (QW-462.2)

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

☐Plate bend specimen, corrosion-resistant weld metal overlay [QW-462.5 (d)];

☐ Pipe specimen macro test for fusion [QW-462.5 (b)]; ☐ Plate specimen macro test for fusion [QW-462.5 (e)];

Type	Result	Type	Result	Type	Result
Side Bends	Acceptable	Side Bends	Acceptable		
Side Bends	Acceptable	Side Bends	Acceptable		

Alternative radiographic examination results (QW-191)

Fillet weld --.Fracture test (QW-180): **N/A** Length and percent of defects: **N/A**

☐ Fillet welds in plate [QW-462.4(b)] ☐ Fillet welds in pipe [QW-462.4(c)

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

Other tests: **N/A**

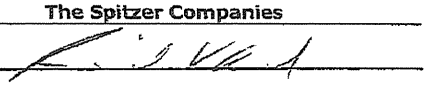
Film or specimens evaluated by: **N/A** Company: **N/A**

Mechanical tests conducted by: ____ Laboratory Test Number: ____

Welding supervised by: **Rogelio Reyes**

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

Manufacturer or Contractor: **The Spitzer Companies**

Date: **12/15/2014** Certified by: 

QW-484A – SUGGESTED FORMAT A FOR WELDER PERFORMANCE QUALIFICATIONS (WPQ)
(SEE QW-301, SECTION IX, ASME BOILER AND PRESSURE VESSEL CODE)

Welders Name: IGNACIO CORREA Identification No.: EE

Test Description

Identification of WPS followed: 62D Rev. 3 ☒ Test Coupon ☐ Production weld

Specification of base metal(s): SA-240-304 Thickness: 3/8""

Testing Conditions and Qualification Limits

Welding Variables (QW-350)	Actual values	Range qualified
Welding process (es)	FCAW	FCAW
Type (i.e., manual, semi-auto) used	Semi-Automatic	Semi-Automatic
Backing (metal, weld metal, double-welded, etc.)	with backing	with backing
☒ Plate ☐ Pipe (enter diameter, if pipe or tube)	3/8"	≥ 2-7/8" O.D.
Base metal P- or S-Number to P-or S-Number	P8 to P8	P1 –P11, P34, P41 ~ P49
Filler metal or electrode specification(s) (SFA) (info only)	5.22	
Filler metal or electrode classification(s) (info only)	E308LT-1	
Filler metal F-Number(s)	F6	F6
Consumable insert (GTAW or PAW)	None	None
Filler type (solid/metal or flux cored/powder (GTAW or PAW)	Flux cored	Solid &/or Flux cored
Deposit thickness for each process		
Process 1: FCAW 3 layers minimum ☒ Yes ☐ No	3/8"	3/4" Max
Process 2: ____ 3 layers minimum ☐ Yes ☐ No	N/A	N/A
Position qualified (2G, 6G, 3F, etc.)	3G	F,V (Fillet – F, H, & V)
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)	SPRAY	SPRAY
GTAW current type/polarity (AC, DCEP, DCEN)	DC-EN	DC-EN

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**

RESULTS

Visual Examination of Completed Weld (QW-302.4): Acceptable per Phillip Hernandez

☐ 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 for 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 per H & G Inspection 1-Dec-07-

Fillet weld -- Fracture test (QW-180): ____ Length and percent of defects: ____

Macro examination (QW-184): ____ Fillet size (in.): ____ X ____ Concavity/convexity (in.): ____

Other tests: ____

Film or specimens evaluated by: S. Brillartes Company: H & G Inspection

Mechanical testing by: ____ Laboratory Test no.: ____

Welding supervised by: Pete Guillory

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

Organization: Curtis Kelly Inc.

Date: 1-Dec-07 By: Nolen R. Glaze Jr.

THE SPITZER COMPANIES

QW-484A – WELDER PERFORMANCE QUALIFICATIONS (WPQ)

Welders Name: **Ignacio Correa** Identification No.: **EE**

Test Description

Identification of WPS followed: **AS-P1-P1-F-A-26** ☒ Test Coupon ☐ Production weld

Specification and type/grade or UNS number of base metal(s): **SA516-70** Thickness: **1.00"**

Testing Conditions and Qualification Limits

Welding Variables (QW-350)	Actual values	Range qualified
Welding process (es)	FCAW	FCAW
Type (i.e., manual, semi-automatic) used	Semi-Automatic	Semi-Automatic
Backing (with/without, metal, weld metal, double-welded, etc.)	With Backing	W/Backing or Back Gouge
☒ Plate ☐ Pipe (enter diameter, if pipe or tube)	Plate	>24" & Up
Base metal P- or S-Number to P-or S-Number	P1 to P1	P1 thru P11 & P4X
Filler metal or electrode specification(s) (SFA) (Info only)	5.20	As Applicable
Filler metal or electrode classification(s) (info only)	E71T-1	As Applicable
Filler metal F-Number(s)	6	6
Consumable insert (GTAW or PAW)	N/A	N/A
Filler type (solid/metal or flux cored/powder (GTAW or PAW)	N/A	N/A
Deposit thickness for each process		
Process 1: FCAW 3 layers minimum ☒ Yes ☐ No	1.00"	0.187" Max to be welded
Process 2: - 3 layers minimum ☐ Yes ☐ No	-	-
Position qualified (2G, 6G, 3F, etc.)	3G	Flat & Vertical
Vertical progression (uphill or downhill)	Up	N/A
Type of fuel gas (OFW)	N/A	N/A
Inert gas backing (GTAW, PAW, GMAW)	None	With/without
Transfer mode (spray/globular or pulse to short circuit –GMAW)	N/A	N/A
GTAW current type/polarity (AC, DCEP, DCEN)	DCEP	DCEP

RESULTS

Visual Examination of Completed Weld (QW-302.4): **Accepted**

☐ Transverse face and root bends [QW-462.3 (a)]; ☐ Longitudinal bends [QW-462.3 (b)]; ☐ Side bends (QW-462.2)

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

☐ Plate bend specimen, corrosion-resistant weld metal overlay [QW-462.5 (d)];

☐ Pipe specimen macro test for fusion [QW-462.5 (b)]; ☐ Plate specimen macro test for fusion [QW-462.5 (e)];

Type	Result	Type	Result	Type	Result
N/A					

Alternative radiographic examination results (QW-191)

Fillet weld -- Fracture test (QW-180): **N/A** Length and percent of defects:

☐ Fillet welds in plate [QW-462.4(b)] ☐ Fillet welds in pipe [QW-462.4(c)

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

Other tests: **RT Report (RT051412-SII-03)**

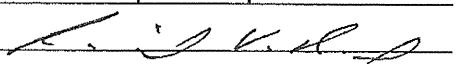
Film or specimens evaluated by: **Blake W Young** Company: **AGD**

Mechanical tests conducted by: ____ Laboratory Test Number: ____

Welding supervised by: **Rusty Gilmer**

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

Manufacturer or Contractor: **The Spitzer Companies**

Date: **5-15-12** Certified by: 

THE SPITZER COMPANIES

QW-484A – WELDER PERFORMANCE QUALIFICATIONS (WPQ)

Welders Name: **Ignacio Correa** Identification No.: **EE**

Test Description

Identification of WPS followed: **62D** ☐ Test Coupon ☒ Production weld

Specification and type/grade or UNS number of base metal(s): **SA240 304L** Thickness: **0.75"**

Testing Conditions and Qualification Limits

Welding Variables (QW-350)	Actual values	Range qualified
Welding process (es)	FCAW	FCAW
Type (i.e., manual, semi-automatic) used	Semi-Automatic	Semi-Automatic
Backing (with/without, metal, weld metal, double-welded, etc.)	Without backing	As applicable
☐ Plate ☒ Pipe (enter diameter, if pipe or tube)	72"	> 24"
Base metal P- or S-Number to P-or S-Number	P8 to P8	P1 thru P11 & P4X
Filler metal or electrode specification(s) (SFA) (info only)	5.22	As Applicable
Filler metal or electrode classification(s) (info only)	E308LT-1	As Applicable
Filler metal F-Number(s)	6	6
Consumable insert (GTAW or PAW)	N/A	N/A
Filler type (solid/metal or flux cored/powder (GTAW or PAW)	N/A	N/A
Deposit thickness for each process		
Process 1: GTAW 3 layers minimum ☒ Yes ☐ No	0.75"	0.187" to Unlimited
Process 2: - 3 layers minimum ☐ Yes ☐ No	N/A	N/A
Position qualified (2G, 6G, 3F, etc.)		ALL
Vertical progression (uphill or downhill)	Up	Up
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)	N/A	N/A
GTAW current type/polarity (AC, DCEP, DCEN)	DCEN	DCEN

RESULTS

Visual Examination of Completed Weld (QW-302.4): **Accepted**

☐Transverse face and root bends [QW-462.3 (a)]; ☐Longitudinal bends [QW-462.3 (b)]; ☐Side bends (QW-462.2)

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

☐Plate bend specimen, corrosion-resistant weld metal overlay [QW-462.5 (d)];

☐ Pipe specimen macro test for fusion [QW-462.5 (b)]; ☐ Plate specimen macro test for fusion [QW-462.5 (e)];

Type	Result	Type	Result	Type	Result
N/A	-	-	-	-	-

Alternative radiographic examination results (QW-191)

Fillet weld -- Fracture test (QW-180): **N/A** Length and percent of defects: _____

☐ Fillet welds in plate [QW-462.4(b)] ☐ Fillet welds in pipe [QW-462.4(c)

Macro examination (QW-184): **N/A** Fillet size (in.): _____ X _____ Concavity/convexity (in.): _____

Other tests: **RT (Report No.1922)**

Film or specimens evaluated by: **Billy Bobbit** Company: **Goolsby Testing, INC.**

Mechanical tests conducted by: **N/A** Laboratory Test Number: **-**

Welding supervised by: **Troy Gilmer**

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

Manufacturer or Contractor: **The Spitzer Companies**

Date: **2-19-11** Certified by: _____

THE SPITZER COMPANIES

QW-484A – WELDER PERFORMANCE QUALIFICATIONS (WPQ)

Welders Name: Gilberto Aguilar Identification No.: H-51

Test Description

Identification of WPS followed: 255-256 HT ☒ Test Coupon ☐ Production weld

Specification and type/grade or UNS number of base metal(s): SA-106 Thickness: 0.719"

Testing Conditions and Qualification Limits

Welding Variables (QW-350)	Actual values	Range qualified
Welding process (es)	GTAW & FCAW	GTAW & FCAW
Type (i.e., manual, semi-automatic) used	Semi-auto	Semi-auto
Backing (with/without, metal, weld metal, double-welded, etc.)	With & without backing	FCAW with backing
☐ Plate ☒ Pipe (enter diameter, if pipe or tube)	6.625"	2.875" & Up
Base metal P- or S-Number to P-or S-Number	P1 to P1	P1 thru P11 & P4X
Filler metal or electrode specification(s) (SFA) (info only)	5.18 & 5.20	As Applicable
Filler metal or electrode classification(s) (info only)	ER70S-6 & E71T-1M	As Applicable
Filler metal F-Number(s)	6	6
Consumable insert (GTAW or PAW)	N/A	N/A
Filler type (solid/metal or flux cored/powder (GTAW or PAW)	N/A	N/A
Deposit thickness for each process		
Process 1: GTAW 3 layers minimum ☐ Yes ☒ No	0.125"	.187" TO Max to be welded
Process 2: FCAW 3 layers minimum ☒ Yes ☐ No	0.594"	0.187" to Unlimited
Position qualified (2G, 6G, 3F, etc.)	6G	All
Vertical progression (uphill or downhill)	Up	Up
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)	GLOBULAR	GLOBULAR
GTAW current type/polarity (AC, DCEP, DCEN)	DCEN	DCEN

RESULTS

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

☐ Transverse face and root bends [QW-462.3 (a)]; ☐ Longitudinal bends [QW-462.3 (b)]; ☐ Side bends (QW-462.2)

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

☐ Plate bend specimen, corrosion-resistant weld metal overlay [QW-462.5 (d)];

☐ Pipe specimen macro test for fusion [QW-462.5 (b)]; ☐ Plate specimen macro test for fusion [QW-462.5 (e)];

Type	Result	Type	Result	Type	Result
-	-	-	-	-	-

Alternative radiographic examination results (QW-191)

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

☐ Fillet welds in plate [QW-462.4(b)] ☐ Fillet welds in pipe [QW-462.4(c)]

Macro examination (QW-184): N/A Fillet size (in.): ___ X ___ Concavity/convexity (in.):

Other tests: RT Report No. 1305

Film or specimens evaluated by: A. Herrera Company: AGD

Mechanical tests conducted by: N/A Laboratory Test Number: N/A

Welding supervised by: Rogelio Reyes

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

Manufacturer or Contractor: The Spitzer Companies

Date: 11-13-13 Certified by:

THE SPITZER COMPANIES

QW-484A – WELDER PERFORMANCE QUALIFICATIONS (WPQ)

Welders Name: Gilberto Aguilar Identification No.: H-51

Test Description

Identification of WPS followed: 256 ☒ Test Coupon ☐ Production weld

Specification and type/grade or UNS number of base metal(s): SA-106B Thickness: 0.344"

Testing Conditions and Qualification Limits

Welding Variables (QW-350)	Actual values	Range qualified
Welding process (es)	GTAW	GTAW
Type (i.e., manual, semi-automatic) used	Manual	Manual
Backing (with/without, metal, weld metal, double-welded, etc.)	Without Back	With or Without backing
☐ Plate ☒ Pipe (enter diameter, if pipe or tube)	2.375	1.00" - Max to be welded
Base metal P- or S-Number to P-or S-Number	P1 to P1	P1 thru P11 & P4X
Filler metal or electrode specification(s) (SFA) (info only)	5.18	As Applicable
Filler metal or electrode classification(s) (info only)	ER70S-6	As Applicable
Filler metal F-Number(s)	6	6
Consumable insert (GTAW or PAW)	N/A	N/A
Filler type (solid/metal or flux cored/powder (GTAW or PAW)	Solid Core	As Applicable
Deposit thickness for each process	N/A	N/A
Process 1: GTAW 3 layers minimum ☒ Yes ☐ No	0.344"	0.688" - Max
Process 2: ____ 3 layers minimum ☐ Yes ☐ No	N/A	N/A
Position qualified (2G, 6G, 3F, etc.)	6G	Plate/Pipe>24" (ALL) Pipe≥ 1.00" & Up (ALL) Fillet (ALL)
Vertical progression (uphill or downhill)	Up	Up
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)	N/A	N/A
GTAW current type/polarity (AC, DCEP, DCEN)	DCEN	DCEN

RESULTS

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

☐Transverse face and root bends [QW-462.3 (a)]; ☐Longitudinal bends [QW-462.3 (b)]; ☐Side bends (QW-462.2)

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

☐Plate bend specimen, corrosion-resistant weld metal overlay [QW-462.5 (d)];

☐ Pipe specimen macro test for fusion [QW-462.5 (b)]; ☐ Plate specimen macro test for fusion [QW-462.5 (e)];

Type	Result	Type	Result	Type	Result
N/A	N/A	-	-	-	-

Alternative radiographic examination results (QW-191)

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

☐ Fillet welds in plate [QW-462.4(b)] ☐ Fillet welds in pipe [QW-462.4(c)

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

Other tests: RT (Report No. 09716)

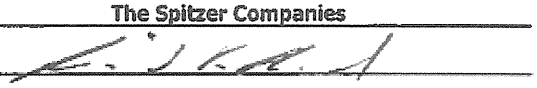
Film or specimens evaluated by: Ramon Flores Company: AGD

Mechanical tests conducted by: N/A Laboratory Test Number: N/A

Welding supervised by: Rogelio Reyes

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

Manufacturer or Contractor: The Spitzer Companies

Date: 13/11/13 Certified by: 

QW-484B – WELDING OPERATOR PERFORMANCE QUALIFICATIONS

Welding operator's name ZENAIDO MARTINEZ Identification No. H-61

Test Description (Information Only)

Identification of WPS followed 251 Rev.1 ☒ Test Coupon ☐ Production weld

Specification and type/grade or UNS number of base metal(s) SA-36 Thickness: 2.50"

Base Metal P- or S- Number 1 to P- or S- Number 1 Position (2G, 6G, 3F, etc.) 1G

☒ Plate ☒ Pipe (enter diameter, if pipe or tube 38.00" L

Filler metal (SFA) specification 5.17 Filler metal or electrode classification EH11K

Testing Conditions and Qualification Limits When Using Automatic Welding Equipment

Welding Variables (QW-361.1)	Actual values	Range qualified
Type of welding (automatic)	-	-
Welding process	-	-
Filler metal used (Yes / No) (EBW or LBW)	-	-
Type of laser for LBW (CO_2 to YAG, etc.)	-	-
Continuous drive or inertia welding (FW)	-	-
Vacuum or out of vacuum (EBW)	-	-

Testing Conditions and Qualification Limits When Using Machine Welding Equipment

Welding Variables (QW-361.2)	Actual values	Range qualified
Type of welding (machine)	Machine	Machine
Welding process	SAW	SAW
Direct or remote visual control	Direct	Direct
Automatic arc voltage control (GTAW)	N/A	-
Automatic joint tracking	N/A	-
Position qualified (2G, 6G, 3F, etc.)	1G	1G
Consumable inserts (GTAW or PAW)	None Used	None
Backing (with/without)	With Backing	with backing or back gouge
Single or multiple passes per side	Multiple	Multiple

RESULTS

Visual Examination of Completed Weld (QW-302.4) **Satisfactory**

☐Transverse face and root bends [QW-462.3 (a)]; ☐Longitudinal bends [QW-462.3 (b)]; ☐Side bends (QW-462.2)

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

☐Plate bend specimen, corrosion-resistant weld metal overlay [QW-462.5 (d)];

☐ Pipe specimen macro test for fusion [QW-462.5 (b)]; ☐ Plate specimen macro test for fusion [QW-462.5 (e)];

Type	Result	Type	Result	Type	Result
N/A	N/A	N/A	N/A	-	-
N/A	N/A	N/A	N/A	-	-

Alternative radiographic examination results (QW-191) Accepted

Fillet weld -- Fracture test (QW-181.2) N/A Length and percent of defects -

☐ Fillet welds in plate [QW-462.4(b)] ☐ Fillet welds in pipe [QW-462.4(c)

Macro examination (QW-184) - Fillet size (in.): - X - Concavity/convexity (in.): -

Other tests

Film or specimens evaluated by: Ramon Flores Company AGD

Mechanical tests conducted by: N/A Laboratory Test Number N/A

Welding supervised by Roger Reyes

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

Manufacturer or Contractor **The Spitzer Companies**

Date: 2/23/2015 Certified by: Richard V. Rocha

Digitally signed by Richard V. Rocha
DN: C=US, E=rocha@spitzerind.com, O=Spitzer Industries, OU=Technical Advisor, CN=Richard V. Rocha
Date: 2015.02.23 16:07:29-06'00'

Spitzer INDUSTRIES

QW-484A – WELDER PERFORMANCE QUALIFICATIONS (WPQ)

Welders Name **Zenaido Martinez** Identification No. **H-61**

Test Description

Identification of WPS followed **AS-P1-S-F-45 Rev. 2** ☒ Test Coupon ☐ Production weld

Specification and type/grade or UNS number of base metal(s) **SA36** Thickness: **0.864"**

Testing Conditions and Qualification Limits

Welding Variables (QW-350)	Actual values	Range qualified
Welding process (es)	FCAW	FCAW
Type (i.e., manual, semi-automatic) used	Semi-Automatic	Semi-Automatic
Backing (with/without, metal, weld metal, double-welded, etc.)	With Backing	W/Backing or Back Gouge
☒ Plate ☐ Pipe (enter diameter, if pipe or tube)	Plate	2.875" & Up
Base metal P- or S-Number to P-or S-Number	P1 to P1	P1 thru P11 & P4X
Filler metal or electrode specification(s) (SFA) (info only)	5.20	As Applicable
Filler metal or electrode classification(s) (info only)	E71T-1	As Applicable
Filler metal F-Number(s)	6	6
Consumable insert (GTAW or PAW)	N/A	N/A
Filler type (solid/metal or flux cored/powder (GTAW or PAW)	N/A	N/A
Deposit thickness for each process		
Process 1: FCAW 3 layers minimum ☒ Yes ☐ No	0.739"	0.187" Max to be welded
Process 2: - 3 layers minimum ☐ Yes ☐ No	-	-
Position qualified (2G, 6G, 3F, etc.)	6G	All
Vertical progression (uphill or downhill)	Up	Up
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)	N/A	N/A
GTAW current type/polarity (AC, DCEP, DCEN)	DCEP	DCEP

RESULTS

Visual Examination of Completed Weld (QW-302.4) **Accepted**

☐Transverse face and root bends [QW-462.3 (a)]; ☐Longitudinal bends [QW-462.3 (b)]; ☐Side bends (QW-462.2)

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

☐Plate bend specimen, corrosion-resistant weld metal overlay [QW-462.5 (d)];

☐ Pipe specimen macro test for fusion [QW-462.5 (b)]; ☐ Plate specimen macro test for fusion [QW-462.5 (e)];

Type	Result	Type	Result	Type	Result
N/A					

Alternative radiographic examination results (QW-191)

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

☐ Fillet welds in plate [QW-462.4(b)] ☐ Fillet welds in pipe [QW-462.4(c)

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

Other tests **RT Report SII13-2-15-02**

Film or specimens evaluated by: **Ramon Flores** Company **The Spitzer Companies**

Mechanical tests conducted by: ____ Laboratory Test Number ____

Welding supervised by **Raul Saenz**

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

Manufacturer or Contractor **The Spitzer Companies**

Date: **02/23/2015** Certified by: Richard V. Rocha

Digitally signed by Richard V. Rocha
DN: C=US, E=rrocha@spitzerind.com, O=Spitzer Industries, OU=Technical Advisor, CN=Richard V. Rocha
Date: 2015.02.23 15:10:45-06'00'

Spitzer INDUSTRIES

QW-484A – WELDER PERFORMANCE QUALIFICATIONS (WPQ)

Welders Name **Ricky Rivera** Identification No. **H-81**

Test Description

Identification of WPS followed **AW-GII-GII-F-02** ☒ Test Coupon ☐ Production weld

Specification and type/grade or UNS number of base metal(s) **SA-36** Thickness: **1.00"**

Testing Conditions and Qualification Limits

Welding Variables (QW-350)	Actual values	Range qualified
Welding process (es)	FCAW	FCAW
Type (i.e., manual, semi-automatic) used	Semi-Automatic	Semi-Automatic
Backing (with/without, metal, weld metal, double-welded, etc.)	FCAW-Weld Metal	FCAW-W/Backing or back gouge
☒ Plate ☐ Pipe (enter diameter, if pipe or tube)	Plate	2.875" & Up
Base metal P- or S-Number to P-or S-Number	P1 to P1	P1 thru P15F & P4X
Filler metal or electrode specification(s) (SFA) (info only)	5.20	As Applicable
Filler metal or electrode classification(s) (info only)	E71T-1M	As Applicable
Filler metal F-Number(s)	6	6
Consumable insert (GTAW or PAW)	N/A	N/A
Filler type (solid/metal or flux cored/powder (GTAW or PAW)	N/A	N/A
Deposit thickness for each process		
Process 1: FCAW 3 layers minimum ☒ Yes ☐ No	1.00"	0.187" Max to be welded
Process 2: - 3 layers minimum ☐ Yes ☐ No	-	-
Position qualified (2G, 6G, 3F, etc.)	3G & 4G	Flat, Vertical, Overhead
Vertical progression (uphill or downhill)	Up	Flat or Up
Type of fuel gas (OFW)	N/A	N/A
Inert gas backing (GTAW, PAW, GMAW)	None	With/without
Transfer mode (spray/globular or pulse to short circuit –GMAW)	N/A	N/A
GTAW current type/polarity (AC, DCEP, DCEN)	DCEP	DCEP

RESULTS

Visual Examination of Completed Weld (QW-302.4) **Accepted**

☐Transverse face and root bends [QW-462.3 (a)]; ☐Longitudinal bends [QW-462.3 (b)]; ☐Side bends (QW-462.2)

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

☐Plate bend specimen, corrosion-resistant weld metal overlay [QW-462.5 (d)];

☐ Pipe specimen macro test for fusion [QW-462.5 (b)]; ☐ Plate specimen macro test for fusion [QW-462.5 (e)];

Type	Result	Type	Result	Type	Result
N/A					

Alternative radiographic examination results (QW-191)

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

☐ Fillet welds in plate [QW-462.4(b)] ☐ Fillet welds in pipe [QW-462.4(c)

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

Other tests **RT Report NO: 10601**

Film or specimens evaluated by: **Ramon Flores** Company **The Spitzer Companies**

Mechanical tests conducted by: **N/A** Laboratory Test Number **N/A**

Welding supervised by **Nelson Reyes**

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

Manufacturer or Contractor **The Spitzer Companies**

Date: **4-21-2015** Certified by: Nick Wright

Digitally signed by Nick Wright
DN: cn=Nick Wright, o=Spitzer Industries, ou=Welding Engineer, email=nicholas.wright@spitzerind.com, c=US
Date: 2015.04.21 13:26:58 -05'00'

Spitzer INDUSTRIES | Curtis Kelly A SPITZER COMPANY

ASME IX – WELDER, WELDING OPERATOR, OR TACK WELDER QUALIFICATION TEST RECORD

Welders Name: **Mauricio Betancourt** Identification No.: **H-82**

Test Description

Identification of WPS followed: **AS-P1-F-102 Rev. 7** ☒ Test Coupon ☐ Production weld

Specification and type/grade or UNS number of base metal(s): **SA-36** Thickness: **1"**

Testing Conditions and Qualification Limits

Welding Variables (QW-350)	Actual values	Range qualified
Welding process (es)	FCAW	FCAW
Type (i.e., manual, semi-automatic) used	Semi-Auto	Semi-Auto
Backing (with/without, metal, weld metal, double-welded, etc.)	With Backing	With backing or back gouging
☒ Plate ☐ Pipe (enter diameter, if pipe or tube)	N/A	N/A
Base metal P- or S-Number to P-or S-Number	P-No. 1 to P-No. 1	P-No. 1 thru 15F, 34, 41 thru 49
Filler metal or electrode specification(s) (SFA) (info only)	5.20	5.20
Filler metal or electrode classification(s) (info only)	E71T-12MJ	E71T-12MJ
Filler metal F-Number(s)	F No. 6	All F No. 6
Consumable insert (GTAW or PAW)	N/A	N/A
Filler type (solid/metal or flux cored/powder (GTAW or PAW)	N/A	N/A
Deposit thickness for each process		
Process 1: FCAW 3 layers minimum ☒ Yes ☐ No	1"	Maximum to be welded
Process 2: N/A 3 layers minimum ☐ Yes ☐ No	N/A	N/A
Position qualified (2G, 6G, 3F, etc.)	3G	O.D. > 24" - F, V 2.875 ≤ O.D.≤ 24" – F Fillet(s) – F, H, V
Vertical progression (uphill or downhill)	Uphill	Uphill
Type of fuel gas (OFW)	N/A	N/A
Inert gas backing (GTAW, PAW, GMAW)	Argon/CO2 75/25%	Argon/CO2 75/25%
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**

☐Transverse face and root bends [QW-462.3 (a)]; ☐Longitudinal bends [QW-462.3 (b)]; ☐Side bends (QW-462.2)

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

☐Plate bend specimen, corrosion-resistant weld metal overlay [QW-462.5 (d)];

☐ Pipe specimen macro test for fusion [QW-462.5 (b)]; ☐ Plate specimen macro test for fusion [QW-462.5 (e)];

Type	Result	Type	Result	Type	Result
-	-	-	-	-	-

Alternative radiographic examination results (QW-191):

Fillet weld -- Fracture test (QW-180): **N/A** Length and percent of defects: **N/A**

☐ Fillet welds in plate [QW-462.4(b)] ☐ Fillet welds in pipe [QW-462.4(c)

Macro examination (QW-184): **N/A** Fillet size (in.): **N/A** X _____ Concavity/convexity (in.): **N/A**

Other tests: **AGD RT Report No. 041216SY2**

Film or specimens evaluated by: **Raymond Flores** Company: **SII**

Mechanical tests conducted by: **N/A** Laboratory Test Number: **N/A**

Welding supervised by: **Kenneth McEvers**

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

Manufacturer or Contractor: **The Spitzer Companies**

Date: 4/26/2016 Certified by: 

THE SPITZER COMPANIES

QW-484B – WELDING OPERATOR PERFORMANCE QUALIFICATIONS

Welding operator's name VICTOR VANEGAS Identification No. H-92

Test Description (Information Only)

Identification of WPS followed 254-255 (-20) ☒ Test Coupon ☐ Production weld

Specification and type/grade or UNS number of base metal(s) SA-106B Thickness: 1.00"

Base Metal P- or S- Number 1 to P- or S- Number 1 Position (2G, 6G, 3F, etc.) 1G

☐ Plate ☒ Pipe (enter diameter, if pipe or tube 12.75" OD

Filler metal (SFA) specification 5.17 Filler metal or electrode classification EM12K

Testing Conditions and Qualification Limits When Using Automatic Welding Equipment

Welding Variables (QW-361.1)	Actual values	Range qualified
Type of welding (automatic)	-	-
Welding process	-	-
Filler metal used (Yes / No) (EBW or LBW)	-	-
Type of laser for LBW (CO_2 to YAG, etc.)	-	-
Continuous drive or inertia welding (FW)	-	-
Vacuum or out of vacuum (EBW)	-	-

Testing Conditions and Qualification Limits When Using Machine Welding Equipment

Welding Variables (QW-361.2)	Actual values	Range qualified
Type of welding (machine)	Machine	Machine
Welding process	SAW	SAW
Direct or remote visual control	Direct	Direct
Automatic arc voltage control (GTAW)	N/A	-
Automatic joint tracking	N/A	-
Position qualified (2G, 6G, 3F, etc.)	1G	1G
Consumable inserts (GTAW or PAW)	None Used	None
Backing (with/without)	With Backing	with backing or back gouge
Single or multiple passes per side	Multiple	Multiple

RESULTS

Visual Examination of Completed Weld (QW-302.4) **Satisfactory**

☐Transverse face and root bends [QW-462.3 (a)]; ☐Longitudinal bends [QW-462.3 (b)]; ☐Side bends (QW-462.2)

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

☐Plate bend specimen, corrosion-resistant weld metal overlay [QW-462.5 (d)];

☐ Pipe specimen macro test for fusion [QW-462.5 (b)]; ☐ Plate specimen macro test for fusion [QW-462.5 (e)];

Type	Result	Type	Result	Type	Result
N/A	N/A	N/A	N/A	-	-
N/A	N/A	N/A	N/A	-	-

Alternative radiographic examination results (QW-191) Accepted

Fillet weld -- Fracture test (QW-181.2) N/A Length and percent of defects -

☐ Fillet welds in plate [QW-462.4(b)] ☐ Fillet welds in pipe [QW-462.4(c)

Macro examination (QW-184) - Fillet size (in.): - X - Concavity/convexity (in.): -

Other tests

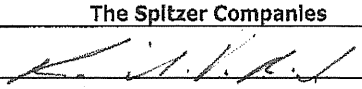
Film or specimens evaluated by: Edward Brillantes Company Agd Inspection Services

Mechanical tests conducted by: N/A Laboratory Test Number N/A

Welding supervised by Billy Free

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

Manufacturer or Contractor **The Spitzer Companies**

Date: 11/18/2011 Certified by: 

THE SPITZER COMPANIES

QW-484A – WELDER PERFORMANCE QUALIFICATIONS (WPQ)

Welders Name **Victor Venegas** Identification No. **H-92**

Test Description

Identification of WPS followed **255HT(-50)** ☒ Test Coupon ☐ Production weld

Specification and type/grade or UNS number of base metal(s) **SA-106** Thickness: **.719"**

Testing Conditions and Qualification Limits

Welding Variables (QW-350)	Actual values	Range qualified
Welding process (es)	FCAW	FCAW
Type (i.e., manual, semi-automatic) used	Semi-auto	Semi-auto
Backing (with/without, metal, weld metal, double-welded, etc.)	With backing	With backing or back gouging
☐ Plate ☒ Pipe (enter diameter, if pipe or tube)	6.625"	2.875" & Up
Base metal P- or S-Number to P-or S-Number	P1 to P1	P1 thru P11 & P4X
Filler metal or electrode specification(s) (SFA) (info only)	5.20	As Applicable
Filler metal or electrode classification(s) (info only)	E71T-1	As Applicable
Filler metal F-Number(s)	6	6
Consumable insert (GTAW or PAW)	N/A	N/A
Filler type (solid/metal or flux cored/powder (GTAW or PAW)	N/A	N/A
Deposit thickness for each process		
Process 1: FCAW 3 layers minimum ☐ Yes ☒ No	.6570"	.187" TO Max to be welded
Process 2: - 3 layers minimum ☐ Yes ☐ No	-	-
Position qualified (2G, 6G, 3F, etc.)	6G	All
Vertical progression (uphill or downhill)	Up	Up
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)	GLOBULAR	GLOBULAR
GTAW current type/polarity (AC, DCEP, DCEN)	DCEP	DCEP

RESULTS

Visual Examination of Completed Weld (QW-302.4) **Accepted**

☐Transverse face and root bends [QW-462.3 (a)]; ☐Longitudinal bends [QW-462.3 (b)]; ☐Side bends (QW-462.2)

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

☐Plate bend specimen, corrosion-resistant weld metal overlay [QW-462.5 (d)];

☐ Pipe specimen macro test for fusion [QW-462.5 (b)]; ☐ Plate specimen macro test for fusion [QW-462.5 (e)];

Type	Result	Type	Result	Type	Result
-	-	-	-	-	-

Alternative radiographic examination results (QW-191)

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

☐ Fillet welds in plate [QW-462.4(b)] ☐ Fillet welds in pipe [QW-462.4(c)

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

Other tests **RT Report No. 102711-RT3**

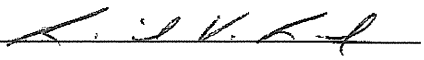
Film or specimens evaluated by: **Edward Brillantes** Company ____

Mechanical tests conducted by: **N/A** Laboratory Test Number **N/A**

Welding supervised by **Eric Holman**

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

Manufacturer or Contractor **The Spitzer Companies**

Date: **10-31-11** Certified by: 

Spitzer INDUSTRIES

QW-484A – WELDER PERFORMANCE QUALIFICATIONS (WPQ)

Welders Name: **Victor Venegas** Identification No.: **H-92**

Test Description

Identification of WPS followed: **AS-P1-S-F-A-43 Rev. 1D** ☒ Test Coupon ☐ Production weld

Specification and type/grade or UNS number of base metal(s): **SA36** Thickness: **1.00"**

Testing Conditions and Qualification Limits

Welding Variables (QW-350)	Actual values	Range qualified
Welding process (es)	FCAW	FCAW
Type (i.e., manual, semi-automatic) used	Semi-Automatic	Semi-Automatic
Backing (with/without, metal, weld metal, double-welded, etc.)	With Backing	W/Backing or Back Gouge
☒ Plate ☐ Pipe (enter diameter, if pipe or tube)	Plate	2.875" & Up
Base metal P- or S-Number to P-or S-Number	P1 to P1	P1 thru P11 & P4X
Filler metal or electrode specification(s) (SFA) (info only)	5.20	As Applicable
Filler metal or electrode classification(s) (info only)	E71T-1	As Applicable
Filler metal F-Number(s)	6	6
Consumable insert (GTAW or PAW)	N/A	N/A
Filler type (solid/metal or flux cored/powder (GTAW or PAW)	N/A	N/A
Deposit thickness for each process		
Process 1: FCAW 3 layers minimum ☒ Yes ☐ No	1.00"	0.187" Max to be welded
Process 2: - 3 layers minimum ☐ Yes ☐ No	-	-
Position qualified (2G, 6G, 3F, etc.)	1G	Flat
Vertical progression (uphill or downhill)	Up	N/A
Type of fuel gas (OFW)	N/A	N/A
Inert gas backing (GTAW, PAW, GMAW)	None	With/without
Transfer mode (spray/globular or pulse to short circuit –GMAW)	N/A	N/A
GTAW current type/polarity (AC, DCEP, DCEN)	DCEP	DCEP

RESULTS

Visual Examination of Completed Weld (QW-302.4): **Accepted**

☐ Transverse face and root bends [QW-462.3 (a)]; ☐ Longitudinal bends [QW-462.3 (b)]; ☒ Side bends (QW-462.2)

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

☐ Plate bend specimen, corrosion-resistant weld metal overlay [QW-462.5 (d)];

☐ Pipe specimen macro test for fusion [QW-462.5 (b)]; ☐ Plate specimen macro test for fusion [QW-462.5 (e)];

Type	Result	Type	Result	Type	Result
Side Bends	Acceptable	Side Bends	Acceptable		
Side Bends	Acceptable	Side Bends	Acceptable		

Alternative radiographic examination results (QW-191)

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

☐ Fillet welds in plate [QW-462.4(b)] ☐ Fillet welds in pipe [QW-462.4(c)

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

Other tests: **N/A**

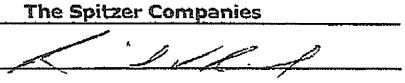
Film or specimens evaluated by: **N/A** Company: **N/A**

Mechanical tests conducted by: ____ Laboratory Test Number: ____

Welding supervised by: **Rogelio Reyes**

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

Manufacturer or Contractor: **The Spitzer Companies**

Date: **12/22/2014** Certified by: 

Spitzer INDUSTRIES

QW-484A – WELDER PERFORMANCE QUALIFICATIONS (WPQ)

Welders Name **Palacius Cesario** Identification No. **M1**

Test Description

Identification of WPS followed **AS-P1-S-F-A-43 Rev. 1D** ☒ Test Coupon ☐ Production weld

Specification and type/grade or UNS number of base metal(s) **SA36** Thickness: **1.00"**

Testing Conditions and Qualification Limits

Welding Variables (QW-350)	Actual values	Range qualified
Welding process (es)	FCAW	FCAW
Type (i.e., manual, semi-automatic) used	Semi-Automatic	Semi-Automatic
Backing (with/without, metal, weld metal, double-welded, etc.)	With Backing	W/Backing or Back Gouge
☒ Plate ☐ Pipe (enter diameter, if pipe or tube)	Plate	2.875" & Up
Base metal P- or S-Number to P-or S-Number	P1 to P1	P1 thru P11 & P4X
Filler metal or electrode specification(s) (SFA) (info only)	5.20	As Applicable
Filler metal or electrode classification(s) (info only)	E71T-1	As Applicable
Filler metal F-Number(s)	6	6
Consumable insert (GTAW or PAW)	N/A	N/A
Filler type (solid/metal or flux cored/powder (GTAW or PAW)	N/A	N/A
Deposit thickness for each process		
Process 1: FCAW 3 layers minimum ☒ Yes ☐ No	1.00"	0.187" Max to be welded
Process 2: - 3 layers minimum ☐ Yes ☐ No	-	-
Position qualified (2G, 6G, 3F, etc.)	1G	Flat
Vertical progression (uphill or downhill)	Up	N/A
Type of fuel gas (OFW)	N/A	N/A
Inert gas backing (GTAW, PAW, GMAW)	None	With/without
Transfer mode (spray/globular or pulse to short circuit –GMAW)	N/A	N/A
GTAW current type/polarity (AC, DCEP, DCEN)	DCEP	DCEP

RESULTS

Visual Examination of Completed Weld (QW-302.4) **Accepted**

☐Transverse face and root bends [QW-462.3 (a)]; ☐Longitudinal bends [QW-462.3 (b)]; ☒Side bends (QW-462.2)

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

☐Plate bend specimen, corrosion-resistant weld metal overlay [QW-462.5 (d)];

☐ Pipe specimen macro test for fusion [QW-462.5 (b)]; ☐ Plate specimen macro test for fusion [QW-462.5 (e)];

Type	Result	Type	Result	Type	Result
Side Bends	Acceptable	Side Bends	Acceptable		
Side Bends	Acceptable	Side Bends	Acceptable		

Alternative radiographic examination results (QW-191)

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

☐ Fillet welds in plate [QW-462.4(b)] ☐ Fillet welds in pipe [QW-462.4(c)

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

Other tests **N/A**

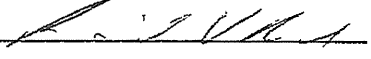
Film or specimens evaluated by: **N/A** Company **N/A**

Mechanical tests conducted by: ____ Laboratory Test Number ____

Welding supervised by **Raul Saenz**

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

Manufacturer or Contractor **The Spitzer Companies**

Date: **12/14/2014** Certified by: 

THE SPITZER COMPANIES

QW-484B -- WELDING OPERATOR PERFORMANCE QUALIFICATIONS

Welding operator's name CESARIO PALACIOUS Identification No. M1

Test Description (Information Only)

Identification of WPS followed AS-P10H-P10H-F-A-10 ☒ Test Coupon ☐ Production weld

Specification and type/grade or UNS number of base metal(s) SA240-S31803 Thickness: 1.00"

Base Metal P- or S- Number 10H to P- or S- Number 10H Position (2G, 6G, 3F, etc.) 1G

☒ Plate ☐ Pipe (enter diameter, if pipe or tube Plate

Filler metal (SFA) specification 5.9 Filler metal or electrode classification ER2209 (P2000 FLUX)

Testing Conditions and Qualification Limits When Using Automatic Welding Equipment

Welding Variables (QW-361.1)	Actual values	Range qualified
Type of welding (automatic)	-	-
Welding process	-	-
Filler metal used (Yes / No) (EBW or LBW)	-	-
Type of laser for LBW (CO_2 to YAG, etc.)	-	-
Continuous drive or inertia welding (FW)	-	-
Vacuum or out of vacuum (EBW)	-	-

Testing Conditions and Qualification Limits When Using Machine Welding Equipment

Welding Variables (QW-361.2)	Actual values	Range qualified
Type of welding (machine)	Machine	Machine
Welding process	SAW	SAW
Direct or remote visual control	Direct	Direct
Automatic arc voltage control (GTAW)	N/A	-
Automatic joint tracking	None	-
Position qualified (2G, 6G, 3F, etc.)	1G	1G
Consumable inserts (GTAW or PAW)	None Used	None
Backing (with/without)	with	With Backing or back gouge
Single or multiple passes per side	Multiple	Multiple

RESULTS

Visual Examination of Completed Weld (QW-302.4) **Satisfactory**

☐Transverse face and root bends [QW-462.3 (a)]; ☐Longitudinal bends [QW-462.3 (b)]; ☒Side bends (QW-462.2)

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

☐Plate bend specimen, corrosion-resistant weld metal overlay [QW-462.5 (d)];

☐ Pipe specimen macro test for fusion [QW-462.5 (b)]; ☐ Plate specimen macro test for fusion [QW-462.5 (e)];

Type	Result	Type	Result	Type	Result
Side Bend	Satisfactory			-	-
Side Bend	Satisfactory			-	-

Alternative radiographic examination results (QW-191) N/A

Fillet weld -- Fracture test (QW-181.2) N/A Length and percent of defects -

☐ Fillet welds in plate [QW-462.4(b)] ☐ Fillet welds in pipe [QW-462.4(c)

Macro examination (QW-184) - Fillet size (in.): - X - Concavity/convexity (in.): -

Other tests

Film or specimens evaluated by: N/A Company -

Mechanical tests conducted by: Accu Test Laboratory Laboratory Test Number 522581.00

Welding supervised by Billy Free

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

Manufacturer or Contractor **The Spitzer Companies**

Date: 9/13/2011 Certified by:

SPITZER INDUSTRIES, INC.

Welders Name *Cesario Palacios* Clock number _____ Stamp no. *(L)M M1*
Welding process(es) used *GMAW & FCAW* Type *Semiautomatic*
Identification of WPS followed by welder during welding of test coupon *255*
Base material(s) welded *SA-106-B to SA-106-B* Thickness *0.864"*

Manual or Semiautomatic Variables for Each Process (QW-350)	Actual Value	Range Qualified
Backing (metal, weld metal, welded from both sides, flux, etc.) QW-402	*With out*	*with or without*
ASME P-No. *1* to ASME P-No. (QW-403)	*1*	*See QW 423.1*
___ Plate *x* Pipe (enter diameter, if pipe)	*6" Nom.*	*>or=2 7/8"OD*
Filler metal specification (SFA): *5.18/5.20* Classification (QW404)	*ER70S-6/E71T-1*	
Filler metal F-No.	*6*	*6*
Consumable insert for GTAW or PAW	*N/A*	*N/A*
Weld deposit thickness for each welding process	*GM-0.125"/FC-0.739"*	*GM-0.1375"/FC-Max. Welded"*
Welding position (1G, 5G, etc.) (QW-405)	*6G*	*ALL*
Progression (uphill/downhill)	*Uphill*	*Uphill*
Backing gas for GTAW, PAW, or GMAW; fuel gas for OFW (QW-408)	*N/A*	*with or without*
GMAW transfer mode	*Short Circuiting*	*Short Circuiting*
GTAW welding current type/polarity	*N/A*	*N/A*

Machine Welding Variables for the Process Used (QW-360)	Actual Value	Range Qualified
Direct/remote visual control	*N/A*	*N/A*
Automatic voltage control (GTAW)	*N/A*	*N/A*
Automatic joint tracking	*N/A*	*N/A*
Welding position (1G, 5G, etc.)	*N/A*	*N/A*
Consumable insert	*N/A*	*N/A*
Backing (metal, weld metal, welded from both sides, flux, etc.)	*N/A*	*N/A*

Guided Bend Test Results

Guided Bend Test Type *X* QW-462.2 (Side) Results ___ QW462.3(a)(Trans. R&F)
___ QW-462.3(b) (Long. R&F) Results

Side Bend	*Satisfactory*	*Side Bend*	*Satisfactory*
Side Bend	*Satisfactory*		
Side Bend	*Satisfactory*		

Visual examination results (QW-302.4) *Satisfactory*
Radiographic test results (QW304 and QW-305) *Acceptable*
(for alternative qualification of groove welds by radiography)
Fillet Weld - Fracture test *N/A* Length and percent of defects *N/A* in.
Macro test fusion *N/A* Fillet leg size ___ in. x ___ in. Concavity/convexity ___ in.
Welding test conducted by *Spitzer Industries, Inc.*
Mechanical test conducted by *In House* Laboratory test no. ___

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

Date: *August 12,2002* By: Michael Kona

ENGINEERED PACKAGED SYSTEMS
ASME CODED
11250 Tanner Road • Houston, Texas 77041 • TEL: 713/466-1618 • FAX: 713/466-1950

SPITZER INDUSTRIES, INC.

Welders Name *Cesario Palacios* Clock number _____ Stamp no. *(L)M,M1*
Welding process(es) used *GMAW & FCAW* Type *Semiautomatic*
Identification of WPS followed by welder during welding of test coupon *255*
Base material(s) welded *SA-106-B to SA-106-B* Thickness *.436"*

Manual or Semiautomatic Variables for Each Process (QW-350)	Actual Value	Range Qualified
Backing (metal, weld metal, welded from both sides, flux, etc.) QW-402	*With out*	*with or without*
ASME P-No. *1* to ASME P-No. (QW-403)	*1*	*See QW 423.1*
___ Plate *x* Pipe (enter diameter, if pipe)	*2" nom.*	*1" OD min. & Over*
Filler metal specification (SFA): *5.18/5.20* Classification (QW404)	*ER70S-6/E71T-1*	
Filler metal F-No.	*6*	*6*
Consumable insert for GTAW or PAW	*N/A*	*N/A*
Weld deposit thickness for each welding process	*GM-0.125"/FC-0.311"*	*GM-0.137"/FC-0.622" max.*
Welding position (1G, 5G, etc.) (QW-405)	*6G*	*ALL*
Progression (uphill/downhill)	*Uphill*	*Uphill*
Backing gas for GTAW, PAW, or GMAW; fuel gas for OFW (QW-408)	*N/A*	*with or without*
GMAW transfer mode	*Short Circuiting*	*Short Circuiting*
GTAW welding current type/polarity	*N/A*	*N/A*

Machine Welding Variables for the Process Used (QW-360)	Actual Value	Range Qualified
Direct/remote visual control	*N/A*	*N/A*
Automatic voltage control (GTAW)	*N/A*	*N/A*
Automatic joint tracking	*N/A*	*N/A*
Welding position (1G, 5G, etc.)	*N/A*	*N/A*
Consumable insert	*N/A*	*N/A*
Backing (metal, weld metal, welded from both sides, flux, etc.)	*N/A*	*N/A*

Guided Bend Test Results

Guided Bend Test Type ___ QW-462.2 (Side) Results *X* QW462.3(a)(Trans. R&F)
___ QW-462.3(b) (Long. R&F) Results

Root Bend	*Satisfactory*	*Face Bend*	*Satisfactory*
Face Bend	*Satisfactory*		
Root Bend	*Satisfactory*		

Visual examination results (QW-302.4) *Satisfactory*
Radiographic test results (QW304 and QW-305) *Acceptable*
(for alternative qualification of groove welds by radiography)
Fillet Weld - Fracture test *N/A* Length and percent of defects *N/A* in.
Macro test fusion *N/A* Fillet leg size ___ in. x ___ in. Concavity/convexity ___ in.
Welding test conducted by *Spitzer Industries, Inc.*
Mechanical test conducted by *In House* Laboratory test no. ___

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

Date: *August 12,2002* By: Michael Hono

11250 Tanner Road • Houston, Texas 77041 • TEL: 713/466-1518 • FAX: 713/466-1950

SPITZER INDUSTRIES, INC.

Welders Name *Cesario Palacios* Clock number _____ Stamp no. *(L)M, M1*

Welding process(es) used *GMAW & SAW* Type *Semiautomation & Machine*

Identification of WPS followed by welder during welding of test coupon *PQR 254-255*

Base material(s) welded *SA-516-70 to SA-516-70* Thickness *1.5"*

Manual or Semiautomatic Variables for Each Process (QW-350)	Actual Value	Range Qualified
Backing (metal, weld metal, welded from both sides, flux, etc.) QW-402	*without*	*with or without*
ASME P-No. *1* to ASME P-No. (QW-403)	*1*	*See QW 423.1*
x Plate ___ Pipe (enter diameter, if pipe)		*> or = 2-7/8"*
Filler metal specification (SFA): 5.18/5.17 Classification (QW404)	*ER70S-6/EM12K*	
Filler metal F-No.	*6*	*6*
Consumable insert for GTAW or PAW	*N/A*	*N/A*
Weld deposit thickness for each welding process	*GM-0.125"S/W-1.375"*	*GM-0.1375" Max, SW-max welded*
Welding position (1G, 5G, etc.) (QW-405)	*1G*	*Flat*
Progression (uphill/downhill)	*Flat*	*Flat*
Backing gas for GTAW, PAW, or GMAW; fuel gas for OFW (QW-408)	*None*	*with or without*
GMAW transfer mode	*Short Circuiting*	*Short Circuiting*
GTAW welding current type/polarity	*N/A*	*N/A*

Machine Welding Variables for the Process Used (QW-360)	Actual Value	Range Qualified
Direct/remote visual control	*Direct*	*Direct*
Automatic voltage control (GTAW)	*N/A*	*N/A*
Automatic joint tracking	*None*	*None*
Welding position (1G, 5G, etc.)	*1G*	*Flat*
Consumable insert	*None*	*None*
Backing (metal, weld metal, welded from both sides, flux, etc.)	*Weld Metal*	*with backing*

Guided Bend Test Results

Guided Bend Test Type *X* QW-462.2 (Side) Results ___ QW462.3(a)(Trans. R&F)

___ QW-462.3(b) (Long. R&F) Results

Side Bend	*Satisfactory*	*Side Bend*	*Satisfactory*
Side Bend	*Satisfactory*		
Side Bend	*Satisfactory*		

Visual examination results (QW-302.4) *Satisfactory*

Radiographic test results (QW304 and QW-305) *Accepted*

(for alternative qualification of groove welds by radiography)

Fillet Weld - Fracture test *N/A* Length and percent of defects *N/A* in.

Macro test fusion *N/A* Fillet leg size ___ in. x ___ in. Concavity/convexity ___ in.

Welding test conducted by *Spitzer Industries, Inc.*

Mechanical test conducted by *In House* Laboratory test no. ___

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

Date: *August 12,2002* By: Michael Kona

SPITZER INDUSTRIES, INC.

Welders Name *Cesario Palacios* Clock number _____ Stamp no. *(L)M,M1*

Welding process(es) used *GTAW* Type *Manual*

Identification of WPS followed by welder during welding of test coupon *WPS253-256*

Base material(s) welded *SA-106-b to SA-106-B* Thickness *0.343"*

Manual or Semiautomatic Variables for Each Process (QW-350)	Actual Value	Range Qualified
Backing (metal, weld metal, welded from both sides, flux, etc.) QW-402	*without*	*with & without*
ASME P-No. *1* to ASME P-No. (QW-403)	*1*	*See QW 423.1*
___ Plate *X* Pipe (enter diameter, if pipe)	*2"nom.*	*1"OD min. & Over*
Filler metal specification (SFA): *5.18* Classification (QW404)	*ER70S-6*	
Filler metal F-No.	*6*	*6*
Consumable insert for GTAW or PAW	*N/A*	*N/A*
Weld deposit thickness for each welding process	*GTA-.343"*	*GTA- .686" Max*
Welding position (1G, 5G, etc.) (QW-405)	*6G*	*ALL*
Progression (uphill/downhill)	*Down/Uphill*	*Down/Uphill*
Backing gas for GTAW, PAW, or GMAW; fuel gas for OFW (QW-408)	*N/A*	with or without
GMAW transfer mode	*N/A*	N/A
GTAW welding current type/polarity	*DCEP*	*DCEP*

Machine Welding Variables for the Process Used (QW-360)	Actual Value	Range Qualified
Direct/remote visual control	*N/A*	*N/A*
Automatic voltage control (GTAW)	*N/A*	*N/A*
Automatic joint tracking	*N/A*	*N/A*
Welding position (1G, 5G, etc.)	*N/A*	*N/A*
Consumable insert	*N/A*	*N/A*
Backing (metal, weld metal, welded from both sides, flux, etc.)	*N/A*	*N/A*

Guided Bend Test Results

Guided Bend Test Type ___ QW-462.2 (Side) Results *X* QW4602.3(a)(Trans. R&F)

___ QW-462.3(b) (Long. R&F) Results

Face Bend	*Satisfactory*		
Root Bend	*Satisfactory*		

Visual examination results (QW-302.4) *Satisfactory*

Radiographic test results (QW304 and QW-305) *Acceptable*

(for alternative qualification of groove welds by radiography)

Fillet Weld - Fracture test *N/A* Length and percent of defects *N/A* in.

Macro test fusion *N/A* Fillet leg size ___ in. x ___ in. Concavity/convexity ___ in.

Welding test conducted by *Spitzer Industries, Inc.*

Mechanical test conducted by *In - House* Laboratory test no. _____

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

Date: *August 12,2002* By: Michael Howe

ENGINEERED PACKAGED SYSTEMS
ASME CODED
11433 Brittmoore Park Drive · Houston, Texas 77041 · TEL: 713/466-1518 · FAX: 713/466-1950

ASME IX – WELDER, WELDING OPERATOR, OR TACK WELDER QUALIFICATION TEST RECORD

Welders Name: **Nelson Torres** Identification No.: **QL**

Test Description

Identification of WPS followed: **255-256(-50)** ☒ Test Coupon ☐ Production weld

Specification and type/grade or UNS number of base metal(s): **SA106-B/C** Dimensions: **6.625" x 0.719"**

Testing Conditions and Qualification Limits

Welding Variables (QW-350)	Actual values	Range qualified
Welding process (es)	GTAW / FCAW	GTAW / FCAW
Type (i.e., manual, semi-automatic) used	Manual / Semi-Auto	Manual / Semi-Auto
Backing (with/without, metal, weld metal, double-welded, etc.)	GTAW: Without FCAW: With	GTAW: With or Without FCAW: With Backing or Back-gouging Only
☐ Plate ☒ Pipe (enter diameter, if pipe or tube)	6.625" O.D.	2.875" - Unlimited
Base metal P- or S-Number to P-or S-Number	P1 to P1	P No. 1-15F, 34, & 41-49
Filler metal or electrode specification(s) (SFA) (info only)	A5.18 / A5.20	-
Filler metal or electrode classification(s) (info only)	ER70S-6 / E71T-9M-H8	-
Filler metal F-Number(s)	F No. 6	F No. 6
Consumable insert (GTAW or PAW)	None	None
Filler type (solid/metal or flux cored/powder (GTAW or PAW)	GTAW: Solid (Bare)	GTAW: Solid (Bare)
Deposit thickness for each process		
Process 1: **GTAW** 3 layers minimum ☐ Yes ☐ No	0.208"	0.416" Max
Process 2: **FCAW** 3 layers minimum ☒ Yes ☐ No	0.511"	Max To Be Welded
Position qualified (2G, 6G, 3F, etc.)	6G	All
Vertical progression (uphill or downhill)	Uphill	Uphill
Type of fuel gas (OFW)	None	None
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 / DCEP	DCEN / DCEP

RESULTS

Visual Examination of Completed Weld (QW-302.4) **Acceptable, See SII Inspection Report No.: Q01085**

☐Transverse face and root bends [QW-462.3 (a)]; ☐Longitudinal bends [QW-462.3 (b)]; ☐Side bends (QW-462.2)

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

☐Plate bend specimen, corrosion-resistant weld metal overlay [QW-462.5 (d)];

☐ Pipe specimen macro test for fusion [QW-462.5 (b)]; ☐ Plate specimen macro test for fusion [QW-462.5 (e)];

Type	Result	Type	Result	Type	Result
-	-	-	-	-	-
-	-	-	-	-	-

Alternative radiographic examination results (QW-191): **Acceptable, See AGD RT Report No.: 042417-JB01**

Fillet weld -- Fracture test (QW-180): **-** Length and percent of defects: **-**

Macro examination (QW-184): **-** Fillet size (in.): **-** X **-** Concavity/convexity (in.): **-**

Other tests: **-**

Film or specimens evaluated by: **Ramon Flores** Company: **Spitzer Industries**

Mechanical tests conducted by: **N/A** Laboratory Test Number: **N/A**

Welding supervised by: **Kenneth McEvers**

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

Manufacturer or Contractor: **The Spitzer Companies**

Date: **5/8/2017** Certified by:

ASME IX – WELDER, WELDING OPERATOR, OR TACK WELDER QUALIFICATION TEST RECORD

Welders Name: **Nelson Torres** Identification No.: **QL**

Test Description

Identification of WPS followed: **AS-P1-G-49 Rev. 2A** ☐ Test Coupon ☐ Production weld

Specification and type/grade or UNS number of base metal(s): **SA106-B/C** Thickness: **0.218"**

Testing Conditions and Qualification Limits

Welding Variables (QW-350)	Actual values	Range qualified
Welding process (es)	**GTAW**	**GTAW**
Type (i.e., manual, semi-automatic) used	**Manual**	**Manual**
Backing (with/without, metal, weld metal, double-welded, etc.)	**Without**	**With or Without**
☐ Plate ☒ Pipe (enter diameter, if pipe or tube)	**2.375" O.D.**	**1" - Unlimited**
Base metal P- or S-Number to P-or S-Number	**P No. 1**	**P No. 1 thru 15F, 34, 41 thru 49**
Filler metal or electrode specification(s) (SFA) (info only)	**A5.18**	**A5.18**
Filler metal or electrode classification(s) (info only)	**ER70S-2**	**ER70S-2**
Filler metal F-Number(s)	**F No. 6**	**F No. 6**
Consumable insert (GTAW or PAW)	**Without**	**Without**
Filler type (solid/metal or flux cored/powder (GTAW or PAW)	**Solid (Bare)**	**Solid (Bare)**
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.)	**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 99.995%**	**Argon 99.995%**
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) **See SII VT Report No. Q01097 - Acceptable**

☐Transverse face and root bends [QW-462.3 (a)]; ☐Longitudinal bends [QW-462.3 (b)]; ☐Side bends (QW-462.2)

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

☐Plate bend specimen, corrosion-resistant weld metal overlay [QW-462.5 (d)];

☐ Pipe specimen macro test for fusion [QW-462.5 (b)]; ☐ Plate specimen macro test for fusion [QW-462.5 (e)];

Type	Result	Type	Result	Type	Result
-	-	-	-	-	-
-	-	-	-	-	-

Alternative radiographic examination results (QW-191):

Fillet weld -- Fracture test (QW-180): **N/A** Length and percent of defects: **N/A**

☐ Fillet welds in plate [QW-462.4(b)] ☐ Fillet welds in pipe [QW-462.4(c)

Macro examination (QW-184): **N/A** Fillet size (in.): **N/A** X _____ Concavity/convexity (in.): **N/A**

Other tests: **AGD RT Report No. 051117AH-RT2**

Film or specimens evaluated by: **Ramon Flores** Company: **SII**

Mechanical tests conducted by: **N/A** Laboratory Test Number: **N/A**

Welding supervised by: **Rogelio Reyes**

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

Manufacturer or Contractor: **The Spitzer Companies**

Date: 5/26/2017 Certified by: 

QW-484 SUGGESTED FORMAT FOR MANUFACTURER'S RECORD OF WELDER / WELDING OPERATOR QUALIFICATION TESTS

Welders Name: Arnoldo Ramirez S.S. #: XXXXXXXXXXX Stamp No.: T

Using WPS No.: 62 Rev. No.: 2

the above welder is qualified for the following ranges.

VARIABLE	Actual Values Used in Qualification	Qualification Range
Process & GMAW transfer mode	FCAW	FCAW
Process Type	Semi Automatic	Semi Automatic
Backing	weld metal	weld metal
Material Spec. P-No. to P-No.	P8 to P8	P1 thru P11,P34,P41~47
Thickness - Groove	.75" more than 3 layers	max. to be welded
Thickness - Fillet	N/A	all
Diameter - Groove	N/A	over 2.875"
Diameter - Fillet	N/A	all
Filler Metal - Spec. No.	SFA-5.22	F6
Filler Metal - F No.	6	any F6
Dep. Weld Metal Thk. Range-groove	.75"	0" to 8"
Dep. Weld Metal Thk. Range-Fillet	N/A	all
Position	3G	F,V,H, fillet only
Weld Progression	uphill	uphill
Gas Type	100% CO2	any inert shielding gas
Electrical Char. - Current	DC	DC
Electrical Char. - Polarity	Rev.	Rev.

GUIDED BEND TEST RESULTS QW-462.2, QW462.3 (a), QW-462.3 (b)

Type and Fig. No.	Result
n/a	n/a

Visual examination results (QW-302.4) - satisfactory
Radiographic test results (QW-304 and QW-305) - satisfactory
Fillet Weld - Fracture test - N/A Length & percent of defects - N/A in.
Macro test fusion - N/A Fillet leg size - N/A in. x N/A in. Concave / convex-N/A in.
Welding test conducted by - Curtis Kelly, Inc.
Mechanical / Radiographic test conducted by - H&G Services Test No.: 07-10-04-1

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

Date: 10/11/04

Organization: CURTIS KELLY, INC.
By: Phillip Hernandez

8/26

QW-484B SUGGESTED FORMAT B FOR WELDING OPERATOR PERFORMANCE QUALIFICATIONS (WOPQ)
(See QW-301, Section IX, ASME Boiler and Pressure Vessel Code)

Welding operator's name Arnoldo Ramirez Identification no. "T"

Test Description (*Information Only*)

Identification of WPS followed 133 ☐ Test coupon ☑ Production weld

Specification of base metal(s) SA-240-304 Thickness .75"

Base metal P or S-Number 8 to P or S-Number 8 Position (2G, 6G, 3F, etc.) 1G

☑ Plate ☐ Pipe (enter diameter if pipe or tube):

Filler metal (SFA) specification 5.9 Filler metal or electrode classification ER-308L

Testing Conditions and Qualification Limits When Using Automatic Welding Equipment

Welding Variables (QW-361.1)	Actual Values	Range Qualified
Type of welding (Automatic)		
Welding process		
Filler metal (EBW or LBW)		
Type of laser for LBW (CO_2 to YAG, etc.)		
Continuous drive or inertia welding (FW)		
Vacuum or out of vacuum (EBW)		

Testing Conditions and Qualification Limits When Using Machine Welding Equipment

Welding Variables (QW-361.2)	Actual Values	Range Qualified
Type of welding (machine)	Machine	Machine
Welding process	SAW	SAW
Direct or remote visual control	Direct Visual Control	Direct Visual Contol
Automatic arc voltage control (GTAW)	N/A	N/A
Automatic joint tracking	NO	NO
Position qualified (2G, 6G, 3F, etc.)	1G	1G
Consumable inserts (GTAW or PAW)	N/A	N/A
Backing (metal, weld metal, etc.)	Weld Metal	Weld Metal
Single or multiple passes per side	Multiple	Multiple

RESULTS

Visual Examination of Completed Weld (QW-302.4) Satisfactory

☐ 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 for 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) Satisfactory - Test No: 05-0311-1

Fillet weld — fracture test (QW-180) Length and percent of defects

Macro examination (QW-184) Fillet size (in.) × Concavity/convexity (in.)

Other tests

Film or specimens evaluated by Mark Cagle Company H & G Services

Mechanical tests conducted by Laboratory test no.

Welding supervised by Curtis Kelly, Inc.

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

Organization CURTIS KELLY INC.

Date 3/11/05 By Phillip Hernandez

(7/03)

QW-484 SUGGESTED FORMAT FOR MANUFACTURER'S RECORD OF WELDER / WELDING OPERATOR QUALIFICATION TESTS

Welders Name: Arnoldo Ramirez [redacted] Stamp No.: T

Using WPS No.: 69 Rev. No.: 4
the above welder is qualified for the following ranges.

VARIABLE	Actual Values Used in Qualification	Qualification Range
Process & GMAW transfer mode	GTAW	GTAW
Process Type	Manual	Manual
Backing	none	none & weld metal
Material Spec. P-No. to P-No.	P8 to P8	P1 thru P11,P34,P41~P47
Thickness - Groove	.375"	0" to .75"
Thickness - Fillet	N/A	all
Diameter - Groove	N/A	over 2.875"
Diameter - Fillet	N/A	all
Filler Metal - Spec. No.	SFA 5.9	SFA 5.9
Filler Metal - F No.	F-6	F6
Dep. Weld Metal Thk. Range-groove	.375"	0" to .75"
Dep. Weld Metal Thk. Range-Fillet	N/A	all
Position	3G	all
Weld Progression	uphill	uphill
Gas Type	100% argon	any inert shielding gas
Electrical Char. - Current	DC	DC
Electrical Char. - Polarity	Str.	Str.

GUIDED BEND TEST RESULTS QW-462.2, QW462.3 (a), QW-462.3 (b)

Type and Fig. No.	Result
n/a	n/a

Visual examination results (QW-302.4) - satisfactory
Radiographic test results (QW-304 and QW-305) - satisfactory
Fillet Weld - Fracture test - N/A Length & percent of defects - N/A in.
Macro test fusion - N/A Fillet leg size - N/A in. x N/A in. Concave / convex-N/A in.
Welding test conducted by - Curtis Kelly, Inc.
Mechanical / Radiographic test conducted by - H&G Services Test No.: 07-10-04-2

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

Date: 10/11/04

Organization: CURTIS KELLY, INC.
By: Phillip Hernandez

QW-484 SUGGESTED FORMAT FOR MANUFACTURER'S RECORD OF WELDER / WELDING OPERATOR QUALIFICATION TESTS

Welders Name: Arnoldo Ramirez S.S. #- ~~XXXXXXXXX~~ Stamp No.: T

Using WPS No.: 62 Rev. No.: 2

the above welder is qualified for the following ranges.

VARIABLE	Actual Values Used in Qualification	Qualification Range
Process & GMAW transfer mode	FCAW	FCAW
Process Type	Semi Automatic	Semi Automatic
Backing	weld metal	weld metal
Material Spec. P-No. to P-No.	P8 to P8	P1 thru P11,P34,P41~47
Thickness - Groove	.75" more than 3 layers	max. to be welded
Thickness - Fillet	N/A	all
Diameter - Groove	N/A	over 2.875"
Diameter - Fillet	N/A	all
Filler Metal - Spec. No.	SFA-5.22	F6
Filler Metal - F No.	6	any F6
Dep. Weld Metal Thk. Range-groove	.75"	0" to 8"
Dep. Weld Metal Thk. Range-Fillet	N/A	all
Position	3G	F,V,H, fillet only
Weld Progression	uphill	uphill
Gas Type	100% CO2	any inert shielding gas
Electrical Char. - Current	DC	DC
Electrical Char. - Polarity	Rev.	Rev.

GUIDED BEND TEST RESULTS QW-462.2, QW462.3 (a), QW-462.3 (b)

Type and Fig. No.	Result
n/a	n/a

Visual examination results (QW-302.4) - satisfactory
Radiographic test results (QW-304 and QW-305) - satisfactory
Fillet Weld - Fracture test - N/A Length & percent of defects - N/A in.
Macro test fusion - N/A Fillet leg size - N/A in. x N/A in. Concave / convex-N/A in.
Welding test conducted by - Curtis Kelly, Inc.
Mechanical / Radiographic test conducted by - H&G Services Test No.: 07-10-04-1

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

Date: 10/11/04

Organization: CURTIS KELLY, INC.
By: Phillip Hernandez

8/26

QW-484 SUGGESTED FORMAT FOR MANUFACTURER'S RECORD OF WELDER / WELDING OPERATOR QUALIFICATION TESTS

Welders Name: Arnoldo Ramirez S.S.#: [redacted] Stamp No.: T

Using WPS No.: 69I Rev. No.: 6
the above welder is qualified for the following ranges.

VARIABLE	Actual Values Used in Qualification	Qualification Range
Process & GMAW transfer mode	GTAW	GTAW
Process Type	Manual	Manual
Backing	none	none & weld metal
Material Spec. P-No. to P-No.	P8 to P8	P1 thru P11,P34,P41~P47
Thickness - Groove	0.5"	max to be welded
Thickness - Fillet	N/A	all
Diameter - Groove	plate	over 2.875" -F
Diameter - Fillet	N/A	all
Filler Metal - Spec. No.	SFA 5.9	SFA 5.9
Filler Metal - F No.	F-6	F6
Dep. Weld Metal Thk. Range-groove	.5"	max to be welded
Dep. Weld Metal Thk. Range-Fillet	N/A	all
Position	3G	F,V,>24"od / F 2.875" ~ 24" F,V,H -fillets
Weld Progression	uphill	uphill
Gas Type	100% argon	any inert shielding gas
Electrical Char. - Current	DC	DC
Electrical Char. - Polarity	Str.	Str.

GUIDED BEND TEST RESULTS QW-462.2, QW462.3 (a), QW-462.3 (b)

Type and Fig. No.	Result
Side Bend per QW462.2	satisfactory
Side Bend per QW462.2	satisfactory

Visual examination results (QW-302.4) - satisfactory
Radiographic test results (QW-304 and QW-305) - satisfactory
Fillet Weld - Fracture test - N/A Length & percent of defects - N/A in.
Macro test fusion - N/A Fillet leg size - N/A in. x N/A in. Concave / convex-N/A in.
Welding test conducted by - Curtis Kelly, Inc.
Mechanical / Radiographic test conducted by - Goolsby Testing Lab Test # 05-08-39984

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

Date: 8/11/05

Organization: CURTIS KELLY, INC.
By: Phillip Hernandez

QW-484B SUGGESTED FORMAT B FOR WELDING OPERATOR PERFORMANCE QUALIFICATIONS (WOPQ)
(See QW-301, Section IX, ASME Boiler and Pressure Vessel Code)

Welding operator's name Arnoldo Ramirez Identification no. "T"

Test Description (*Information Only*)

Identification of WPS followed 133 ☐ Test coupon ☑ Production weld

Specification of base metal(s) SA-240-304 Thickness .75"

Base metal P or S-Number 8 to P or S-Number 8 Position (2G, 6G, 3F, etc.) 1G

☑ Plate ☐ Pipe (enter diameter if pipe or tube):

Filler metal (SFA) specification 5.9 Filler metal or electrode classification ER-308L

Testing Conditions and Qualification Limits When Using Automatic Welding Equipment

Welding Variables (QW-361.1)	Actual Values	Range Qualified
Type of welding (Automatic)		
Welding process		
Filler metal (EBW or LBW)		
Type of laser for LBW (CO_2 to YAG, etc.)		
Continuous drive or inertia welding (FW)		
Vacuum or out of vacuum (EBW)		

Testing Conditions and Qualification Limits When Using Machine Welding Equipment

Welding Variables (QW-361.2)	Actual Values	Range Qualified
Type of welding (machine)	Machine	Machine
Welding process	SAW	SAW
Direct or remote visual control	Direct Visual Control	Direct Visual Contol
Automatic arc voltage control (GTAW)	N/A	N/A
Automatic joint tracking	NO	NO
Position qualified (2G, 6G, 3F, etc.)	1G	1G
Consumable inserts (GTAW or PAW)	N/A	N/A
Backing (metal, weld metal, etc.)	Weld Metal	Weld Metal
Single or multiple passes per side	Multiple	Multiple

RESULTS

Visual Examination of Completed Weld (QW-302.4) Satisfactory

☐ 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 for 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) Satisfactory - Test No: 05-0311-1

Fillet weld — fracture test (QW-180) Length and percent of defects

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

Other tests

Film or specimens evaluated by Mark Cagle Company H & G Services

Mechanical tests conducted by Laboratory test no.

Welding supervised by Curtis Kelly, Inc.

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

Organization CURTIS KELLY INC.

Date 3/11/05 By Phillip Hernandez

(7/03)

QW-484 SUGGESTED FORMAT FOR MANUFACTURER'S RECORD OF WELDER / WELDING OPERATOR QUALIFICATION TESTS

Welders Name: Arnoldo Ramirez [redacted] Stamp No.: T

Using WPS No.: 69 Rev. No.: 4

the above welder is qualified for the following ranges.

VARIABLE	Actual Values Used in Qualification	Qualification Range
Process & GMAW transfer mode	GTAW	GTAW
Process Type	Manual	Manual
Backing	none	none & weld metal
Material Spec. P-No. to P-No.	P8 to P8	P1 thru P11,P34,P41~P47
Thickness - Groove	.375"	0" to .75"
Thickness - Fillet	N/A	all
Diameter - Groove	N/A	over 2.875"
Diameter - Fillet	N/A	all
Filler Metal - Spec. No.	SFA 5.9	SFA 5.9
Filler Metal - F No.	F-6	F6
Dep. Weld Metal Thk. Range-groove	.375"	0" to .75"
Dep. Weld Metal Thk. Range-Fillet	N/A	all
Position	3G	all
Weld Progression	uphill	uphill
Gas Type	100% argon	any inert shielding gas
Electrical Char. - Current	DC	DC
Electrical Char. - Polarity	Str.	Str.

GUIDED BEND TEST RESULTS QW-462.2, QW462.3 (a), QW-462.3 (b)

Type and Fig. No.	Result
n/a	n/a

Visual examination results (QW-302.4) - satisfactory
Radiographic test results (QW-304 and QW-305) - satisfactory
Fillet Weld - Fracture test - N/A Length & percent of defects - N/A in.
Macro test fusion - N/A Fillet leg size - N/A in. x N/A in. Concave / convex-N/A in.
Welding test conducted by - Curtis Kelly, Inc.
Mechanical / Radiographic test conducted by - H&G Services Test No.: 07-10-04-2

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

Date: 10/11/04

Organization: CURTIS KELLY, INC.
By: Phillip Hernandez

QW-484 SUGGESTED FORMAT FOR MANUFACTURER'S RECORD OF WELDER / WELDING OPERATOR QUALIFICATION TESTS

Welders Name: Arnoldo Ramirez S.S.#: XXX-XX-XXXX Stamp No.: T

Using WPS No.: 260 Rev. No.: 1
the above welder is qualified for the following ranges.

VARIABLE	Actual Values Used in Qualification	Qualification Range
Process & GMAW transfer mode	FCAW	FCAW
Process Type	Semi Automatic	Semi Automatic
Backing	weld metal	weld metal
Material Spec. P-No. to P-No.	P8 to P8	P1 thru P11,P34,P41~47
Thickness - Groove	.5" more than 3 layers	max. to be welded
Thickness - Fillet	N/A	all
Diameter - Groove	N/A	over 2.875"
Diameter - Fillet	N/A	all
Filler Metal - Spec. No.	SFA-5.22	F6
Filler Metal - F No.	6	any F6
Dep. Weld Metal Thk. Range-groove	.5"	0" to 8"
Dep. Weld Metal Thk. Range-Fillet	N/A	all
Position	3G	F,V,H, fillet only
Weld Progression	uphill	uphill
Gas Type	75% argon 25% CO2	any inert shielding gas
Electrical Char. - Current	DC	DC
Electrical Char. - Polarity	Rev.	Rev.

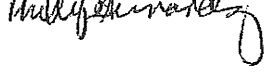
GUIDED BEND TEST RESULTS QW-462.2, QW462.3 (a), QW-462.3 (b)

Type and Fig. No.	Result
Side Bend per QW462.2	satisfactory
Side Bend per QW462.2	satisfactory

Visual examination results (QW-302.4) - satisfactory
Radiographic test results (QW-304 and QW-305) - n/a
Fillet Weld - Fracture test - N/A Length & percent of defects - N/A in.
Macro test fusion - N/A Fillet leg size - N/A in. x N/A in. Concave / convex-N/A in.
Welding test conducted by - Curtis Kelly, Inc.
Mechanical / Radiographic test conducted by -Goolsby Testing Lab #05-03-38826

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

Date: 3/23/05

Organization: CURTIS KELLY, INC.
By: 

QW-484 SUGGESTED FORMAT FOR MANUFACTURER'S RECORD OF WELDER / WELDING OPERATOR QUALIFICATION TESTS

Welders Name: Arnoldo Ramirez SS.# [redacted]XXXX Stamp No.: T

Using WPS No.: 130 Rev. No.: 5

the above welder is qualified for the following ranges.

VARIABLE	Actual Values Used in Qualification	Qualification Range
Process & GMAW transfer mode	GMAW	GMAW
Process Type	Semi Automatic	Semi Automatic
Backing	weld metal	weld metal
Material Spec. P-No. to P-No.	P8 to P8	P1 thru P11,P34,P41~47
Thickness - Groove	.5" - 5 LAYERS	max. to be welded
Thickness - Fillet	N/A	all
Diameter - Groove	N/A	over 2.875"
Diameter - Fillet	N/A	all
Filler Metal - Spec. No.	SFA-5.14	F41~F45 & F34
Filler Metal - F No.	43	F41~F45 & F34
Dep. Weld Metal Thk. Range-groove	.5"	max. to be welded
Dep. Weld Metal Thk. Range-Fillet	N/A	all
Position	3G	F,V,H, fillet only
Weld Progression	uphill	uphill
Gas Type	70%Argon/30%Helium	any inert shielding gas
Electrical Char. - Current	DC	DC
Electrical Char. - Polarity	Rev.	Rev.

GUIDED BEND TEST RESULTS QW-462.2, QW462.3 (a), QW-462.3 (b)

Type and Fig. No.	Result
n/a	n/a

Visual examination results (QW-302.4) - satisfactory
Radiographic test results (QW-304 and QW-305) - satisfactory
Fillet Weld - Fracture test - N/A Length & percent of defects - N/A in.
Macro test fusion - N/A Fillet leg size - N/A in. x N/A in. Concave / convex-N/A in.
Welding test conducted by - Curtis Kelly, Inc.
Mechanical / Radiographic test conducted by - H&G Services Test No.: 14-10-04-1

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

Date: 10/14/04

Organization: CURTIS KELLY, INC.
By: Phillip Alvarado

QW-484 SUGGESTED FORMAT FOR MANUFACTURER'S RECORD OF WELDER / WELDING OPERATOR QUALIFICATION TESTS

Welders Name: Arnoldo Ramirez S.S.# [redacted] Stamp No.: T

Using WPS No.: 199 Rev. No.: 2

the above welder is qualified for the following ranges.

VARIABLE	Actual Values Used in Qualification	Qualification Range
Process & GMAW transfer mode	GTAW	GTAW
Process Type	Manual	Manual
Backing	none/argon	with or without backing
Material Spec. P-No. to P-No.	P43 to P43	P1 thru P11,P34,P41~47
Thickness - Groove	.218"	0" to .436"
Thickness - Fillet	N/A	all
Diameter - Groove	2.375"	over 1"
Diameter - Fillet	N/A	all
Filler Metal - Spec. No.	SFA5.14	SFA 5.14
Filler Metal - F No.	F43	F41 ~ F45 & F34
Dep. Weld Metal Thk. Range-groove	.218"	0" to .436"
Dep. Weld Metal Thk. Range-Fillet	N/A	all
Position	6G	all
Weld Progression	uphill	uphill
Gas Type	100% argon	any inert shielding gas
Electrical Char. - Current	DC	DC
Electrical Char. - Polarity	Str.	Str.

GUIDED BEND TEST RESULTS QW-462.2, QW462.3 (a), QW-462.3 (b)

Type and Fig. No.	Result
n/a	n/a

Visual examination results (QW-302.4) - satisfactory
Radiographic test results (QW-304 and QW-305) - satisfactory
Fillet Weld - Fracture test - N/A Length & percent of defects - N/A in.
Macro test fusion - N/A Fillet leg size - N/A in. x N/A in. Concave / convex-N/A in.
Welding test conducted by - Curtis Kelly, Inc.
Mechanical / Radiographic test conducted by - H&G Services Test No.: 04-1202-1

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

Date: 12/06/04

Organization: CURTIS KELLY, INC.
By: Arnoldo Ramirez

QW-484 SUGGESTED FORMAT FOR MANUFACTURER'S RECORD OF WELDER / WELDING OPERATOR QUALIFICATION TESTS

Welders Name: Arnoldo Ramirez [redacted] Stamp No.: T

Using WPS No.: 199 Rev. No.: 2

the above welder is qualified for the following ranges.

VARIABLE	Actual Values Used in Qualification	Qualification Range
Process & GMAW transfer mode	GTAW	GTAW
Process Type	Manual	Manual
Backing	none/argon	with or without backing
Material Spec. P-No. to P-No.	P43 to P43	P1 thru P11,P34,P41~47
Thickness - Groove	.218"	0" to .436"
Thickness - Fillet	N/A	all
Diameter - Groove	2.375"	over 1"
Diameter - Fillet	N/A	all
Filler Metal - Spec. No.	SFA5.14	SFA 5.14
Filler Metal - F No.	F43	F41 ~ F45 & F34
Dep. Weld Metal Thk. Range-groove	.218"	0" to .436"
Dep. Weld Metal Thk. Range-Fillet	N/A	all
Position	6G	all
Weld Progression	uphill	uphill
Gas Type	100% argon	any inert shielding gas
Electrical Char. - Current	DC	DC
Electrical Char. - Polarity	Str.	Str.

GUIDED BEND TEST RESULTS QW-462.2, QW462.3 (a), QW-462.3 (b)

Type and Fig. No.	Result
n/a	n/a

Visual examination results (QW-302.4) - satisfactory
Radiographic test results (QW-304 and QW-305) - satisfactory
Fillet Weld - Fracture test - N/A Length & percent of defects - N/A in.
Macro test fusion - N/A Fillet leg size - N/A in. x N/A in. Concave / convex-N/A in.
Welding test conducted by - Curtis Kelly, Inc.
Mechanical / Radiographic test conducted by - H&G Services Test No.: 04-1202-1

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

Date: 12/06/04

Organization: CURTIS KELLY, INC.
By: [signature]

Spitzer INDUSTRIES | Curtis Kelly A SPITZER COMPANY

ASME IX – WELDER, WELDING OPERATOR, OR TACK WELDER QUALIFICATION TEST RECORD

Welders Name: **Ignacio Tristan** Identification No.: **H6**

Test Description

Identification of WPS followed: **255HT(-50)** ☒ Test Coupon ☐ Production weld

Specification and type/grade or UNS number of base metal(s): **SA106 Gr. B** Dimensions: **6.625" x 0.719"**

Testing Conditions and Qualification Limits

Welding Variables (QW-350)	Actual values	Range qualified
Welding process (es)	FCAW	FCAW
Type (i.e., manual, semi-automatic) used	Semi-automatic	Semi-automatic
Backing (with/without, metal, weld metal, double-welded, etc.)	With Backing	With Backing or Back-gouging
☐ Plate ☒ Pipe (enter diameter, if pipe or tube)	6.625" O.D.	2.875" - Unlimited
Base metal P- or S-Number to P-or S-Number	P1 to P1	P No. 1-15F, 34, & 41-49
Filler metal or electrode specification(s) (SFA) (info only)	A5.20	-
Filler metal or electrode classification(s) (info only)	E71T-9M-H8	-
Filler metal F-Number(s)	F-No. 6	F No. 6
Consumable insert (GTAW or PAW)	None	None
Filler type (solid/metal or flux cored/powder (GTAW or PAW)	Flux Cored Electrode	Flux Cored Electrode
Deposit thickness for each process		
Process 1: FCAW 3 layers minimum ☒ Yes ☐ No	0.719"	Max To Be Welded
Process 2: - 3 layers minimum ☐ Yes ☐ No	-	-
Position qualified (2G, 6G, 3F, etc.)	6G	All
Vertical progression (uphill or downhill)	Uphill	Uphill
Type of fuel gas (OFW)	None	None
Inert gas backing (GTAW, PAW, GMAW)	None	None
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) **See SII Inspection Report No.: Q01006 - Acceptable**

☐Transverse face and root bends [QW-462.3 (a)]; ☐Longitudinal bends [QW-462.3 (b)]; ☐Side bends (QW-462.2)

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

☐Plate bend specimen, corrosion-resistant weld metal overlay [QW-462.5 (d)];

☐ Pipe specimen macro test for fusion [QW-462.5 (b)]; ☐ Plate specimen macro test for fusion [QW-462.5 (e)];

Type	Result	Type	Result	Type	Result
-	-	-	-	-	-
-	-	-	-	-	-

Alternative radiographic examination results (QW-191): **See AGD RT Report No.: 032017-JB01 - Acceptable**

Fillet weld -- Fracture test (QW-180): - Length and percent of defects: -

Macro examination (QW-184): - Fillet size (in.): - X - Concavity/convexity (in.): -

Other tests: -

Film or specimens evaluated by: **Ramon Flores** Company: **Spitzer Industries**

Mechanical tests conducted by: **N/A** Laboratory Test Number: **N/A**

Welding supervised by: **Nelson Reyes**

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

Manufacturer or Contractor: **The Spitzer Companies**

Date: **3/28/2017** Certified by: 

SECTION 10
WPS / PQR'S



Curtis Kelly Inc.
Houston, Texas

QW-482 (FRONT)

WELDING PROCEDURE SPECIFICATION "WPS"

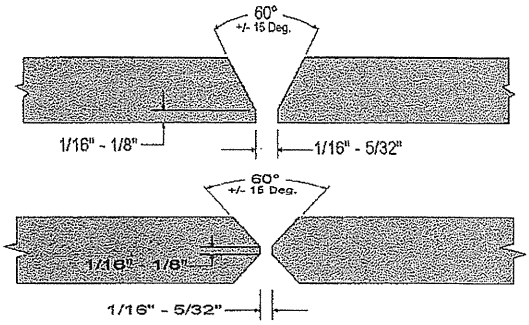
WPS#: 114IT Revision 1	Supporting PQR No.(s): 303 & 330	Welding Process(es): FCAW

Types: Semi-Automatic
(Automatic, Manual, Machine or Semi-Auto)

JOINTS (QW-402)
Joint Design: SINGLE VEE GROOVE AND FILLET WELD
Backing: Yes X No
Backing Material (Type): Weld Metal (No Retainers Used)
(Refer to both backing and retainers)

☐ Metal ☐ Nonfusing Metal
☐ Non-metallic ☐ Other

Details



BASE METALS (QW-403)
P-No. 1 Group No. 1 To P-No 1 Group No. 2
OR
Specification type and grade SA-516-65
to Specification type and grade SA-516-70
OR
Chem. Analysis and Mech Prop. N/A
to Chem. Analysis and Mech Prop. N/A
Thickness Range:
Base Metal: Groove *3/8" to 8" Fillet ALL
Pipe Dia. Range: Groove N/A Fillet ALL
Other *When "notch toughness testing" is not required the base material thickness range shall be 3/16" to 8"

FILLER METALS (QW-404)

Spec No. (SFA)	5.20
AWS No. (Class)	E71T-12MJ
F-No.	6
A-No.	1
Size of Filler Metals	045" & 1/16"Ø
Deposited Weld Metal	UNLIMITED
Thickness Range:	3/8" to 8" (see note #2)
Groove	8" MAX
Fillet	ALL
Electrode-Flux Class	N/A
Flux Trade Name	N/A
Consumable Insert	N/A
Filler Product Form	Flux cored

(Flux Cored, Bare / Metal Cored or Powder)

Note(s): 1). No Supplementary filler metal added.
2). 3/16 to 8" if not notch-toughness testing in not required

APPROVED FOR CONSTRUCTION
WL 2132 10/19/16
Curtis Kelly, Inc.

WELDING PROCEDURE SPECIFICATION "WPS"

WPS#.: 114IT Revision 1	Supporting PQR No.: 303 & 330	Welding Process(es): FCAW

POSITIONS (QW-405)
Position(s) of Groove: 3G
Welding Progression: Up X Down
Position(s) of Fillet: ALL

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

PREHEAT (QW-406)
Preheat Temp. Min.: 100° F for < 1" & 200° F for ≥ 1"
Interpass Temp. Max: 500° F
Preheat Maintenance: None used

GAS (QW-408)

	Gas(es)	Percent Composition (Mixture)	Flow Rate
Shielding	Argon/Co2	75 / 25	30 ~ 50 CFH
Trailing	None used	N/A	N/A
Backing	None used	N/A	N/A

ELECTRICAL CHARACTERISTICS (QW-409)
Current AC or DC: DC
Polarity: Reverse
AMPS (Range): SEE BELOW
Volts (Range): SEE BELOW
Tungsten Electrode Size and Type: N/A
(Pure Tungsten, 2% Thoriated, etc.)
Mode or Metal Transfer for GMAW: GLOBULAR
(Spray arc, short circuiting arc, etc.)
Electrode Wire feed speed range: N/A

TECHNIQUE (QW 410)
String or Weave Bead: WEAVE – 5/8" MAXIMUM BEAD WIDTH
Orifice or Gas Cup Size: 1/2" TO 5/8"
Initial and Interpass Cleaning (Bushing, Grinding, etc.): CLEAN 2" FROM WELD JOINT BY GRINDING, BRUSHING, CHIPPING OR SOLVENT
Method of Back Gouging: ARC GOUGE TO CLEAN METAL AND GRIND TO BRIGHT METAL
Oscillation: None
Contact Tube to Work Distance: 1/2" ~ 5/8"
Multiple or Single Pass (per side): MULTIPLE WITH PASSES LESS THAN 1/2" THICK
Multiple or Single Electrodes: SINGLE
Travel Speed (Range): SEE BELOW
Peening: NOT PERMITTED
Other:

Weld Layers	Process	Filler Metal		Current		Volt Range	Travel Speed Range (in per min)	Other (e.g. Remarks, Comments, Hot Wire Addition, Technique, Torch Angle, etc.)
		Class	Diameter	Type Polar	Amp Range			
1-3	FCAW	E71T-12MJ	.045"	REVERSE	220 - 275	28-32	8.5 - 12	48,141 J/in *
REMAINDER	FCAW	E71T-12MJ	1/16"	REVERSE	275 - 375	31 - 34	10 - 14	61,687 J/in **

* .045" DIA ELECTRODE, MAX BEAD WIDTH 5/8"
** 1/16" DIA. ELECTRODE, MAX BEAD WIDTH 7/8"
NOTE: ENTIRE WELD JOINT MAY BE WELDED W/ EITHER ELECTRODE PROVIDED THE HEAT INPUT IS NOT EXCEEDED

Acceptance
Company: Curtis Kelly, Inc.
Title: Quality Control Manager
By: *Nolen R. Glaze Jr.*
Date: 30-May-09

CURTIS KELLY INC.
HOUSTON, TEXAS

QW-483 FORMAT FOR PROCEDURE QUALIFICATION RECORD (PQR) SHEET 1 of 2

Company Name: Curtis Kelly Inc. By: Phillip Hernandez
Procedure Qualification Record No.: 303
Welding Procedure Specification No. 114 IT Date: 4/28/06
Welding Processes: FCAW Type(s): semi-automatic

JOINTS (QW-402)
Joint Design:60 Deg. double vee 30 deg. bevel 1/8"land 1/16" opening
Backing: see backing
Backing Material (Type): WELD METAL (BACKGOUGE)
Retainers: none

BASE METALS (QW-403)
P-No. 1 Gr. No. 2 to P-No. 1 Gr. No. 2
Specification type & grade: SA516-70
to Specification type & grade: SA516-70
Thickness of Test Coupon: 2.25"
Diameter of Test Coupon: plate
Other: N/A

FILLER METALS (QW-404)
F-No.: 6 Other: ----
A-No.: 1 Other: ----
Spec. No. (SFA): 5.20
AWS No.(Class): E71T-12MJ
Size of filler metals: .045" & 1/16"
Electrode Flux (Class): N/A
Flux Tradename: N/A
Consumable Insert: N/A
Weld metal Thickness: 2.25"

POSITIONS (QW-405)
Position of Groove: 3G
Welding Progression: uphill

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

PREHEAT (QW-406)
Preheat Temp. : 200 deg F
Interpass Temp. : 500 deg. F
Other: N/A

GAS (QW-408)
Shielding Gas or Gases: argon/CO2
Percent Composition (mixtures):75%Ar/25%CO2
Flow Rate: 35 C.f.H.
Gas Backing: NONE
Trailing Shielding Gas Composition: none

ELECTRICAL CHARACTERISTICS (QW-409)
Current (AC or DC): DC Polarity: * Pulsing current: none
Amps (Range): * Volts (Range): *

Procedure Qualification Record No.: 303
Welding Procedure Specification No. 114 IT Date: 4/28/06 SHEET 2 of 2

TECHNIQUE (QW-410)
String or Weave Bead: string
Oscillaton: None
Multiple or Single Pass (per side): Multiple
Multiple or Single Electrodes: Single
Other:

* Weld Layer(s)	Process	Filler Metal Class	Filler Metal Dia.	Current Type Polar.	Current Amp Range	Volt Range	Travel Speed Range ("/min.)	Other (J/in.) (Max.)
1 -3	FCAW	E71T-12MJ	.045"	REV.	220	31	8.5"	48141
remain.	FCAW	E71T-12MJ	1/16"	REV.	290	32	9"	61867

Tensile Test (QW-150)

Specimen No.	Width	Thickness	Area	Ultimate Total Load	Ultimate Unit Stress	Fracture Location
1(QW462.1a)	.757"	2.187"	1.655"	125,500	75,831	BASE
2(QW462.1a)	.753"	2.192"	1.650"	124,400	75,394	BASE

Guided Bend Test (QW-160)

Type & Figure No.	Result
SIDE BEND QW 462.2a	SATISFACTORY
SIDE BEND QW 462.2a	SATISFACTORY
SIDE BEND QW 462.2a	SATISFACTORY
SIDE BEND QW 462.2a	SATISFACTORY

Toughness Test (QW-170)

Specimen No.	Notch Location	Notch Type	Test Temp.	Impact Values ft/lbs	lateral expansion % shear	lateral expansion mils	Drop Weight Break	Drop Weight No Break
1 & 4	weld top/mid	vee	-40	105/125	70/70	.098/.099		
2 & 5	weld top/mid	vee	-40	100/122	70/70	.093/.096		
3 & 6	weld top/mid	vee	-40	105/120	70/70	.098/.094		
7 & 10	HAZ/Base	vee	-40	90/70	60/50	.086/.065		
8 & 11	HAZ/Base	vee	-40	95/72	60/50	.091/.067		
9 & 12	HAZ/Base	vee	-40	90/70	60/50	.086/.065		

Welder's Name: Mario Torres Stamp: I S.S.#: 452-02-2521
Test conducted by:Goolsby Testing Laboratories
Laboratory Test No.:06-04-42114

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: Curtis Kelly Inc.

Date:4/28/06

By: Phillip Hernandez
Phillip Hernandez

GOOLSBY TESTING LABORATORIES, INC.
2620 WILSON ROAD - P.O. BOX 1416
HUMBLE, TEXAS 77347-1416
(281) 540-1255 FAX (281) 540-8125

TO: CURTIS KELLY, INC.	DATE: 4/28/2006
P.O. BOX 450808	LABORATORY TEST NO: 06-04-42114
HOUSTON, TEXAS 77245	MATERIAL: SA 516-70 N
FCAW PROCESS	GTL# 7062 HEAT # 815359
MATERIAL THICKNESS: 2 1/4"	SPECIFICATIONS: ASME SECT. IX

TENSILE TEST

SPEC. NO.	WIDTH	THK. NESS	SQ.IN. AREA	ULT.LD YIELD	YIELD PSI	ULT.LD TENSILE	TENSILE PSI	%EL IN 2"	% ROA	FRAC. LOC.
QW462.1A	.757	2.187	1.655			125500	75831			BASE
QW462.1A	.753	2.192	1.650			124400	75394			BASE

IMPACT TEST

TESTING MACHINE: BALDWIN SATEC S1-1	TEST METHOD: SIMPLE BEAM CHARPY
LINEAR VELOCITY OF HAMMER: 17 FT/SEC.	EFFECTIVE ENERGY: 240 FT/LBS.
SPECIMEN TYPE: ASTM TYPE A LVNC	SPECIMEN SIZE: 10 MM X 10 MM
SPECIMEN TEMP: -40 DEG.F.	ACCEPTANCE CRITERIA: 15/12 FT.LBS

SPECIMEN LOCATION	WIDTH	EFFECTIVE SECTION SIZE	IMPACT VALUES FOOT POUNDS	% SHEAR FRACTURE	LATERAL EXPANSION
1 TOP WELD	.394	.315	105	70	.098
2 TOP WELD	.394	.315	100	70	.093
3 TOP WELD	.394	.315	105	70	.098
4 MID WELD	.394	.315	125	70	.099
5 MID WELD	.394	.315	122	70	.096
6 MID WELD	.394	.315	120	70	.094
7 HAZ	.394	.315	90	60	.086
8 HAZ	.394	.315	95	60	.091
9 HAZ	.394	.315	90	60	.086
10 BASE	.394	.315	70	50	.065
11 BASE	.394	.315	72	50	.067
12 BASE	.394	.315	70	50	.065

BEND TEST

SPEC.# AND TYPE	RESULTS	SPEC.# AND TYPE	RESULTS
QW462.2 SIDE	SATISFACTORY	QW462.2 SIDE	SATISFACTORY
QW462.2 SIDE	SATISFACTORY	QW462.2 SIDE	SATISFACTORY

ACCEPTABLE < XX > REJECTABLE < > PER APPLICABLE SPECIFICATIONS.
ACTUAL WELDING WAS < > WAS NOT < X > WITNESSED BY GTL.

GOOLSBY TESTING LABORATORIES, INC.

PER: W Keith Goolsby
W. KEITH GOOLSBY PRESIDENT / LEVEL III

Our letters and reports are for the use of our clients to whom they are addressed. Our name may be used only with our prior written approval. Our letters and reports apply only to the sample tested and / or inspected, and do not necessarily represent the quality of other apparently similar or identical materials.

CURTIS KELLY INC.
HOUSTON, TEXAS

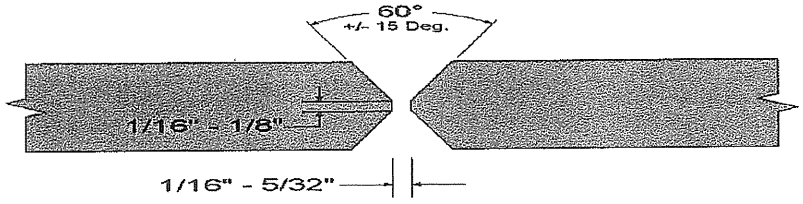
QW-483 (Front)

PROCEDURE QUALIFICATION RECORD (PQR)

		PQR No.: 330
Date: 30-May-09	WPS No.(s): 114IT	Welding Process(es): FCAW

Type(s) Semi Auto
(Automatic, Manual, Machine or Semi-Auto.)

JOINTS (QW-402)



BASE METALS (QW-403)
Specification Type and Grade SA-516-65
to Specification Type and Grade SA-516-70
P-No. 1 Grp.No. 1 To P-No. 1 Grp No. 2
Thickness Tested 3/8" Range N/A
Diameter Tested N/A Range N/A
Number of weld passes exceeding ½" in thickness None
Backing Yes X No ____ Material WELD METAL
Other

FILLER METALS (QW-404)

Process	FCAW	
A-No.	1	
F-No.	6	
Manufacturer Trade name		
Diameter of Filler Metals	.045"	
SFA Specification	5.20	
AWS Classification	E71T-12MJ	
Weld Deposit Thickness	3/8"	
Filler Metal Product Form	Flux Cored	

Electrode – Flux Class none
Flux Trade Name N/A Designation N/A
Tungsten Size N/A Type N/A Class N/A
Other SUPPLEMENTAL FILLER NOT USED

POSITION (QW-405)
Position of Test Groove 3G
Weld Progression (Up, Down, Flat) Up
Root n/a Hot Pass n/a Filler n/a Cap n/a

PREHEAT (QW-406)
Yes Yes None
Preheat Temp. 100°F
Interpass Temp. Max 500°F
Other

POSTWELD HEAT TREATMENT (QW-407)
Method AS WELDED
Temperature Range N/A
Time N/A
Other

GAS (QW-408)

Process	FCAW	
Shielding	Ar / Co2 75%/25%	
Flow Rate	35 CFH	
Backing	None used	
Flow Rate	N/A	

Other

ELECTRICAL CHARACTERISTICS (QW-409)

Process	FCAW	
Current	Direct	
Polarity	Reverse	
Voltage Range	31	
Amperage Range	220	

Other Transfer Mode: Globular

TECHNIQUE (QW-410)

Process(es)	FCAW	
Travel Speed (in/min.)	8.5	
String or Weave Bead	Weave	
Oscillation	None	
Multiple or single Pass	Multiple	
Single or Multiple Electrodes	Single	
Peening	None	

Other J/IN. 48,141

Tensile Test (QW-150)

Specimen No.	Width	Thickness	Area	Tensile Strength	Yields Strength	Ultimate Load lbs.	Character of Failure and Location
T-1 QW462.1A	.750	.370	.277	81,227	49,638	22,500	Base Metal
T-2 QW462.1A	.752	.368	.276	81,159	49,275	22,400	Base Metal

Guided Bend Test (QW-160)

Specimen No.	Type	Figure No.	Results	Specimen No.	Type	Figure No.	Results
S-1	Side	QW462.5(d)	Satisfactory				
S-2	Side	QW462.5(d)	Satisfactory				
S-3	Side	QW462.5(d)	Satisfactory				
S-4	Side	QW462.5(d)	Satisfactory				

Toughness Test (QW-170)

Specimen Loc.	Notch Type	Specimen Size	Test Temp	Impact Values Ft/lbs	Avg.	Lateral Exp.		Drop Weight
						% Shear	Mils	
Base material	Vee	8 x 10 mm	-40°	50, 52, 54	52.6	30, 30, 30	.041, .043, .045	Not performed
Weld metal	Vee	8 x 10 mm	-40°	80, 82, 84	82	60, 60, 60	.071, .073, .075	Not performed
HAZ	Vee	8 x 10 mm	-40°	86, 88, 88	87.3	60, 60, 60	.077, .079, .079	Not performed

Hardness Vickers Test Per ASTM E92

Location	Base	HAZ			Weld			HAZ			Base
Top from left to right	198	182		193	202		219	207		212	205
Center			214			213			213		
Bottom	192	221		216	228		225	218		219	215

Other Tests

Type of Test PT examination per QW 195 – acceptable. Goolsby Report #09-04-54704

Deposit Analysis N/A

Other

Welder's Name Antonio Ponce

Stamp No. "P"

Test Conducted by Goolsby Testing Laboratories, Inc.

Laboratory-Test No. 09-04-54699, 09-04-54700

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

Manufacturer CURTIS KELLY INC.

Date 30-April-09

By *Nolen R. Glaze Jr.*

GOOLSBY TESTING LABORATORIES, INC.
2620 WILSON ROAD - P.O. BOX 1416
HUMBLE, TEXAS 77347-1416
(281) 540-1255 FAX (281) 540-8125

TO: CURTIS KELLY, INC.	DATE: 4/27/09
P.O. BOX 450808	LABORATORY TEST NO: 09-04-54699
HOUSTON, TEXAS 77245	MATERIAL: SA516-70 (N) WELD PLATE
SHOP ORDER#: 1852	GTL#: WPS1141T/ PQR 330 HT#: 9101126
MATERIAL THICKNESS: 3/8"	SPECIFICATIONS: ASME SECT IX

TENSILE TEST

SPEC. NO.	WIDTH	THK. NESS	SQ.IN. AREA	ULT.LD YIELD	YIELD PSI	ULT.LD TENSILE	TENSILE PSI	%EL IN 2"	% ROA	FRAC. LOC.
QW462.1A	.750	.370	.277	13750	49638	22500	81227	34	59	BASE METAL
QW462.1A	.752	.368	.276	13600	49275	22400	81159	35	45	BASE METAL

IMPACT TEST

TESTING MACHINE: BALDWIN SATEC S1-1	TEST METHOD: SIMPLE BEAM CHARPY
LINEAR VELOCITY OF HAMMER: 17 FT/SEC.	EFFECTIVE ENERGY:300 FT/LBS/406.7JOULES
SPECIMEN TYPE: ASTM TYPE A LVNC	SPECIMEN SIZE: 8 MM X 10 MM
SPECIMEN TEMP: -40°F.	ACCEPTANCE CRITERIA: 15/12 FT.LBS

SPECIMEN LOCATION	WIDTH	EFFECTIVE SECTION SIZE	IMPACT VALUES FOOT POUNDS	% SHEAR FRACTURE	LATERAL EXPANSION
WELD	.315	.315	80	60	.071
WELD	.315	.315	82	60	.073
WELD	.315	.315	84	60	.075
HAZ	.315	.315	86	60	.077
HAZ	.315	.315	88	60	.079
HAZ	.315	.315	88	60	.079
BASE	.315	.315	50	30	.041
BASE	.315	.315	52	30	.043
BASE	.315	.315	54	30	.045

BEND TEST

SPEC.# AND TYPE	RESULTS	SPEC.# AND TYPE	RESULTS
QW462.2 SIDE BEND	SATISFACTORY	QW462.2 SIDE BEND	SATISFACTORY
QW462.2 SIDE BEND	SATISFACTORY	QW462.2 SIDE BEND	SATISFACTORY

ACCEPTABLE < XX > REJECTABLE < > PER APPLICABLE SPECIFICATIONS.
ACTUAL WELDING WAS < > WAS NOT < X > WITNESSED BY GTL.

GOOLSBY TESTING LABORATORIES, INC.

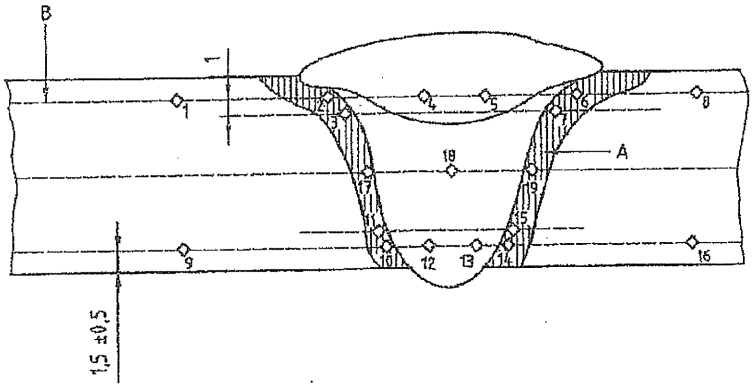
PER: W. Keith Goolsby
W. KEITH GOOLSBY PRESIDENT / LEVEL III

Our letters and reports are for the use of our clients to whom they are addressed. Our name may be used only with our prior written approval. Our letters and reports apply only to the sample tested and / or inspected, and do not necessarily represent the quality of other apparently similar or identical materials.

GOOLSBY TESTING LABORATORIES, INC.
2620 WILSON ROAD - P.O. BOX 1416
HUMBLE, TEXAS 77347-1416
(281) 540-1255 FAX (281) 540-8125

TO: CURTIS KELLY	DATE: 4/27/09
P.O. BOX 450808	LABORATORY TEST NO: 09-04-54700
HOUSTON TX, 77245	MATERIAL: SA516-70 (N) WELD PLATE
WPS 1141T/ PQR330 GTL# 421	HEAT 9101126 SB#
JOB NUMBER: 1852	SPECIFICATIONS:NACE MR0175-2003
MATERIAL THICKNESS: 3/8"	PARA 7.3.3.2 + 7.3.3.3

VICKERS HARDNESS



LOCATION	Vickers Hardness Number	Location	Vickers Hardness Number
1	198	11	216
2	182	12	228
3	193	13	225
4	202	14	218
5	219	15	219
6	207	16	215
7	212	17	214
8	205	18	213
9	192	19	213
10	221		

ACCEPTABLE < XX > Rejectable < > Per Applicable Specifications.
Actual Welding was < > was not < > witnessed by GTL.

GOOLSBY TESTING LABORATORIES, INC.

PER: W. Keith Goolsby
W. KEITH GOOLSBY, PRESIDENT / LEVEL III

Our letters and reports are for the use of our clients to whom they are addressed. Our name may be used only with our prior written approval. Our letters and reports apply only to the sample tested and/or inspected, and do not necessarily represent the quality of other apparently similar or identical materials. The results reported represent opinions only and are not to be considered as warranties or guarantees of quality classification or usability of material examined. In no event shall the liability of Goolsby Testing Laboratories Inc. as to any items inspected or tested (including any liability as to selection and/or results of such tests) exceed the charge of Goolsby Testing Laboratories Inc. for the inspection of such items. We shall assume no responsibility following the acceptance by the customer's field representative upon signing of field ticket.

GOOLSBY TESTING LABORATORIES, INC.
2620 WILSON ROAD – P.O. BOX 1416
HUMBLE, TEXAS 77347-1416
(281) 540-1255 FAX (281) 540-8125

LIQUID PENETRANT INSPECTION REPORT

TO: CURTIS KELLY	DATE: 04-23-09 TIME: 9:35AM
	LABORATORY TEST NO: 09-04-54704
	MATERIAL: SA516-70 THK: 3/8"
JOB REFERENCE: 1852	GTL PROC: REV:
SPECIFICATION: ASME SECTION IX WQ-195	

TYPE OF INSPECTION

PENETRANT
COLOR ☒ FLUORESCENT ☐
DWELL TIME: 10 Min
LIGHTING: >100FC

DEVELOPER
WET ☒ DRY
DRYING TIME: 10Min

CLEANER
MAGNAFLUX
TEMPERATURE: 75f°

BATCH # PENETRANT: 4GHL25 DEVELOPER: NB481K PENETRANT REMOVER: J229B3

ITEM	QTY	DESCRIPTION	RESULTS
	1	WELDED TEST PLATE	NO REJECTABLE INDICATIONS
			FOUND PER MY INSPECTION.

TECHNICIAN

WILL GOOLSBY
LEVEL II

GOOLSBY TESTING LABORATORIES, INC.

PER: W. Keith Goolsby
W. KEITH GOOLSBY PRES. / LEVEL III

Accepted by: _____ Company: _____

Our letters and reports are for the use of our client to whom they are addressed. Our name may be used only with our prior written approval. Our letters and reports apply only to the sample tested and/or inspected, and do not necessarily represent the quality of other apparently similar or identical materials. The results recorded represent opinions only and are not to be considered as warranties or guarantees of quality, classification or usability of material examined. In no event shall the liability of Goolsby Testing Laboratories, Inc. as to any items inspected or tested (including liability as to selection and/or results of such tests) exceed the charge of Goolsby Testing Laboratories, Inc. for the inspection of such items. We shall assume no responsibility following the acceptance by the customers field representative upon signing of field ticket.

Certificate of Mill Test Res

Pg 1 of

1DAY 208640

NUCOR
PLATE MILL

P.O.Box 279
Wilson, NC 27895
(252) 265-9700

Mill Test Report

Page 1

NUCOR
It's our Nature

Issuing Date : 03/24/2009 BL No. : 208640 Lead No. : 227544 Our Order No. : 701441 Cust. Order No. : HOUL-4020

Vehicle No: ATW 63075

Specification : 0.2750" x 96.000" x 480.000"
ASTM A516 70 PRESSURE BASIN TO PVQ 2008 Addenda

Marking :

Heat No	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Al(sol)	V	Nb	Ti	N	Ca	B	Sn	CEQ	PCM
9101126	0.19	1.05	0.009	0.001	0.19	0.17	0.06	0.05	0.01	0.030	0.004	0.001	0.004		0.0020	0.0000	0.001	0.40	0.27

Plate Serial No	Pieces	Tons	Dir.	Tensile Test (ksi) Yield	(ksi) Tensile	Elongation % in 2"	Elongation % in 8"	Charpy Impacts Qlty.	1	(ft) shear	2	(ft) shear	3	(ft) shear	Ave.	(ft) shear	Size	Temp	Min Ave.
9101126-03	4	9.60	T	64,500	77,000		24.4												
9101126-04	6	14.76	T	64,300	77,000		22.4												
9101126-05	2	4.80	T	64,200	77,700		23.1												

SAMUEL SON
APPROVED
W.O.#
CUSTOMER
CUSTOMER P.O.#
JOB #
PART #

Also meets A516-65
MS
6-Apr-09

Manufactured to fully killed fine grain practice by Electric Arc Furnace. Welding or weld repair was not performed on this material. Mercury has not been used in the direct manufacturing of this material. Produced as continuous cast electric plate as-rolled, unless otherwise noted in Remarks.

Yield by ASTM method offset elongation specified. Ceq = C+(Mn/6)+(Cr+Mo+V)/5+(Cu+Ni)/15

Formulas for CEQ and PCM

Melted and manufactured in the USA. ISO 9001:2000 certified (Reg. No. 11) by SAI Global. PED 97/23/EC Tot Annex 1, Para. 4.3 Compliant. DIN 55949 0.1/EN 10204 3.1(2004), DIN EN 10204 3.1(2005) compliant. For ABS plates only, Quality Assurance certificate on MSP-QA-383

We hereby certify that the contents of this report are accurate and correct. All test results and operations performed by the material manufacturer are in compliance with the applicable specifications, including customer specifications.

T. A. Depaolo, Metallurgist

03/24/2009 8:31:49 AM

Doc No. 204723 Indexed 28Mar09 by 145elvac

THE SPITZER COMPANIES

Welding Code: ASME Sect. IX • Welding Procedure Specification No.: AS-P8-P8-A-36 Revision No.:1 Date:8-2-12 By: R. Rocha
PQR No. (s): 195, 133S & 133S2 Welding Process(es): SAW Process Type: Manual ☐ Semi-Auto ☐ Automatic ☐ Machine ☒

Joints (QW-402)
Joint Design: All Grooves and Fillets
Root Spacing: .062" ±.062" Root Face Dimension: .062" ±.062"
Groove Angle: 60° ±5° Radius (J-U) _____
Backing: Yes ☒ With backing or backgouge No ☐ _____
Material Type: ☒ Metal ☐Nonmetallic ☐Nonfusing ☐ Other
Retainers ☐ Yes ☒ No,

Base Metals (QW-403)
P No.: 8 Group No.: 1 to P No.: 8 Group No.: 1
Specification Type/Grade/UNS No.: N/A to Specification Type/Grade/UNS No.: N/A
Thickness Range: Base Metal: Groove .375"-8.00" Fillet ALL Maximum Pass Thickness ≤ ½": ☒ Yes ☐ No
Pipe Diameter Range: ALL
Note: _____

Filler Metals (QW-404)

Variables/Process(es)	SAW
SFA Classification	5.9
AWS Classification	See Chart
F No.	6
A No.	8
Size of Filler Metal	.093"-.125"
Thickness Range	8.00" Max.
Filler Manf./Trade Name	Lincoln
Electrode-Flux (Class)	Neutral
± Flux	With Flux
Flux Trade Name	880M
Consumable Insert	None
Product Form	Bare Wire
± Supplemental	None
± Filler	With Filler Only
Other	None

CHART

Base	FILLER SAW	FILLER N/A
304/L	ER308/L	-
316/L	ER316/L	-

Positions (QW-405)
Position of Groove: 1G Position of Fillets: 1F & 2F
Welding Progression: ☐ Up ☐ Down ☒ N/A

Postweld Heat Treatment (QW-407)
Temperature Range: N/A °F Time Range: -
Note: -

Preheat (QW-406)
Preheat Temp Min.: 60 °F
Interpass Temp. Max.: 350 °F
Preheat Maintenance: None
Note: _____

Gas (QW-408)
Process N/A Shielding Gas - Mixture - Flow Rate -
Process - Shielding Gas - Mixture - Flow Rate -
Backing Gas None Mixture - Flow Rate -
Trailing Req.: None

Electrical Characteristics (QW-409)
Tungsten Electrode Type and Size: N/A Mode of Metal Transfer for GMAW/FCAW: N/A Wire Feed Speed: N/A

Weld Layer	Process	Class	Dia.	Polarity	Amps.	Volts.	T/Speed (IPM)	Heat Input (kj/in)
ALL	SAW	See Chart	0.093"	DCEP	300-350	30-32	15-18	39.5
ALL	SAW	See Chart	0.125"	DCEP	400-450	31-32	16-18	50.8

Parametric combinations that exceed the maximum allowable heat inputs are not allowed.

Technique (QW-410)
Bead Type: ☒ String ☒ Weave • CTWD: 1.00"-1.250" • Orifice Cup Size:N/A • Oscillation: None • Multiple or Single Electrodes: Single
Multiple or Single Pass: Multiple • Peening: Not Allowed • Method of Back Gouging: Air carbon arc or Plasma gouge. Grind to clean metal.
• Use of Thermal Processes ☐ Yes ☒ No
Initial and Interpass Cleaning: Chipping, brushing, grinding as required for interpass cleaning. Bevel preps must be free from rust, oil, paint or any other deleterious substances. Only use equipment designated for stainless steel.
Notes: _____

APPROVED FOR CONSTRUCTION
WJ 2132 10/19/16
Curtis Kelly, Inc.

CURTIS KELLY INC.
HOUSTON, TEXAS

QW-483 FORMAT FOR PROCEDURE QUALIFICATION RECORD (PQR) SHEET 1 of 2

Company Name: Curtis Kelly Inc. By: Phillip Hernandez
Procedure Qualification Record No.: 195
Welding Procedure Specification No. 133 Date: 3/18/91
Welding Processes: SAW Type(s): Machine Welding
Direct Visual Control
No Automatic Joint Tracking Used

JOINTS (QW-402)
Joint Design:60 deg. double vee 30 deg. bevel 3/8" land 0" opening.
Backing: see backing
Backing Material (Type): weld metal
backgouge to clean metal & grind

Base Metals (QW-403)
P-No.8 Gr. No.1 to P-No 8 Gr. No. 1
Specification type & grade: SA240-304
to Specification type & grade: SA240-304
Thickness of Test Coupon: 1.5"
Diameter of Test Coupon: Plate
Other: Multiple passes less than 1/2" thick

FILLER METALS (QW-404)
F-No.: 6
A-No.: 8
Spec. No. (SFA): 5.9
AWS No.(Class): ER308L
Size of filler metals: 3/32" & 1/8"
Electrode Flux (Class): (SAW) No Standard Classification - neutral
Flux Tradename: Lincoln 880M
Consumable Insert: none used
Weld Metal Thickness: 1.5" *
Other:No recrushed slag used/ QW404.24~QW404.27 no supplemental powders used *

POSITIONS (QW-405)
Position of Groove: 1G
Welding Progression: -

POSTWELD HEAT TREATMENT (QW-407)
Temperature : None
Time : None

PREHEAT (QW-406)
Preheat Temp. Min: 60 deg.F.
Interpass Temp. Max.: 350 Deg F.
Other: N/A

GAS (QW-408)
Shielding Gas or Gases: -
Percent Composition (mixtures): -
Flow Rate: -
Gas Backing: NONE
Trailing Shielding Gas Composition: N/A

ELECTRICAL CHARACTERISTICS (QW-409)
Current (AC or DC): DC Polarity: *
Amps (Range): * Volts (Range): *

Procedure Qualification Record No.: 195
Welding Procedure Specification No. 133 Date: 3/18/91 SHEET 2 of 2

TECHNIQUE (QW-410)
String or Weave Bead: string
Oscillaton: None
Multiple or Single Pass (per side): Multiple
Multiple or Single Electrodes: Single
Other: contact tube to work distance 1" - 1 1/4"/ no peening done *

* Weld Layer(s)	Process	Filler Metal Class	Filler Metal Dia.	Current Type Polar.	Current Amp Range	Volt Range	Travel Speed Range ("/min.)	Other (J/in.) (Max.)
1&2	SAW	ER308L	3/32"	reverse	350	32	17	39529
REMAINDER	SAW	ER308L	1/8"	reverse	450	32	17	50824

Tensile Test (QW-150)

Specimen	Width	Thickness	Area	Ultimate Total Load	Ultimate Unit Stress	Fracture Location
(QW462.1a)	.747"	1.379"	1.030"	87,500	84,900	weld
(QW462.1A)	.751"	1.332"	1.00"	81,800	81,800	base

Guided Bend Test (QW-160)

Type & Figure No.	Result
Side Bend QW462.2	Satisfactory
Side Bend QW462.2	Satisfactory
Side Bend QW462.2	Satisfactory
Side Bend QW462.2	Satisfactory

Toughness test (QW-170)

Specimen No.	Notch location	Notch Type	Test Temp.	Impact Values	Lateral Exp.In. %Shear	Lateral Exp.In. Mils	Drop Weight Break	Drop Weight No. Break
(Weld)								
1	Weld	vee	-320			.018"		
2	Weld	vee	-320			.018"		
3	Weld	vee	-320			.019"		

Edwin Garrison Stamp: G S.S.#: 457-96-8771
Test conducted by: W H Company
Laboratory Test No.: 91-0312-07

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: Curtis Kelly Inc.

Date: 3/18/91 By: Phillip Hernandez
Phillip Hernandez

* Recertified to include n/a variables & weld metal thickness.

Date: 6/14/02 By: Phillip Hernandez

Recertified to include multiple passes less than 1/2" thick

Date 10-22-07 By Phillip Hernandez

WHC

W H COMPANY

CONSULTING ENGINEERS

8450 RAYSON • HOUSTON, TEXAS 77080 • 713/895-7504

ENGINEERING
TESTING

Date March 15, 1991

Company Curtis-Kelly, Inc.
P.O. Box 405808
Houston, TX 77245

Lab Test # 91-0312-07

P.O. #

Attention: Phil Hernandez

Identification Procedure Qualification Plate

1-1/2" Plate

SA240 Type 304

Procedure

Process SAW

Filler

Qualification: Procedure X

Welder

Welder's Name

Symbol G

TENSILE TEST

	Dimensions	Area	Yield	Ultimate Load	Yield Strength	Tensile Strength
W-1	.747" x 1.379"	1.030	42,400	87,500	41,200	84,900
W-2	.751" x 1.332"	1.000	41,200	81,800	41,200	81,800

Elongation	Reduction of Area	Fracture	Comments
51.1%	46.9%	Ductile	Broke in Weld
75.3%	45.4%	Ductile	Broke in Base Material

.2% Offset Yield

4 - Side Bends per QW-462.2 - Satisfactory

Wes Heinsohn, P.E.

WHC

W H COMPANY

CONSULTING ENGINEERS

8450 RAYSON • HOUSTON, TEXAS 77080 • 713/895-7504

ENGINEERING TESTING

Lab. Test # 91-0312-07

Date March 12, 1991

Impact Test For Curtis-Kelly, Inc. P.O.# Verbal

Type of Machine: SATEC Systems Model SI-1K S/N 1440 Impact Tester 300 Ft/Lbs Capacity Certified per ASTM E-23 and ISO R 83. Calibration due November, 1991.

Type of Steel SA240 Type 304 to SA240 Type 304

Heat No. _____ Pipe or Plate Thickness 1-1/2" Plate

Weld Rod SAW

Welder _____ Symbol G Procedure Spec. _____

Charpy V Notch (Type A) Full Size: 10 mm x 10 mm

P.W.H.T. None

MK	TEMP.° F	FT. LBS.	LATERAL EXPANSION	% SHEAR	NOTCH LOCATION
W-7	- 320°F	21	18	40	Weld
W-8	- 320°F	22	18	40	Weld
W-9	- 320°F	24	19	40	Weld
W-4	- 320°F	36	25	40	HAZ
W-5	- 320°F	34	22	40	HAZ
W-6	- 320°F	37	30	40	HAZ

The W H Company Testing Laboratory certifies that the statements made in this report are correct and that the test plates were prepared and tested in accordance with the requirements of ASME and ASTM specifications

Witnessed by _____ Signed _____

Wes Heinsohn, P.E.

THE SPITZER COMPANIES

FOR WELDING PROCEDURE QUALIFICATION RECORD (PQR)

(See QW-200.2, Section IX, ASME Boiler and Pressure Vessel Code)
Record Actual Conditions Used to Weld Test Coupons.

PQR NO.: 133S Rev. No. 0 Date: 8-1-11
WPS NO.: 133
WELDING PROCESS (ES): SAW
TYPES: Machine

JOINTS (QW-402)

SINGLE VEE
60 DEG. INCLUDED ANGLE
.093" ROOT GAP
.000" ROOT LAND

GROOVE DESIGN OF TEST COUPON & WELD BEAD DISTRIBUTION
For combination qualifications the deposited weld metal thickness shall be recorded for each filler metal or process used.

BASE METALS (QW-403)

Material Spec.: SA240
Type or Grade: 304L
P No. 8 Gr. 1 to P No. 8 Gr. 1
Thickness of Coupon: .500"
Diameter of Test Coupon: Plate
Heat No.: 7YTO

POST WELD HEAT TREATMENT (QW-407)

Temp Range: N/A
Time Range: ---

FILLER METALS (QW-404)

	SAW
SFA Spec.:	5.9
AWS Spec.:	ER308L
Filler F No.:	6
Filler A No.:	8
Size of Filler:	.093"
Dep't Weld Metal:	.500"
Filler Trade Name:	N/A
Manufacturer Name:	Lincoln Electric
Heat No.:	12508026
Other:	880M Flux

GAS (QW-408)

	Gas	Percent Composition Mixture	Flow
Shielding:	None	---	---
Backing:	None	---	---
Trailing:	None	---	---

ELECTRICAL CHARACTERISTICS (QW-409)

Current: DC
Polarity: Reverse
Amps: 373 – 384
Volts: 31.4 – 31.5
Heat Input: 48.2 kj/in
Tungsten Electrode Size: N/A
Other: None

POSITION (QW-405)

Position of Groove: 1G
Weld Progression: Flat
Other: None

TECHNIQUE (QW-410)

	IPM
Travel Speed:	15.0 – 16.3
String or Weave:	String
Oscillation:	N.A
Multiple or Single: (Pass per Side)	Multiple
Multiple or Single: (Electrode)	Single
CTWD:	1.00"

PREHEAT (QW-406)

Preheat Temp.: 70°F
Interpass Temp.: 287°F Max.
Other:

PQR No. 133S

Tensile Test (QW-150)

Specimen No.	Size (in.)	Area in^2	UTL [psi]	Yield [psi]	UTS [psi]	%EL	%RA	Fracture Location (Comments)
N/A								

Guided-Bend Tests (QW-160)

Type and Figure No. QW-462.2	Result
N/A	

Toughness Tests (QW-170)

Specimen No.	Notch Location	Notch Type	Test Temp.	Impact Values (ft/lbs)	Mils Lateral Exp.
1	Weld	V-Notch	-320°F	49	37
2	Weld	V-Notch	-320°F	48	38
3	Weld	V-Notch	-320°F	43	34
4	HAZ	V-Notch	-320°F	137	77
5	HAZ	V-Notch	-320°F	138	80
6	HAZ	V-Notch	-320°F	107	63

Hardness Values (HV10)

N/A

Fillet Weld Test (QW-180)

Results– Satisfactory: N/A Penetration Into Base Metal < >Yes < >No < >N/A

Macro Results: N/A

Other Tests

Type of Test: None

Deposit Analysis: N/A

Other: None

Welder Name (s): Antonio Barlanga Stamp: B

Test Conducted by: Accu Test Laboratory Lab Test No.: 515429.00

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: The Spitzer Companies

Date: 8-1-11

By Richard V. Rocha, Sr.

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

Accu Test Labs L.L.P P.O. Box 802404 ◆ Houston, TX 77280-2404 ◆ Telephone (713) 460-3655 ◆ FAX (713) 460-3695

Report Date: 08/02/11
Report No: **515429.00**
Rev.: C
Cust Acct: SPI041

To: Spitzer Industries, Inc. (Industrial Rd)
Attn: Loretta Falcon
P.O. Box 96097
Houston, TX 77213

Ordered By: Richard Rocha PO#: J-1949-007
Material: SA240-304/L 0.500" THK Weld Coupon
ID/Heat: 7YTO WPS:133 Supplement
Job Info: ASME IX; ASME VIII Div 1

Charpy Test Results

No.	Temp	Location	Foot-Pounds	% Shear	Mils Lat Exp
1	-320°F	Weld Metal	49-48-43	45-45-45	37-38-34
2	-320°F	HAZ	137-138-107	100-100-100	77-80-63

Unless otherwise stated, Charpy Impact specimens are V-notch 10 x 10 mm.

Notes:
Specimens cooled in pure liquid nitrogen.

Signed: Chris Briggs

Our reports are for the exclusive use of our customer and our name may be used only with prior written approval. Our reports apply only to the sample tested or inspected and do not necessarily represent the quality of other apparently similar or identical materials. All test specimens and testing conforms to ASTM A-370 requirements unless otherwise stated. This test report shall not be reproduced, except in full, without the written approval of Accu-Test Labs LLP.

THE SPITZER COMPANIES

FOR WELDING PROCEDURE QUALIFICATION RECORD (PQR)

(See QW-200.2, Section IX, ASME Boiler and Pressure Vessel Code)
Record Actual Conditions Used to Weld Test Coupons.

PQR NO.: 133S2 Rev. No. 0 Date: 7-5-12
WPS NO.: 133
WELDING PROCESS (ES): SAW
TYPES: Machine

JOINTS (QW-402)

SINGLE VEE
60 DEG. INCLUDED ANGLE
.062" ROOT GAP
.000" ROOT LAND

GROOVE DESIGN OF TEST COUPON & WELD BEAD DISTRIBUTION
For combination qualifications the deposited weld metal thickness shall be recorded for each filler metal or process used.

BASE METALS (QW-403)

Material Spec.: SA240
Type or Grade: 304L
P No. 8 Gr. 1 to P No. 8 Gr. 1
Thickness of Coupon: .375"
Diameter of Test Coupon: Plate
Heat No.: 849692

POST WELD HEAT TREATMENT (QW-407)

Temp Range: N/A
Time Range: ---

FILLER METALS (QW-404)

	SAW
SFA Spec.:	5.9
AWS Spec.:	ER308L
Filler F No.:	6
Filler A No.:	8
Size of Filler:	.093"
Dep't Weld Metal:	.375"
Filler Trade Name:	N/A
Manufacturer Name:	Lincoln Electric
Heat No.:	12821996
Other:	880M Flux

GAS (QW-408)

	Percent Composition		
	Gas	Mixture	Flow
Shielding:	None	---	---
Backing:	None	---	---
Trailing:	None	---	---

ELECTRICAL CHARACTERISTICS (QW-409)

Current: DC
Polarity: Reverse
Amps: 310 – 350
Volts: 31.0
Heat Input: 38.2 kj/in
Tungsten Electrode Size: N/A
Other: None

POSITION (QW-405)

Position of Groove: 1G
Weld Progression: Flat
Other: None

TECHNIQUE (QW-410)

	IPM
Travel Speed:	17.0
String or Weave:	String
Oscillation:	N.A
Multiple or Single:	Multiple
(Pass per Side)	
Multiple or Single:	Single
(Electrode)	
CTWD:	1.00"

PREHEAT (QW-406)

Preheat Temp.: 96°F
Interpass Temp.: 250°F Max.
Other:

PQR No. 133S2

Tensile Test (QW-150)

Specimen No.	Size (in.)	Area in^2	UTL [psi]	Yield [psi]	UTS [psi]	%EL	%RA	Fracture Location (Comments)
N/A								

Guided-Bend Tests (QW-160)

Type and Figure No. QW-462.2	Result
N/A	

Toughness Tests (QW-170)

Specimen No.	Notch Location	Notch Type	Test Temp.	Impact Values (ft/lbs)	Mils Lateral Exp.
1	Weld	V-Notch	-320°F	24	18
2	Weld	V-Notch	-320°F	34	26
3	Weld	V-Notch	-320°F	25	18
4	HAZ	V-Notch	-320°F	88	68
5	HAZ	V-Notch	-320°F	78	55
6	HAZ	V-Notch	-320°F	90	70

Hardness Values (HV10)

N/A

Fillet Weld Test (QW-180)

Results– Satisfactory: N/A Penetration Into Base Metal < >Yes < >No < >N/A

Macro Results: N/A

Other Tests

Type of Test: None

Deposit Analysis: N/A

Other: None

Welder Name (s): Gerardo Vigil Stamp: Box 45

Test Conducted by: Accu Test Laboratory Lab Test No.: 565539.00

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: The Spitzer Companies

Date: 7-5-12 Richard V. Rocha

By Richard V. Rocha, Sr.

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

Accu Test Labs L.L.P
P.O. Box 802404 ◆ Houston, TX 77280-2404 ◆ Telephone (713) 460-3655 ◆ FAX (713) 460-3695

Report Date: 07/03/12
Report No: **565539.00**
Rev.: A
Cust Acct: SPI770

To: Spitzer Industries, Inc. (Tanner Rd.)
Attn: Joy Jenkens
11250 Tanner Road
Houston, TX 77041

Ordered By: Richard Rocha PO#: 4204002
Material: SA240-304/L .375" Thick Plate
ID/Heat: WO:J-4204 PQR:133S2
Job Info: ASME VIII Div.1

Charpy Test Results

No.	Temp	Location	Foot-Pounds	% Shear	Mils Lat Exp
1	-320℉	Weld Metal	24-34-25	35-45-35	18-26-18
2	-320℉	HAZ	88-78-90	100-100-100	68-55-70

Unless otherwise stated, Charpy Impact specimens are V-notch 10 x 10 mm.

Notes:
Size: .295" x .394"

Signed: Veronica Ramirez
Veronica Ramirez

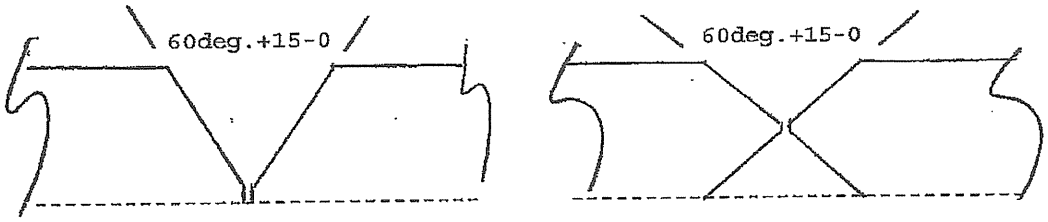
Our reports are for the exclusive use of our customer and our name may be used only with prior written approval. Our reports apply only to the sample tested or inspected and do not necessarily represent the quality of other apparently similar or identical materials. All test specimens and testing conforms to ASTM A-370 requirements unless otherwise stated. This test report shall not be reproduced, except in full, without the written approval of Accu-Test Labs LLP.

CURTIS KELLY INC.
HOUSTON, TEXAS

ASME-482 FORMAT FOR WELDING PROCEDURE SPECIFICATION (WPS)

Company Name: Curtis Kelly Inc. By: Phillip Hernandez
Welding Procedure Specification No. 62D Date: 3/18/91 Supporting PQR Nos. 194,279 & 280
Revision No. 4 Date: 4/08/04
Welding Processes: FCAW Type(s): Semi-automatic

JOINTS (QW-402) see drawing or
Joint Design: 60 deg. Single Vee 30 deg. Bevel 1/16"Land 1/8" Opening
60 deg. double vee 30 deg. bevel 1/16" land 1/16" opening
Backing: See backing material
Backing Material (Type): weld metal (backgouge to clean metal & grind)



BASE METALS (QW-403)
P-No. 8 Gr. No. 1 to P-No. 8 Gr. No.1
Specification type & grade: SA240-304/L
to Specification type & grade: SA240-304/L
Thickness Range:
Base Metal: Groove: .1875" to 8" & .375" to 2.5" for temp. below -320 F. Fillet:All
Deposited Weld Metal: 0" to 8" & 0" to 2.5" for temp. below -320 F.
Pipe Dia. Range: Groove: N/A Fillet: All
Other: N/A

FILLER METALS (QW-404) Other:restricted to Kobelco flux core wire
F-No.: 6 mfg. trade designation DW308LT-1 &
A-No.: 8 DW316LT1-1 for temperatures below -320 F.
Spec. No. (SFA): 5.22 Production test required for each heat of electrode
AWS No.(Class): E308LT-1 & E316LT1-1 for temp. below -320 F.
Size of filler metals: .045" & 1/16"
Electrode Flux (Class): N/A
Flux Tradename: N/A
Consumable Insert: N/A
Other: no supplemental powders to be used. Ferrite to be <5.0 (WRC) for below -320 F.

---

charpy vee notch -320 F.

APPROVED FOR CONSTRUCTION
WS 2132 10/19/16
Curtis Kelly, Inc.

Welding Procedure Specification No. 62D
Revision No. 4 Date:4/08/04

POSITIONS (QW-405)
Position of Groove: All (1G below -320 F.)
Welding Progression: Up
Position of Fillet: ----

POSTWELD HEAT TREATMENT (QW-407)
Temperature Range: No P.W.H.T.
Time Range: No P.W.H.T.

PREHEAT (QW-406)
Preheat Temp. Min.: 60 Deg F.
Interpass Temp. Max.: 350 Deg F.
Preheat Maintenance: none

GAS (QW-408)
Shielding Gas or Gases: CO2
Percent Composition (mixtures): 100%
Flow Rate: 40-55 C.F.H.
Gas Backing: None
Trailing Shielding Gas Composition: None

ELECTRICAL CHARACTERISTICS (QW-409)
Current (AC or DC): DC Polarity: *
Amps (Range): * Volts (Range): *
Tungsten Electrode Size and Type: N/A
Mode of Metal Transfer for GMAW: spray transfer
Electrode Wire feed speed range: *

TECHNIQUE (QW-410)
String or Weave Bead: Weave
Orifice,Gas Cup or Nozzle Size: 3/8" to 5/8"
Initial and Interpass Cleaning (Brushing, Grinding, Etc.): Clean on each side of the weld joint and the joint itself by grinding, chipping hammer, & SS wire brush.
Method of Back Gouging: Arc or plasma gouge to clean metal & grind
Oscillaton: None
Contact Tube to work distance: 1/2"
Multiple or Single Pass (per side): Multiple with passes less than 1/2" thk.
Multiple or Single Electrodes: Single
Travel Speed (Range): --
Peening: None
Other: ----

* Weld Layer(s)	Process	Filler Metal Class	Filler Metal Dia.	Current Type Polar.	Current Amp Range	Volt Range	Travel Speed Range ("/min.)	Other (J/in.) (Max.)
* 1-3	FCAW	E308LT-1	.045"	Rev.	155-190	26-30	8.5"-12"	29000
Remainder	FCAW	E308LT-1	1/16"	Rev.	215-265	27-33	9"-12.5"	45000
For temperatures below -320 deg. F.								
1	FCAW	E316LT1-1	.045"	Rev.	155-190	26-30	8.5"-12"	32,254
Remainder	FCAW	E316LT1-1	.045"	Rev.	165-205	27-31	9"-12.5"	33,545

* .045" dia. electrode max. bead width - 5/8"

* 1/16" dia. electrode max. bead width - 3/4"

CURTIS KELLY INC.
HOUSTON, TEXAS

QW-483 FORMAT FOR PROCEDURE QUALIFICATION RECORD (PQR) SHEET 1 of 2

Company Name: Curtis Kelly Inc. By: Phillip Hernandez
Procedure Qualification Record No.: 194
Welding Procedure Specification No. 62D Date: 3/18/91
Welding Processes: FCAW Type(s): Semi-automatic

JOINTS (QW-402)
Joint Design:60 deg. double vee 30 deg. bevel 3/16" land 1/16" opening.
Backing: see backing
Backing Material (Type): weld metal
backgouge to clean metal & grind

P-No.8 Gr. No.1 to P-No 8 Gr. No. 1
Specification type & grade: SA240-304
to Specification type & grade: SA240-304
Thickness of Test Coupon: 1.5"
Diameter of Test Coupon: Plate
Other:** QW403.9 N/A - ALL PASSES <1/2"
QW403.10 N/A - VOLTAGE & AMPERAGE ARE IN SPRAY TRANSFER MODE

FILLER METALS (QW-404)
F-No.: 6 Other:
A-No.: 8
Spec. No. (SFA): 5.22
AWS No.(Class): E308LT-1
Size of filler metals: .045", 1/16" & 5/64"
Electrode Flux (Class): N/A
Flux Tradename: N/A
Consumable Insert: N/A
Weld Metal Thickness: 1.5" **
Other: ** QW404.24 thru QW404.27 N/A - no supplemental powders used

POSITIONS (QW-405)
Position of Groove: 3G
Welding Progression: uphill

POSTWELD HEAT TREATMENT (QW-407)
Temperature : None
Time : None

PREHEAT (QW-406)
Preheat Temp. Min: 60 deg.F.
Interpass Temp. Max.: 350 Deg F.
Other: N/A

GAS (QW-408)
Shielding Gas or Gases: CO2
Percent Composition (mixtures): 100%
Flow Rate: 35-40 CFH
Gas Backing: NONE
Trailing Shielding Gas Composition: N/A

ELECTRICAL CHARACTERISTICS (QW-409)
Current (AC or DC): DC Polarity: *
Amps (Range): * Volts (Range): *

Procedure Qualification Record No.: 194
Welding Procedure Specification No. 62D Date: 3/18/91 SHEET 2 of 2

TECHNIQUE (QW-410)
String or Weave Bead: weave
Oscillaton: None
Multiple or Single Pass (per side): Multiple
Multiple or Single Electrodes: Single
Other: ----

* Weld Layer(s)	Process	Filler Metal Class	Filler Metal Dia.	Current Type Polar.	Current Amp Range	Volt Range	Travel Speed Range ("/min.)	Other (J/in.) (Max.)
1 & Cap	FCAW	E308LT-1	.045"	reverse	175	29	10.5	29000
2 & 3	FCAW	E308LT-1	1/16"	reverse	250	33	11	45000
remainder	FCAW	E308LT-1	5/64"	reverse	310	33	11	55800

Tensile Test (QW-150)

Specimen	Width	Thickness	Area	Ultimate Total Load	Ultimate Unit Stress	Fracture Location
(QW462.1a)	.749"	1.346"	1.008"	86,400	85,700	weld
(QW462.1a)	.748"	1.305"	.976"	83,600	85,600	weld

Guided Bend Test (QW-160)

Type & Figure No.	Result
Side Bend QW462.2A	Satisfactory
Side Bend QW462.2A	Satisfactory
Side Bend QW462.2A	Satisfactory
Side Bend QW462.2A	Satisfactory

Toughness test (QW-170)

Specimen No.	Notch location	Notch Type	Test Temp.	Impact Values	Lateral Exp.In. %Shear	Lateral Exp.In. Mils	Drop Weight Break	Drop Weight No. Break
(Weld)								
1	Weld	vee	-320			.022"		
2	Weld	vee	-320			.020		
3	Weld	vee	-320			.024"		

Welder's Name: Edwin Garrison Stamp: G S.S.#: 457-96-8771
Test conducted by: W H Company
Laboratory Test No.: 91-0312-06

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: Curtis Kelly Inc.

Date: 3/18/91 By: Phillip Hernandez
Phillip Hernandez

Recertified to include N/a variables, weld metal thickness & transfer mode not previously stated but indicative of volts and amps. All changes Mk'd **.

WHC

W H COMPANY

CONSULTING ENGINEERS

8450 RAYSON • HOUSTON, TEXAS 77080 • 713/895-7504

ENGINEERING TESTING

Date March 15, 1991

Company Curtis-Kelly, Inc.
P.O. Box 405808
Houston, TX 77245

Lab Test # 91-0312-06

P.O. # Verbal

Attention: Phil Hernandez

Identification Procedure Qualification Plate

1 1/2" Plate
SA240 - Type 304 to SA240 - Type 304

Procedure

Process

Filler

Qualification: Procedure X

Welder

Welder's Name

Symbol "G"

TENSILE TEST

	Dimensions	Area	Yield	Ultimate Load	Yield Strength	Tensile Strength
V-1	.749" x 1.346"	1.008	42,500	86,400	42,200	85,700
V-2	.748" x 1.305"	.976	39,400	83,600	40,400	85,600

Elongation	Reduction of Area	Fracture	Comments
40.4%	39.3%	Ductile	Broke in Weld
41.0%	54.1%	Ductile	Broke in Weld

.2% Offset Yield

4 - Side Bends per QW-462.2 - Satisfactory

Wes Heinsohn, P.E.

WHC

W H COMPANY

ENGINEERING TESTING

CONSULTING ENGINEERS

8450 RAYSON • HOUSTON, TEXAS 77080 • 713/895-7504

Lab. Test # 91-0312-06

Date March 12, 1991

Impact Test For Curtis-Kelly, Inc. P.O.# Verbal

Type of Machine: SATEC Systems Model SI-1K S/N 1440 Impact Tester 300 Ft/Lbs Capacity Certified per ASTM E-23 and ISO R 83. Calibration due November, 1991.

Type of Steel SA240 Type 304 to SA240 Type 304

Heat No. _____ Pipe or Plate Thickness 1-1/2" Plate

Weld Rod GMAW and FCAW

Welder _____ Procedure Spec. _____

Charpy V Notch (Type A) Full Size: 10 mm x 10 mm

P.W.H.T. None

MK	TEMP. ° F	FT. LBS.	LATERAL EXPANSION	% SHEAR	NOTCH LOCATION
V-1	- 320°F	24	22	20	Weld
V-2	- 320°F	24	20	20	Weld
V-3	- 320°F	27	24	20	Weld
V-4	- 320°F	41	25	30	HAZ
V-5	- 320°F	44	29	30	HAZ
V-6	- 320°F	47	30	30	HAZ

The W H Company Testing Laboratory certifies that the statements made in this report are correct and that the test plates were prepared and tested in accordance with the requirements of ASME and ASTM specifications

Witnessed by _____ Signed _____

Wes Heinsohn, P.E.

CURTIS KELLY INC.
HOUSTON, TEXAS

QW-483 FORMAT FOR PROCEDURE QUALIFICATION RECORD (PQR) SHEET 1 of 2

Company Name: Curtis Kelly Inc. By: Phillip Hernandez
Procedure Qualification Record No.: 280
Welding Procedure Specification No. 62D Date: 04/05/04
Welding Processes: FCAW Type(s): semi-automatic

JOINTS (QW-402)
Joint Design:60 Deg. double vee 30 deg. bevel 1/8"land 1/16" opening
Backing: see backing
Backing Material (Type): WELD METAL (BACKGOUGE)
Retainers: none

BASE METALS (QW-403)
P-No. 8 Gr. No. 1 to P-No. 8 Gr. No. 1
Specification type & grade: SA240-304/L
to Specification type & grade: SA240-304/L
Thickness of Test Coupon: 1.25"
Diameter of Test Coupon: plate
Other: N/A

FILLER METALS (QW-404)
F-No.: 6 Other: Kobelco DW316LT
A-No.: 8 Ferrite: 3.7 (WRC)
Spec. No. (SFA): 5.22
AWS No.(Class): E316LT1-1
Size of filler metals: .045"
Electrode Flux (Class): N/A
Flux Tradename: N/A
Consumable Insert: N/A
Weld metal Thickness: 1.25"

POSITIONS (QW-405)
Position of Groove: 1G
Welding Progression: ---

PREHEAT (QW-406)
Preheat Temp. : 60 deg F
Interpass Temp. : 350 deg. F
Other: N/A

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

GAS (QW-408)
Shielding Gas or Gases: CO2
Percent Composition (mixtures):100%
Flow Rate: 45 C.f.H.
Gas Backing: NONE
Trailing Shielding Gas Composition: none

ELECTRICAL CHARACTERISTICS (QW-409)
Current (AC or DC): DC Polarity: * Pulsing current: none
Amps (Range): * Volts (Range): * Transfer Mode: spray transfer

Procedure Qualification Record No.: 280
Welding Procedure Specification No. 62D Date: 04/05/04 SHEET 2 of 2

TECHNIQUE (QW-410)
String or Weave Bead: SLIGHT WEAVE (MAX. BEAD WIDTH 5/8")
Oscillaton: None
Multiple or Single Pass (per side): Multiple
Multiple or Single Electrodes: Single
Other:WIRE SPEED 360 - 440 IN/MIN.

* Weld Layer(s)	Process	Filler Metal Class	Filler Metal Dia.	Current Type Polar.	Current Amp Range	Volt Range	Travel Speed Range ("/min.)	Other (J/in.) (Max.)
1	FCAW	E316LT1-1	.045"	REV.	190	29	10.25"	32,254
REMAINDER	FCAW	E316LT1-1	.045"	REV.	205	30	11"	33,545

Tensile Test (QW-150)

Specimen No.	Width	Thickness	Area	Ultimate Total Load	Ultimate Unit Stress	Fracture Location
1(QW462.1a)	.752"	1.277"	.960"	86,000	89,583	BASE
2(QW462.1a)	.755"	1.273"	.961"	87,400	90,947	BASE

Guided Bend Test (QW-160)

Type & Figure No.	Result
SIDE BEND QW 462.2	SATISFACTORY
SIDE BEND QW 462.2	SATISFACTORY
SIDE BEND QW 462.2	SATISFACTORY
SIDE BEND QW 462.2	SATISFACTORY

Toughness Test (QW-170)

Specimen No.	Notch Location	Notch Type	Test Temp.	Impact Values ft/lbs	lateral expansion % shear	lateral expansion mils	Drop Weight Break	Drop Weight No Break
1	WELD	VEE	-320 F.	49	40	.041		
2	WELD	VEE	-320 F.	47	40	.039		
3	WELD	VEE	-320 F.	44	40	.044		
4	HAZ	VEE	-320 F.	102	60	.064		
5	HAZ	VEE	-320 F.	97	60	.060		
6	HAZ	VEE	-320 F.	90	60	.059		
7	BASE	VEE	-320 F.	238	99	.098		
8	BASE	VEE	-320 F.	229	99	.114		
9	BASE	VEE	-320 F.	230	99	.117		

Welder's Name: Sergio Perez Stamp: O S.S.#: 466-73-3165
Test conducted by:GOOLSBY TESTING LAB. Laboratory Test No.:04-04-36991

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:04/05/04

Manufacturer: Curtis Kelly Inc.
By: Phillip Hernandez
Phillip Hernandez

GOOLSBY TESTING LABORATORIES, INC.
2620 WILSON ROAD - P.O. BOX 1416
HUMBLE, TEXAS 77347-1416
(281) 540-1255 FAX (281) 540-8126

TO: CURTIS KELLY, INC.	DATE: 04/05/04
P.O. BOX 450808	LABORATORY TEST NO: 04-04-36991
HOUSTON, TEXAS 77245	MATERIAL: SA-240-304L HT# 899116-26140
FCAW /DW 316LT (KOBELCO) HT# B2L 2075	GTL# 4553 PQR#
MATERIAL THICKNESS: 1 ¼"	SPECIFICATIONS: ASME SECT. IX

TENSILE TEST

SPEC. NO.	WIDTH	THK. NESS	SQ.IN. AREA	ULT.LD YIELD	YIELD PSI	ULT.LD TENSILE	TENSILE PSI	%EL IN 2"	% ROA	FRAC. LOC.
QW462.1A	.752	1.277	.960			86000	89583			BASE
QW462.1A	.755	1.273	.961			87400	90947			BASE

IMPACT TEST

TESTING MACHINE: BALDWIN SATEC S1-1	TEST METHOD: SIMPLE BEAM CHARPY
LINEAR VELOCITY OF HAMMER: 17 FT/SEC.	EFFECTIVE ENERGY: 240 FT/LBS.
SPECIMEN TYPE: ASTM TYPE A LVNC	SPECIMEN SIZE: 10 MM X 10 MM
SPECIMEN TEMP: -320 DEG.F.	ACCEPTANCE CRITERIA: .021" MIN LATERAL EXP.

SPECIMEN LOCATION	WIDTH	EFFECTIVE SECTION SIZE	IMPACT VALUES FOOT POUNDS	% SHEAR FRACTURE	LATERAL EXPANSION
WELD	.394	.315	49	40	.041
WELD	.394	.315	47	40	.039
WELD	.394	.315	44	40	.044
HAZ	.394	.315	102	60	.064
HAZ	.394	.315	97	60	.060
HAZ	.394	.315	90	60	.059
BASE	.394	.315	238	99	.098
BASE	.394	.315	229	99	.114
BASE	.394	.315	230	99	.117

BEND TEST

SPEC.# AND TYPE	RESULTS	SPEC.# AND TYPE	RESULTS
QW462.2 SIDE	SATISFACTORY	QW462.2 SIDE	SATISFACTORY
QW462.2 SIDE	SATISFACTORY	QW462.2 SIDE	SATISFACTORY

ACCEPTABLE < XX > REJECTABLE < > PER APPLICABLE SPECIFICATIONS.
ACTUAL WELDING WAS < > WAS NOT < X > WITNESSED BY GTL.

GOOLSBY TESTING LABORATORIES, INC.

PER: W. Keith Goolsby
W. KEITH GOOLSBY PRESIDENT / LEVEL III

Our letters and reports are for the use of our clients to whom they are addressed. Our name may be used only with our prior written approval. Our letters and reports apply only to the sample tested and / or inspected, and do not necessarily represent the quality of other apparently similar or identical materials.

CURTIS KELLY INC.
HOUSTON, TEXAS

QW-483 FORMAT FOR PROCEDURE QUALIFICATION RECORD (PQR) SHEET 1 of 2

Company Name: Curtis Kelly Inc. By: Phillip Hernandez
Procedure Qualification Record No.: 279
Welding Procedure Specification No. 62D Date: 04/05/04
Welding Processes: FCAW Type(s): semi-automatic

JOINTS (QW-402)
Joint Design:60 Deg. single vee 30 deg. bevel 1/8"land 1/16" opening
Backing: see backing
Backing Material (Type): WELD METAL (BACKGOUGE)
Retainers: none

BASE METALS (QW-403)
P-No. 8 Gr. No. 1 to P-No. 8 Gr. No. 1
Specification type & grade: SA240-304/L
to Specification type & grade: SA240-304/L
Thickness of Test Coupon: .375"
Diameter of Test Coupon: plate
Other: N/A

FILLER METALS (QW-404)
F-No.: 6 Other: Kobelco DW316LT
A-No.: 8 Ferrite: 3.7 (WRC)
Spec. No. (SFA): 5.22
AWS No.(Class): E316LT1-1
Size of filler metals: .045"
Electrode Flux (Class): N/A
Flux Tradename: N/A
Consumable Insert: N/A
Weld metal Thickness: .375"

POSITIONS (QW-405)
Position of Groove: 1G
Welding Progression: ---

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

PREHEAT (QW-406)
Preheat Temp. : 60 deg F
Interpass Temp. : 350 deg. F
Other: N/A

GAS (QW-408)
Shielding Gas or Gases: CO2
Percent Composition (mixtures):100%
Flow Rate: 45 C.f.H.
Gas Backing: NONE
Trailing Shielding Gas Composition: none

ELECTRICAL CHARACTERISTICS (QW-409)
Current (AC or DC): DC Polarity: * Pulsing current: none
Amps (Range): * Volts (Range): * Transfer Mode: Spray transfer

Procedure Qualification Record No.: 279
Welding Procedure Specification No. 62D Date: 04/05/04

TECHNIQUE (QW-410)
String or Weave Bead: SLIGHT WEAVE (MAX. BEAD WIDTH 5/8")
Oscillaton: None
Multiple or Single Pass (per side): Multiple
Multiple or Single Electrodes: Single
Other:WIRE SPEED 360 - 440 IN/MIN.

* Weld Layer(s)	Process	Filler Metal Class	Filler Metal Dia.	Current Type Polar.	Current Amp Range	Volt Range	Travel Speed Range ("/min.)	Other (J/in.) (Max.)
1	FCAW	E316LT1-1	.045"	REV.	190	29	10.25"	32,254
REMAINDER	FCAW	E316LT1-1	.045"	REV.	205	30	11"	33,545

Tensile Test (QW-150)

Specimen No.	Width	Thickness	Area	Ultimate Total Load	Ultimate Unit Stress	Fracture Location
1(QW462.1a)	.753"	.390"	.294"	26,350	89,626	BASE
2(QW462.1a)	.751"	.382"	.287"	25,250	87,979	BASE

Guided Bend Test (QW-160)

Type & Figure No.	Result
FACE BEND QW 462.3a	SATISFACTORY
FACE BEND QW 462.3a	SATISFACTORY
ROOT BEND QW 462.3a	SATISFACTORY
ROOT BEND QW 462.3a	SATISFACTORY

Toughness Test (QW-170)

Specimen No.	Notch Location	Notch Type	Test Temp.	Impact Values ft/lbs	lateral expansion % shear	lateral expansion mils	Drop Weight Break	Drop Weight No Break
1	WELD	VEE	-320 F.	47	60	.052		
2	WELD	VEE	-320 F.	52	60	.047		
3	WELD	VEE	-320 F.	42	60	.057		
4	HAZ	VEE	-320 F.	228	90	.099		
5	HAZ	VEE	-320 F.	225	90	.094		
6	HAZ	VEE	-320 F.	225	90	.095		
7	BASE	VEE	-320 F.	201	90	.095		
8	BASE	VEE	-320 F.	210	90	.097		
9	BASE	VEE	-320 F.	202	90	.094		

Welder's Name: Sergio Perez Stamp: O S.S.#: 466-73-3165
Test conducted by:GOOLSBY TESTING LAB. Laboratory Test No.:04-04-36990

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:04/05/04

Manufacturer: Curtis Kelly Inc.
By: Phillip Hernandez
Phillip Hernandez

GOOLSBY TESTING LABORATORIES, INC.
2620 WILSON ROAD - P.O. BOX 1416
HUMBLE, TEXAS 77347-1416
(281) 540-1255 FAX (281) 540-8125

TO: CURTIS KELLY, INC.	DATE: 04/05/04
P.O. BOX 450808	LABORATORY TEST NO: 04-04-36990
HOUSTON, TEXAS 77245	MATERIAL: SA-240-304L HT# 2P82
FCAW /DW 316LT (KOBELCO) HT# B2L 2075	GTL# 4552 PQR#
MATERIAL THICKNESS: 3/8"	SPECIFICATIONS: ASME SECT. IX

TENSILE TEST

SPEC. NO.	WIDTH	THK. NESS	SQ.IN. AREA	ULT.LD YIELD	YIELD PSI	ULT.LD TENSILE	TENSILE PSI	%EL IN 2"	% ROA	FRAC. LOC.
QW462.1A	.753	.390	.294			26350	89626			BASE
QW462.1A	.751	.382	.287			25250	87979			BASE

IMPACT TEST

TESTING MACHINE: BALDWIN SATEC S1-1	TEST METHOD: SIMPLE BEAM CHARPY
LINEAR VELOCITY OF HAMMER: 17 FT/SEC.	EFFECTIVE ENERGY: 240 FT/LBS.
SPECIMEN TYPE: ASTM TYPE A LVNC	SPECIMEN SIZE: 8 MM X 10 MM
SPECIMEN TEMP: -320 DEG.F.	ACCEPTANCE CRITERIA: .021" MIN LATERAL EXP.

SPECIMEN LOCATION	WIDTH	EFFECTIVE SECTION SIZE	IMPACT VALUES FOOT POUNDS	% SHEAR FRACTURE	LATERAL EXPANSION
WELD	.315	.315	47	60	.052
WELD	.315	.315	52	60	.047
WELD	.315	.315	42	60	.057
HAZ	.315	.315	228	90	.099
HAZ	.315	.315	225	90	.094
HAZ	.315	.315	225	90	.095
BASE	.315	.315	201	90	.095
BASE	.315	.315	210	90	.097
BASE	.315	.315	202	90	.094

BEND TEST

SPEC.# AND TYPE	RESULTS	SPEC.# AND TYPE	RESULTS
QW462.3A ROOT	SATISFACTORY	QW462.3A FACE	SATISFACTORY
QW462.3A ROOT	SATISFACTORY	QW462.3A FACE	SATISFACTORY

ACCEPTABLE < XX > REJECTABLE < > PER APPLICABLE SPECIFICATIONS.
ACTUAL WELDING WAS < > WAS NOT < X > WITNESSED BY GTL.

GOOLSBY TESTING LABORATORIES, INC.

PER: W. Keith Goolsby
W. KEITH GOOLSBY PRESIDENT / LEVEL III

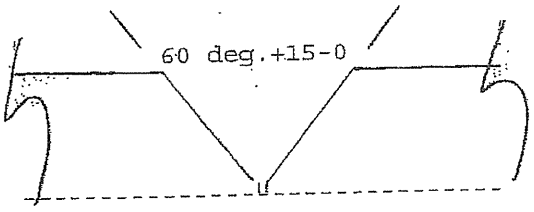
Our letters and reports are for the use of our clients to whom they are addressed. Our name may be used only with our prior written approval. Our letters and reports apply only to the sample tested and / or inspected, and do not necessarily represent the quality of other apparently similar or identical materials.

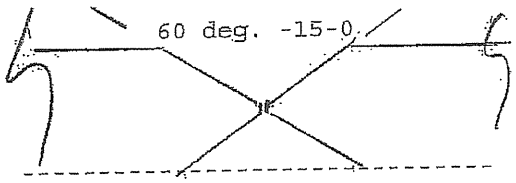
CURTIS KELLY INC.
HOUSTON, TEXAS

QW-482 FORMAT FOR WELDING PROCEDURE SPECIFICATION (WPS)

Company Name: Curtis Kelly Inc. By: Phillip Hernandez
Welding Procedure Specification No. 64 Date: 1/12/88 Supporting PQR Nos. 134 & 301
Revision No. 9 Date: 4/25/08 Type(s): Semi-automatic
Welding Processes: FCAW

JOINTS (QW-402) see drawing or
Joint Design: 60 deg. Single Vee 30 deg. Bevel 1/16"Land 1/8" Opening
60 deg. double vee 30 deg.bevel 1/16" land 1/16" opening
Backing: See backing material - no retainers used
Backing Material (Type): weld metal (backgouge to clean metal & grind)





BASE METALS (QW-403)
P-No. 1 Gr. No. 2 to P-No. 8 Gr. No.1
Specification type & grade: SA516-70
To Specification type & grade: SA240-304
Thickness Range:
*Base Metal: Groove: .1875" to1.5" Fillet: All .625" to 1.25" for low temp.
Deposited Weld Metal: 0" to 1.5" 0" to 1.25" for low temp.
Pipe Dia. Range: Groove: N/A Fillet: All
Other: N/A

FILLER METALS (QW-404)
F-No.: 6 Other: Mfg. trade name Kobelco DW309L
A-No.: 8 Other: ----
Spec. No. (SFA): 5.22
AWS No.(Class): E309LT1-1 or E309LTO-1 (low temp requires E309LT0-1)
Size of filler metals: .045"&1/16"
Electrode Flux (Class): N/A
Flux Tradename: N/A
Consumable Insert: N/A
Other: no supplemental powders to be used./ Filler metal product form: Flux Cored

* 200 Deg. preheat for base metal thickness over 1.25" to 1.5" Max.
Over 1.5" thick requires P.W.H.T. for P-1 material. (per UCS 56)

APPROVED FOR CONSTRUCTION
WL 2132 10/19/16
Curtis Kelly, Inc.

lding Procedure Specification No. 64
vision No. 9 Date: 4/25/08

POSITIONS (QW-405)
Position of Groove: All **
Welding Progression: Up
Position of Fillet: ----

PREHEAT (QW-406)
Preheat Temp. Min.: 60 Deg F. *
Interpass Temp. Max.: 350 Deg F.
Preheat Maintenance: none
* 200 DEG. FOR "T" >/= 1.25"

POSTWELD HEAT TREATMENT (QW-407)
Temperature Range: No P.W.H.T.
Time Range: No P.W.H.T.

GAS (QW-408)
Shielding Gas or Gases: CO2
Percent Composition (mixtures): 100%
Flow Rate: 35-50 C.F.H.
Gas Backing: None
Trailing Shielding Gas Composition: None

ELECTRICAL CHARACTERISTICS (QW-409)
Current (AC or DC): DC Polarity: *
Amps (Range): * Volts (Range): *
Tungsten Electrode Size and Type: N/A
Mode of Metal Transfer for FCAW: Spray transfer
Electrode Wire feed speed range: *

TECHNIQUE (QW-410)
String or Weave Bead: Weave
Orifice or Gas Cup Size: 1/2"
Initial and Interpass Cleaning (Brushing, Grinding, Etc.): Clean on each side of the weld joint and the joint itself by grinding, chipping hammer, & SS wire brush.
Method of Back Gouging: Arc gouge to clean metal & grind
Oscillaton: None
Contact Tube to work distance: 1/2"
Multiple or Single Pass (per side): Multiple with passes less than 3/8" thk.
Multiple or Single Electrodes: Single
Travel Speed (Range): --
Peening: None
Other: ----

* Weld Layer(s)	Process	Filler Metal Class	Filler Metal Dia.	Current Type Polar.	Current Amp Range	Volt Range	Travel Speed Range ("/min.)	Other (J/in.) (Max.)
1-Remainder	FCAW	**	.045"	Rev.	190-200	26-30	11" - 12"	32727 ***
Mid - Remainder	FCAW	**	1/16"	Rev.	220-240	28-32	10" - 12"	Impacts not required

**E309LT1-1 or E309LTO-1 for 1G position - Low temp 3G or 1G
***Low temp restricted to .045" electrode - 11/16" max. bead width.

Notes:
1. The minimum Ferrite number for the filler metal shall be a 3FN.

lding Procedure Specification No. 64
vision No. 9 Date: 4/25/08

POSITIONS (QW-405)
Position of Groove: All **
Welding Progression: Up
Position of Fillet: ----

POSTWELD HEAT TREATMENT (QW-407)
Temperature Range: No P.W.H.T.
Time Range: No P.W.H.T.

PREHEAT (QW-406)
Preheat Temp. Min.: 60 Deg F. *
Interpass Temp. Max.: 350 Deg F.
Preheat Maintenance: none
* 200 DEG. FOR "T" >/= 1.25"

GAS (QW-408)
Shielding Gas or Gases: CO2
Percent Composition (mixtures): 100%
Flow Rate: 35-50 C.F.H.
Gas Backing: None
Trailing Shielding Gas Composition: None

ELECTRICAL CHARACTERISTICS (QW-409)
Current (AC or DC): DC Polarity: *
Amps (Range): * Volts (Range): *
Tungsten Electrode Size and Type: N/A
Mode of Metal Transfer for FCAW: Spray transfer
Electrode Wire feed speed range: *

TECHNIQUE (QW-410)
String or Weave Bead: Weave
Orifice or Gas Cup Size: 1/2"
Initial and Interpass Cleaning (Brushing, Grinding, Etc.): Clean on each side of the weld joint and the joint itself by grinding, chipping hammer, & SS wire brush.
Method of Back Gouging: Arc gouge to clean metal & grind
Oscillaton: None
Contact Tube to work distance: 1/2"
Multiple or Single Pass (per side): Multiple with passes less than 3/8" thk.
Multiple or Single Electrodes: Single
Travel Speed (Range): --
Peening: None
Other: ----

* Weld Layer(s)	Process	Filler Metal Class	Filler Metal Dia.	Current Type Polar.	Current Amp Range	Volt Range	Travel Speed Range ("/min.)	Other (J/in.) (Max.)
1-Remainder	FCAW	**	.045"	Rev.	190-200	26-30	11" - 12"	32727 ***
Mid - Remainder	FCAW	**	1/16"	Rev.	220-240	28-32	10" - 12"	Impacts not required

** E309LT1-1 or E309LTO-1 for 1G position - Low temp 3G or 1G
***Low temp restricted to .045" electrode - 11/16" max. bead width.

Notes:
1. The minimum Ferrite number for the filler metal shall be a 3FN.

CURTIS KELLY INC.
HOUSTON, TEXAS

QW-483 FORMAT FOR PROCEDURE QUALIFICATION RECORD (PQR) SHEET 1 of 2

Company Name: Curtis Kelly Inc. By: Phillip Hernandez
Procedure Qualification Record No.: 134
Welding Procedure Specification No. 64 Date: 1/12/88
Welding Processes: FCAW Type(s): Semi-automatic

JOINTS (QW-402)
Joint Design:60 deg. single vee 30 deg. bevel 1/16" land 1/8" opening.
Backing: see backing
Backing Material (Type): first pass none, remaining passes weld metal.

BASE METALS (QW-403)
P-No. 1 Gr. No. 2 to P-No.8 Gr. No. 1
Specification type & grade: SA516 GR.70
to Specification type & grade: SA240-304
Thickness of Test Coupon: 1"
Diameter of Test Coupon: Plate
Other:** QW403.9 N/A - ALL PASSES <1/2"
QW403.10 N/A - VOLTAGE & AMPERAGE ARE IN SPRAY TRANSFER MODE

FILLER METALS (QW-404)
F-No.: 6 Other: Mfg. trade name Kobelco DW309L
A-No.: 8 Other: Filler metal product form: Flux cored
Spec. No. (SFA): 5.22
AWS No.(Class): E309LT1-1
Size of filler metals: .045" & 1/16" wire
Electrode Flux (Class): N/A
Flux Tradename: N/A
Consumable Insert: N/A
Weld Metal Thickness: 1" **
Other: ** QW404.24 THRU QW404.27 N/A - NO SUPPLEMENTAL POWDERS USED.

POSITIONS (QW-405)
Position of Groove: 3G
Welding Progression: uphill

POSTWELD HEAT TREATMENT (QW-407)
Temperature : None
Time : None

PREHEAT (QW-406)
Preheat Temp. Min.: 50 deg.F.
Interpass Temp. Max.: 350 Deg F.
Other: N/A

GAS (QW-408)
Shielding Gas or Gases: CO2
Percent Composition (mixtures): 100%
Flow Rate: 35-40 C.F.H.
Gas Backing: None
Trailing Shielding Gas Composition: None

ELECTRICAL CHARACTERISTICS (QW-409)
Current (AC or DC): DC Polarity: * Transfer Mode: spray **
Amps (Range): * Volts (Range): *

Procedure Qualification Record No.: 134
Welding Procedure Specification No. 64 Date: 1/12/88 SHEET 2 of 2

TECHNIQUE (QW-410)
String or Weave Bead: Weave
Oscillaton: None
Multiple or Single Pass (per side): Multiple
Multiple or Single Electrodes: Single
Other: ----

* Weld Layer(s)	Process	Filler Metal Class	Filler Metal Dia.	Current Type Polar.	Current Amp Range	Volt Range	Travel Speed Range ("/min.)	Other (J/in.) (Max.)
1	FCAW	E309LT1-1	.045"	Rev.	175	29	10.5"	29,000
2	FCAW	E309LT1-1	.045"	Rev.	175	29	10.5"	29,000
3	FCAW	E309LT1-1	.045"	Rev.	175	29	10.5"	29,000
remainder	FCAW	E309LT1-1	1/16"	Rev.	240	32	12"	38,400

Tensile Test (QW-150)

Specimen No.	Width	Thickness	Area	Ultimate Total Load	Ultimate Unit Stress	Fracture Location
1. (QW462.1A)	.877"	.736"	.6455"	52,000	80,500	BASE METAL
2. (QW462.1A)	.854"	.758"	.6473"	51,600	79,700	BASE METAL

Guided Bend Test (QW-160)

Type & Figure No.	Result
SIDE BEND QW 462.2 (A)	SATISFACTORY
SIDE BEND QW 462.2 (A)	SATISFACTORY
SIDE BEND QW 462.2 (A)	SATISFACTORY
SIDE BEND QW 462.2 (A)	SATISFACTORY

Welder's Name: ARNULFO ESCOBEDO Stamp: E
Test conducted by: OMNI INC.
Laboratory Test No.: 46382.0

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: Curtis Kelly Inc.

By: Phillip Hernandez
Phillip Hernandez

Date: 1/12/88

Recertified to include N/A variables, weld metal thickness and transfer mode not previously stated but indicative of volts & amps. All changes Mk'd **.
Date: 6-12-96 By: Phillip Hernandez

Recertified to correct group number - P16-70 Gr. No. 2
Date: 10-6-04 By: Phillip Hernandez

Recertified to update AWS classification
Date: 7-13-05 By: Phillip Hernandez

Recertified to include filler metal product form and the calculated heat input and omit the welder's social security number.
Date: 29-April-08 By: Robert P. Hernandez

OMNI
INCORPORATED

DATE: 01/12/88
REPORT NO: 46382.0
CUST ACCT: 1795

TO: CURTIS KELLY, INC.
P.O. Box 20322
Houston,, Tx 77225

********** MECHANICAL TEST REPORT **********

CUSTOMER JOB: VERBAL PHIL HERNANDEZ
MATERIAL : WELD PROCEEDURE QUALIFICATION 516-70 TO SA 240 TP304
IDENT. : WELDER STAMP "E"

********** TENSILE TEST RESULTS **********

NO	SIZE (IN)	YIELD (PSI)	TENSILE (PSI)	ELONG. (%)	R OF A (%)	HARDNESS
1	.877X.736		80,500			
2	.854X.758		79,700			

Unless otherwise stated, yield stress is .2% offset.
Gage length is 2 in. for 1/2 in. bars or 1 in. for 1/4 in. bars.

********** BEND TEST RESULTS **********

	BEND - TYPE AND FIGURE	RESULTS
1	4 SIDE BENDS QW 462.2(a)	SATISFACTORY

	TENSILE #1	TENSILE #2
AREA:	.6455	.6473
TENSILE LOAD:	52,000	51,600
FRACTURE:	DUCTILE	DUCTILE
BROKE IN:	BASE SS	BASE SS

OMNI TESTING LABORATORIES, INC.

BY: _____
- METALLURGIST -

(713) 939-8690
4302 Dayco Street
Houston, Texas 77092

WHC

W H COMPANY

CONSULTING ENGINEERS

8450 RAYSON • HOUSTON, TEXAS 77080 • 713/895-7504

ENGINEERING
TESTING

COMPANY: Curtis-Kelly, Inc.
P.O. Box 450808
Houston, TX 77245

Date October 12, 1990

Lab Test # 90-1011-02

P. O. # Verbal

ATTN: Phillip Hernandez

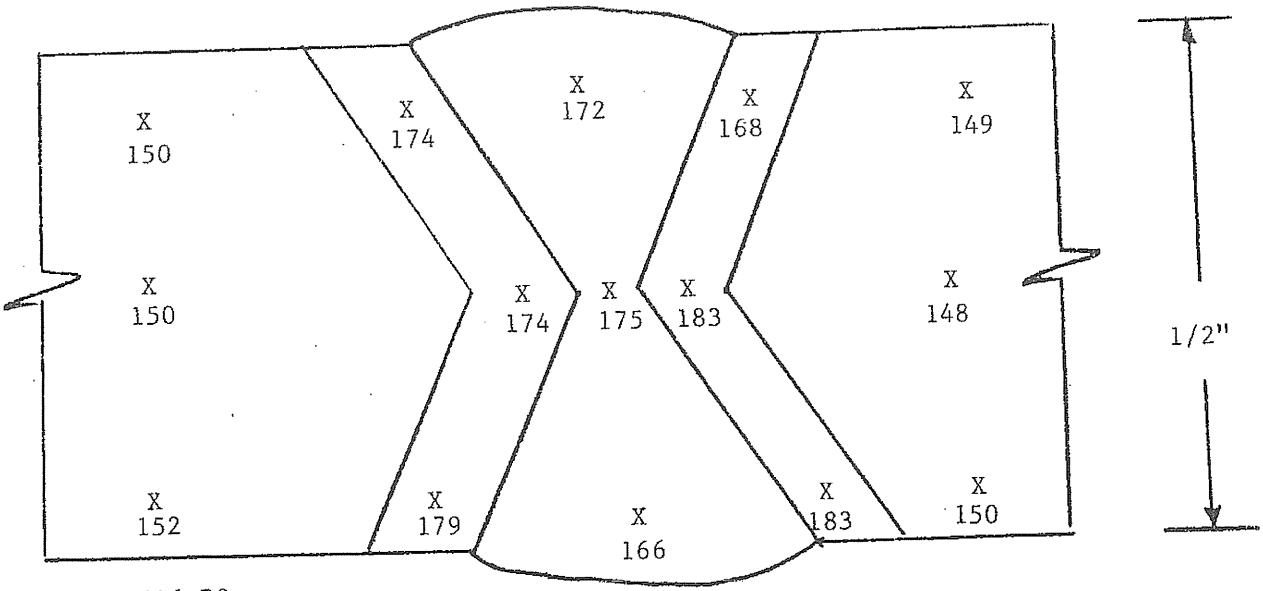
Identification of specimen, e.g., base material, weld rod, process, heat treatment, procedure or welder qualification, etc.

WPS #64 SA516-70 to 304 SS

Rockwell "B" Converted to BHN

Lab Stamp "S"

HARDNESS SURVEY



SA516-70

Wes Heinsohn

Wes Heinsohn, P.E.

CURTIS KELLY INC.
HOUSTON, TEXAS

QW-483 FORMAT FOR PROCEDURE QUALIFICATION RECORD (PQR) SHEET 1 of 2

Company Name: Curtis Kelly Inc. By: Phillip Hernandez
Procedure Qualification Record No.: 301
Welding Procedure Specification No. 64 Date: 12/22/05
Welding Processes: FCAW Type(s): Semi-automatic

JOINTS (QW-402)
Joint Design:60 deg. single vee 30 deg. bevel 1/16" land 1/8" opening.
Backing: backweld & backgouge
Backing Material (Type): first pass none, remaining passes weld metal.

BASE METALS (QW-403)
P-No. 1 Gr. No. 2 to P-No.8 Gr. No. 1
Specification type & grade: SA516 GR 70
to Specification type & grade: SA240-304
Thickness of Test Coupon: .625"
Diameter of Test Coupon: Plate
Other: QW403.9 N/A - ALL PASSES <1/2"
QW403.10 N/A - VOLTAGE & AMPERAGE ARE IN SPRAY TRANSFER MODE

FILLER METALS (QW-404)
F-No.: 6 Other: Mfg. trade name Kobelco DW309L
A-No.: 8 Other: Filler metal product form: Flux cored
Spec. No. (SFA): 5.22
AWS No.(Class): E309LT0-1
Size of filler metals: .045"
Electrode Flux (Class): N/A
Flux Tradename: N/A
Consumable Insert: N/A
Weld Metal Thickness: .625"
Other: QW404.24 THRU QW404.27 N/A - NO SUPPLEMENTAL POWDERS USED.

POSITIONS (QW-405)
Position of Groove: 3G
Welding Progression: uphill

PREHEAT (QW-406)
Preheat Temp. Min.: 50 deg.F.
Interpass Temp. Max.: 350 Deg F.
Other: N/A

POSTWELD HEAT TREATMENT (QW-407)
Temperature : None
Time : None

GAS (QW-408)
Shielding Gas or Gases: CO2
Percent Composition (mixtures): 100%
Flow Rate: 35-40 C.F.H.
Gas Backing: None
Trailing Shielding Gas Composition: None

ELECTRICAL CHARACTERISTICS (QW-409)
Current (AC or DC): DC Polarity: * Transfer Mode: spray
Amps (Range): * Volts (Range): *

Procedure Qualification Record No.: 301
Welding Procedure Specification No. 64 Date: 12/22/05 SHEET 2 of 2

TECHNIQUE (QW-410)
String or Weave Bead: Weave
Oscillaton: None
Multiple or Single Pass (per side): Multiple
Multiple or Single Electrodes: Single
Other: ----

* Weld Layer(s)	Process	Filler Metal Class	Filler Metal Dia.	Current Type Polar.	Current Amp Range	Volt Range	Travel Speed Range ("/min.)	Other (J/in.) (Max.)
1	FCAW	E309LT0-1	.045"	Rev.	175	29	10.5"	29000
2	FCAW	E309LT0-1	.045"	Rev.	190	29	11"	30055
remainder	FCAW	E309LT0-1	.045"	Rev.	200	30	11"	32727

Tensile Test (QW-150)

Specimen No.	Width	Thickness	Area	Ultimate Total Load	Ultimate Unit Stress	Fracture Location

Guided Bend Test (QW-160)

Type & Figure No.	Result

Toughness Test (QW-170)

Specimen No.	Notch location	Notch type	Test Temp. F.	Impact Values	Lateral Expansion %shear	Lateral Expansion mils
1	weld	vee	-50	54	40	.036"
2	weld	vee	-50	44	40	.041"
3	weld	vee	-50	62	40	.051"
4	HAZ-516	vee	-50	67	40	.052"
5	HAZ-516	vee	-50	77	40	.055"
6	HAZ-516	vee	-50	66	40	.057"
7	Base-516	vee	-50	44	40	.034"
8	Base-516	vee	-50	47	40	.038"
9	Base-516	vee	-50	49	40	.039"

Welder's Name: ARNULFO ESCOBEDO Stamp: E
Test conducted by:Goolsby Testing Lab
Lab Test number: 05-12-40994

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: Curtis Kelly Inc.

Date: 12/22/05 By: Phillip Hernandez
Phillip Hernandez

Recertified to incorporate the filler metal product form and to omit the welder's social security number.

Date: 29-April-08 By: Robert R. Stanley

GOOLSBY TESTING LABORATORIES, INC.
2620 WILSON ROAD - P.O. BOX 1416
HUMBLE, TEXAS 77347-1416
(281) 540-1255 FAX (281) 540-8125

TO: CURTIS KELLY INC	DATE: 12/20/05
PO BOX 450808	LABORATORY TEST NO: 05-12-40994
HOUSTON, TEXAS 77008	GTL#: 6523
MATERIAL: SA-240-304L to SA-516-70	ELECTRODE HEAT#:
MATERIAL THICKNESS: 5/8"	
SPECIFICATIONS: ASME SECT VIII	WPS#: 64 (FCAW) E309LTO-1

IMPACT TEST

TESTING MACHINE: BALDWIN SATEC S1-1	TEST METHOD: SIMPLE BEAM CHARPY
LINEAR VELOCITY OF HAMMER: 17 FT/SEC.	EFFECTIVE ENERGY: 240 FT/LBS.
SPCIMEN TYPE: ASTM TYPE A LVNC	SPECIMEN SIZE: 10 MM X 10 MM
SPECIMEN TEMP: -50 DEG. F	ACCEPTANCE CRITERIA: .015 LATERAL EXP.

SPECIMEN LOCATION	WIDTH	EFFECTIVE SECTION SIZE	IMPACT VALUES FOOT POUNDS	SHEAR FRACTURE	LATERAL EXPANSION
WELD	.394	.315	54	40	.036
WELD	.394	.315	44	40	.041
WELD	.394	.315	62	40	.051
HAZ-516	.394	.315	67	40	.052
HAZ-516	.394	.315	77	40	.055
HAZ-516	.394	.315	66	40	.057
BASE	.394	.315	44	40	.034
BASE	.394	.315	47	40	.038
BASE	.394	.315	49	40	.039

Acceptable < X > Rejectable < > Per Applicable Specifications.
Actual Welding was < > was not < X > witnessed by GTL.

GOOLSBY TESTING LABORATORIES, INC.

PER: W. Keith Goolsby
W.KEITH GOOLSBY PRESIDENT / LEVEL III

Our letters and reports are for the use of our clients to whom they are addressed. Our name may be used only with our prior written approval. Our letters and reports apply only to the sample tested and/or inspected, and do not necessarily represent the quality of other apparently similar or identical materials.

THE SPITZER COMPANIES

Welding Code: ASME Sect. IX • Welding Procedure Specification No.: 69 Revision No.:10 Date:7-17-13 By: D. Hickman
PQR No. (s): 138,281,282,306 Welding Process(es): GTAW Process Type: Manual ☒ Semi-Auto ☐ Automatic ☐ Machine ☐

Joints (QW-402)

Joint Design: All Grooves and Fillets
Root Spacing: 0.093" - 0.156" Root Face Dimension:0.0" - 0.125"
Groove Angle: 60° ± 10° Radius (J-U) _____
Backing: Yes ☐ _____ No ☒ _____
Material Type: ☐ Metal ☐Nonmetallic ☐Nonfusing ☐ Other
Retainers ☐ Yes ☒ No,

Base Metals (QW-403)

P No.: 8 Group No.: 1 to P No.: 8 Group No.: 1
Specification Type/Grade/UNS No.: N/A to Specification Type/Grade/UNS No.: N/A
Thickness Range: Base Metal: Groove .187"- 1.0" Fillet ALL Maximum Pass Thickness ≤ ½": ☒ Yes ☐ No
Pipe Diameter Range: ALL

Filler Metals (QW-404)

Variables/Process(es)	GTAW
SFA Classification	5.9
AWS Classification	See Chart
F No.	6
A No.	8
Size of Filler Metal	.093"-.125"
Thickness Range	1.00" Max.
Filler Manf./Trade Name	N/A
Electrode-Flux (Class)	None
± Flux	None Used
Flux Trade Name	N/A
Consumable Insert	None
Product Form	Bare Wire
± Supplemental	None
± Filler	With Filler Only
Other	None

CHART

Base Type/Grade	FILLER GTAW
TP/WP/F-304/L	ER308/L
TP/WP/F-316/L	ER316/L

APPROVED FOR CONSTRUCTION
WJ 2132 10/19/16
Curtis Kelly, Inc.

Positions (QW-405)

Position of Groove: Any Position of Fillets: Any
Welding Progression: ☒ Up ☐ Down

Postweld Heat Treatment (QW-407)

Temperature Range: None °F Time Range: _____
Note: _____

Preheat (QW-406)

Preheat Temp Min.: 60 °F
Interpass Temp. Max.: 350 °F
Preheat Maintenance: None
Note: Preheat to remove moisture for plate.

Gas (QW-408)

Process GTAW Shielding Gas Argon Mixture 99.995% Flow Rate 24-30 CFH
Backing Gas Argon Mixture 99.995% Flow Rate 6-25 CFH
Trailing Req.: None

Electrical Characteristics (QW-409)

Tungsten Electrode Type and Size: .093:-.125" 2% Thoriated Mode of Metal Transfer for GMAW/FCAW: N/A Wire Feed Speed: N/A Pulsing:No

Weld Layer	Process	Class	Dia.	Polarity	Amps.	Volts.	T/Speed (IPM)	Heat Input (kj/in)
ALL	GTAW	See Chart	0.063"	DCEN	70-95	8.5-15.0	2.0 - 4.0	16.3
ALL	GTAW	See Chart	0.093"	DCEN	45-155	8.5-15.0	1.25 - 5.0	63.8
ALL	GTAW	See Chart	0.125"	DCEN	120-192	10.0-16.0	2.0 - 4.0	49.4

Parametric combinations that exceed that maximum allowable heat inputs are not allowed.

Technique (QW-410)

Bead Type: ☒ String ☒ *Weave • CTWD: N/A • Orifice Cup Size:#6 - #10 • Oscillation: None • Multiple or Single Electrodes: Single
Multiple or Single Pass: Multiple • Peening: Not Allowed • Method of Back Gouging: N/A • Use of Thermal Processes ☐ Yes ☒ No
Initial and Interpass Cleaning: Chipping, brushing, grinding as required for interpass cleaning. Bevel preps must be free from rust, oil, paint or any other deleterious substances. Only use equipment designated for stainless steel.
Notes: *Maximum bead width .500".

CURTIS KELLY INC.
HOUSTON, TEXAS

QW-483 FORMAT FOR PROCEDURE QUALIFICATION RECORD (PQR) SHEET 1 of 2

Company Name: Curtis Kelly Inc. By: Phillip Hernandez
Procedure Qualification Record No.: 138
Welding Procedure Specification No. 69 Date: 6/21/88
Welding Processes: GTAW Type(s): Manual

JOINTS (QW-402)
Joint Design: 60 deg. single vee 30 deg. bevel 1/16" land 3/32" opening.
Backing: see backing
Backing Material (Type): first pass none; remaining passes weld metal.

P-No.8 Gr. No.1 to P-No 8 Gr. No. 1
Specification type & grade: SA240-304
to Specification type & grade: SA240-304
Thickness of Test Coupon: .3125"
Diameter of Test Coupon: Plate
Other: N/A

FILLER METALS (QW-404)
F-No.: 6 Other: ----
A-No.: 8 Other: ----
Spec. No. (SFA): 5.9
AWS No.(Class): ER308L
Size of filler metals: 1/16"& 3/32" Hand held filler rod
Electrode Flux (Class): N/A
Flux Tradename: N/A
Consumable Insert: N/A
Weld metal thickness: .3125"

POSITIONS (QW-405)
Position of Groove: 3G
Welding Progression: uphill

PREHEAT (QW-406)
Preheat Temp. Min: 60 deg.F.
Interpass Temp. Max.: 300 Deg F.
Other: N/A

POSTWELD HEAT TREATMENT (QW-407)
Temperature : None
Time : None

GAS (QW-408)
Shielding Gas or Gases: Argon
Percent Composition (mixtures): 100%
Flow Rate: 25CFH
Gas Backing: Argon 100%@6-25 C.F.H.
Trailing Shielding Gas Composition: N/A

ELECTRICAL CHARACTERISTICS (QW-409)
Current (AC or DC): DC Polarity: *
Amps (Range): * Volts (Range): *

Procedure Qualification Record No.: 138
Welding Procedure Specification No. 69 Date: 6/21/88 SHEET 2 of 2

TECHNIQUE (QW-410)
String or Weave Bead: String
Oscillaton: None
Multiple or Single Pass (per side): Multiple
Multiple or Single Electrodes: Single
Other: ---

* Weld Layer(s)	Process	Filler Metal Class	Filler Metal Dia.	Current Type Polar.	Current Amp Range	Volt Range	Travel Speed Range ("/min.)	Other (J/in.) (Max.)
1	GTAW	ER308L	1/16"	Straight	85-87	9-10	3	16340
remainder	GTAW	ER308L	3/32"	Straight	95-97	9-10	4	13680

Tensile Test (QW-150)

Specimen	Width	Thickness	Area	Ultimate Total Load	Ultimate Unit Stress	Fracture Location
1. (QW462.1A)	.744"	.295"	.219"	18,800	85,800	WELD
2. (QW462.1A)	.744"	.293"	.218"	18,750	86,000	WELD

Guided Bend Test (QW-160)

Type & Figure No.	Result
ROOT BEND QW 462.3A	SATISFACTORY
FACE BEND QW 462.3A	SATISFACTORY
ROOT BEND QW 462.2A	SATISFACTORY
FACE BEND QW 462.2A	SATISFACTORY

Toughness test (QW-170)

Specimen No.	Notch location	Notch Type	Test Temp.	Impact Values	Lateral Exp. %Shear	Lateral Exp. inchs	Drop Weight Break	Drop Weight No. Break
(Weld)								
629 W-1	Weld		-320	61.0		.059		
629 W-2	Weld		-320	72.0		.066		
629 W-3	Weld		-320	69.0		.063		

Larry Milner Stamp: T
Test conducted by: Metallon
Laboratory Test No.: 853-88

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: Curtis Kelly Inc.

Date: 6/21/88 By: Phillip Hernandez
Phillip Hernandez

Recertified to incorporate editorial change mils to inchs.
Date: 6/15/06 By: Phillip Hernandez

Recertified to incorporate backing gas flow rate and to also add the weld metal thickness.
Date: 7-24-08 By: Robert R. Jones

Metallon

Metallurgical Testing Laboratories

2524 Sutherland, Houston, Texas 77023
(713) 923-7761

MECHANICAL TEST RESULTS

TO Curtis Kelly Inc.
DATE 6-15-88 REPORT NO. 853-88 P.O. Verbal-Hernandez
MATERIAL SPECIFICATION 5/16" Welded Plate Coupon, ASME SA 240 Type 304

TEST RESULTS CONFORM TO SPECIFICATION: ☒ YES ☐ NO ☐ NOT APPLICABLE
IDENTIFICATION PQR #138, WPS #69
HEAT TREATMENT N.A.

COMMENTS Tested per ASME Sec IX; Welder-"T"; SS #465-94-1812

Lab ID No.	Size	Area Sq. In.	Yield, p.s.i.*	Ultimate Load, Lbs.	Tensile Strength, p.s.i.	%El.	% R.A.	Frac Loc
629-1 (QW-462.1a)	.744 .295	.219		18,800	85,800			Weld
629-2 (QW-462.1a)	.744 .293	.218		18,750	86,000			Weld

Bend Tests

629-R1 (Root, QW-462.3a)	Satisfactory
629-F2 (Face, QW-462.3a)	Satisfactory
629-R3 (Root, QW-462.3a)	Satisfactory
629-F4 (Face, QW-462.3a)	Satisfactory

METALLON, Incorporated

Donald R. McGehee, P.E.

Our reports apply only to the actual sample tested and are not necessarily indicative of the properties of other identical or similar materials.

Metallon

Metallurgical Testing Laboratories

2524 Sutherland, Houston, Texas 77023
(713) 923-7761

CHARPY IMPACT TEST RESULTS

TO Curtis Kelly Inc.

DATE 6-15-88 REPORT NO. 853-88 P.O. Verbal-Hernandez

MATERIAL SPECIFICATION 5/16" Welded Plate Coupon, ASME SA 240 Type 304

TEST RESULTS CONFORM TO SPECIFICATION: ☒ YES ☐ NO ☐ NOT APPLICABLE

IDENTIFICATION PQR #138, WPS #69 TEST TEMP. -320°F

SPECIMEN TYPE Charpy V-Notch SPECIMEN SIZE 10 x 6.67mm (2/3 size)

HEAT TREATMENT N.A.

COMMENTS Tested per ASME Sec VIII, UG-84; Welder-"T"; SS #465-94-1812

Capacity of impact machine is 264 foot pounds with a striking velocity of 16.8 feet per second.

LAB ID NO.	IMPACT VALUE (ft.-lbs.)	Lat Exp(in)
629 W-1 (Weld)	61.0	0.059
629 W-2 (Weld)	72.0	0.066
629 W-3 (Weld)	69.0	0.063

METALLON, Incorporated

Donald R. McGehee, P.E.

Our reports apply only to the actual sample tested and are not necessarily indicative of the properties of other identical or similar materials.

CURTIS KELLY INC.
HOUSTON, TEXAS

QW-483 FORMAT FOR PROCEDURE QUALIFICATION RECORD (PQR) SHEET 1 of 2

Company Name: Curtis Kelly Inc. By: Phillip Hernandez
Procedure Qualification Record No.: 281
Welding Procedure Specification No. 69 Date: 04/06/04
Welding Processes: GTAW Type(s): Manual

JOINTS (QW-402)
Joint Design:60 Deg. single vee 30 deg. bevel 3/32"land 1/8" opening
Backing: see backing
Backing Material (Type): first pass none, remaining passes weld metal
Retainers: none

BASE METALS (QW-403)
P-No. 8 Gr. No. 1 to P-No. 8 Gr. No. 1
Specification type & grade: SA240-304/L
to Specification type & grade: SA240-304/L
Thickness of Test Coupon: .375"
Diameter of Test Coupon: plate
Other: N/A

FILLER METALS (QW-404)
F-No.: 6 Other: Williams Welding Alloys
A-No.: 8 Ferrite: 3.9 (WRC)
Spec. No. (SFA): 5.9
AWS No.(Class): ER316L
Size of filler metals: 3/32"
Electrode Flux (Class): N/A
Flux Tradename: N/A
Consumable Insert: N/A
Weld metal Thickness: .375"

POSITIONS (QW-405)
Position of Groove: 3G
Welding Progression: uphill

POSTWELD HEAT TREATMENT (QW-407)
Temperature : none
Time : N/A

PREHEAT (QW-406)
Preheat Temp. : 60 deg F
Interpass Temp. : 350 deg. F
Other: N/A

GAS (QW-408)
Shielding Gas or Gases: Argon
Percent Composition (mixtures):100%
Flow Rate: 25 C.f.H.
Gas Backing:Argon -100% 20CFH
Trailing Shielding Gas Composition: none

ELECTRICAL CHARACTERISTICS (QW-409)
Current (AC or DC): DC Polarity: * Pulsing current: none
Amps (Range): * Volts (Range): * Transfer Mode: n/a

Procedure Qualification Record No.: 281
Welding Procedure Specification No. 69 Date: 04/06/04 SHEET 2 of 2

TECHNIQUE (QW-410)
String or Weave Bead: string
Oscillaton: None
Multiple or Single Pass (per side): Multiple
Multiple or Single Electrodes: Single
Other: n/a

* Weld Layer(s)	Process	Filler Metal Class	Filler Metal Dia.	Current Type Polar.	Current Amp Range	Volt Range	Travel Speed Range ("/min.)	Other (J/in.) (Max.)
ROOT	GTAW	ER316L	3/32"	STR.	45~47	10.5	1.25"	22,680
2ND PASS	GTAW	ER316L	3/32"	STR.	80~82	11.5	2 1/2"	22,080
REMAINDER	GTAW	ER316L	3/32"	STR.	98~100	12	3.25"	21,711

Tensile Test (QW-150)

Specimen No.	Width	Thickness	Area	Ultimate Total Load	Ultimate Unit Stress	Fracture Location
1(QW462.1a)	.756"	.387"	.292"	25,500	87,329	BASE
2(QW462.1a)	.753"	.391"	.294"	26,000	88,435	BASE

Guided Bend Test (QW-160)

Type & Figure No.	Result
FACE BEND QW 462.3a	SATISFACTORY
FACE BEND QW 462.3a	SATISFACTORY
ROOT BEND QW 462.3a	SATISFACTORY
ROOT BEND QW 462.3a	SATISFACTORY

Toughness Test (QW-170)

Specimen No.	Notch Location	Notch Type	Test Temp.	Impact Values ft/lbs	lateral expansion % shear	lateral expansion inchs	Drop Weight Break	Drop Weight No Break
1	WELD	VEE	-320 F.	67	40	.062		
2	WELD	VEE	-320 F.	56	40	.052		
3	WELD	VEE	-320 F.	66	40	.056		
4	HAZ	VEE	-320 F.	142	60	.077		
5	HAZ	VEE	-320 F.	118	60	.072		
6	HAZ	VEE	-320 F.	121	60	.075		
7	BASE	VEE	-320 F.	155	60	.078		
8	BASE	VEE	-320 F.	134	60	.082		
9	BASE	VEE	-320 F.	167	60	.076		

Welder's Name: Sergio Perez Stamp: O S.S.#: 466-73-3165
Test conducted by:GOOLSBY TESTING LAB. Laboratory Test No.:04-04-36995
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: Curtis Kelly Inc.
Date:04/06/04 By: Phillip Hernandez
Phillip Hernandez

Recertified to incorporate editorial change in QW407 (n/a to none), uphill weld progression that was omitted in error and editorial change mils to inchs.
Date: 6/15/06 By Phillip Hernandez

GOOLSBY TESTING LABORATORIES, INC.
2620 WILSON ROAD - P.O. BOX 1416
HUMBLE, TEXAS 77347-1416
(281) 540-1255 FAX (281) 540-8125

TO: CURTIS KELLY, INC.	DATE: 04/06/04
P.O. BOX 450808	LABORATORY TEST NO: 04-04-36995
HOUSTON, TEXAS 77245	MATERIAL: SA-240-304L HT# 2P92
GTAW ER316L WILLIAMS WELDING ALLOY HT# 1Y438	GTL# 4564 PQR#
MATERIAL THICKNESS: 3/8"	SPECIFICATIONS: ASME SECT. IX

TENSILE TEST

SPEC. NO.	WIDTH	THK. NESS	SQ.IN. AREA	ULT.LD YIELD	YIELD PSI	ULT.LD TENSILE	TENSILE PSI	%EL IN 2"	% ROA	FRAC. LOC.
QW462.1A	.756	.387	.292			25500	87329			BASE
QW462.1A	.753	.391	.294			26000	88435			BASE

IMPACT TEST

TESTING MACHINE: BALDWIN SATEC S1-1	TEST METHOD: SIMPLE BEAM CHARPY
LINEAR VELOCITY OF HAMMER: 17 FT/SEC.	EFFECTIVE ENERGY: 240 FT/LBS.
SPECIMEN TYPE: ASTM TYPE A LVNC	SPECIMEN SIZE: 8 MM X 10 MM
SPECIMEN TEMP: -320 DEG.F.	ACCEPTANCE CRITERIA: .021" MIN LATERAL EXP.

SPECIMEN LOCATION	WIDTH	EFFECTIVE SECTION SIZE	IMPACT VALUES FOOT POUNDS	% SHEAR FRACTURE	LATERAL EXPANSION
WELD	.315	.315	67	40	.062
WELD	.315	.315	56	40	.052
WELD	.315	.315	66	40	.056
HAZ	.315	.315	142	60	.077
HAZ	.315	.315	118	60	.072
HAZ	.315	.315	121	60	.075
BASE	.315	.315	155	60	.078
BASE	.315	.315	134	60	.082
BASE	.315	.315	167	60	.076

BEND TEST

SPEC.# AND TYPE	RESULTS	SPEC.# AND TYPE	RESULTS
QW462.3A ROOT	SATISFACTORY	QW462.3A FACE	SATISFACTORY
QW462.3A ROOT	SATISFACTORY	QW462.3A FACE	SATISFACTORY

ACCEPTABLE < XX > REJECTABLE < > PER APPLICABLE SPECIFICATIONS.
ACTUAL WELDING WAS < > WAS NOT < X > WITNESSED BY GTL.

GOOLSBY TESTING LABORATORIES, INC.

PER: W. Keith Goolsby
W. KEITH GOOLSBY PRESIDENT + LEVEL III

Our letters and reports are for the use of our clients to whom they are addressed. Our name may be used only with our prior written approval. Our letters and reports apply only to the sample tested and / or inspected, and do not necessarily represent the quality of other apparently similar or identical materials.

FROM : GOOLSBY TESTING FAX NO. : 2815408125 Apr. 06 2004 11:38AM P2

CURTIS KELLY INC.
HOUSTON, TEXAS

QW-483 FORMAT FOR PROCEDURE QUALIFICATION RECORD (PQR) SHEET 1 of 2

Company Name: Curtis Kelly Inc. By: Phillip Hernandez
Procedure Qualification Record No.: 282
Welding Procedure Specification No. 69 Date: 04/06/04
Welding Processes: GTAW Type(s): Manual

JOINTS (QW-402)
Joint Design:60 Deg. single vee 30 deg. bevel 1/16"land 1/8" opening
Backing: see backing
Backing Material (Type): first pass none, remaining passes weld metal
Retainers: none

BASE METALS (QW-403)
P-No. 8 Gr. No. 1 to P-No. 8 Gr. No. 1
Specification type & grade: SA240-304/L
to Specification type & grade: SA240-304/L
Thickness of Test Coupon: .187"
Diameter of Test Coupon: plate
Other: N/A

FILLER METALS (QW-404)
F-No.: 6 Other: Williams Welding Alloys
A-No.: 8 Ferrite: 3.9 (WRC)
Spec. No. (SFA): 5.9
AWS No.(Class): ER316L
Size of filler metals: 3/32"
Electrode Flux (Class): N/A
Flux Tradename: N/A
Consumable Insert: N/A
Weld metal Thickness: .187"

POSITIONS (QW-405)
Position of Groove: 3G
Welding Progression:uphill

POSTWELD HEAT TREATMENT (QW-407)
Temperature : none
Time : N/A

PREHEAT (QW-406)
Preheat Temp. : 60 deg F
Interpass Temp. : 350 deg. F
Other: N/A

GAS (QW-408)
Shielding Gas or Gases: Argon
Percent Composition (mixtures):100%
Flow Rate: 25 C.f.H.
Gas Backing:Argon -100% 20CFH
Trailing Shielding Gas Composition: none

ELECTRICAL CHARACTERISTICS (QW-409)
Current (AC or DC): DC Polarity: * Pulsing current: none
Amps (Range): * Volts (Range): * Transfer Mode: n/a

Procedure Qualification Record No.: 282
Welding Procedure Specification No. 69 Date: 04/06/04 SHEET 2 of 2

TECHNIQUE (QW-410)
String or Weave Bead: string
Oscillaton: None
Multiple or Single Pass (per side): Multiple
Multiple or Single Electrodes: Single
Other: n/a

* Weld Layer(s)	Process	Filler Metal Class	Filler Metal Dia.	Current Type Polar.	Current Amp Range	Volt Range	Travel Speed Range ("/min.)	Other (J/in.) (Max.)
ROOT	GTAW	ER316L	3/32"	STR.	45~47	10.5	1.25"	22,680
REMAINDER	GTAW	ER316L	3/32"	STR.	80~82	11.5	2 1/2"	22,080

Tensile Test (QW-150)

Specimen No.	Width	Thickness	Area	Ultimate Total Load	Ultimate Unit Stress	Fracture Location
1(QW462.1a)	.756"	.297"	.224"	19,750	88,170	BASE
2(QW462.1a)	.753"	.288"	.216"	19,300	89,352	BASE

Guided Bend Test (QW-160)

Type & Figure No.	Result
FACE BEND QW 462.3a	SATISFACTORY
FACE BEND QW 462.3a	SATISFACTORY
ROOT BEND QW 462.3a	SATISFACTORY
ROOT BEND QW 462.3a	SATISFACTORY

Toughness Test (QW-170)

Specimen No.	Notch Location	Notch Type	Test Temp.	Impact Values ft/lbs	lateral expansion % shear	lateral expansion inchs	Drop Weight Break	Drop Weight No Break
1	WELD	VEE	-320 F.	58.8	40	.034		
2	WELD	VEE	-320 F.	65.8	40	.041		
3	WELD	VEE	-320 F.	72.8	40	.044		
4	HAZ	VEE	-320 F.	57.4	40	.037		
5	HAZ	VEE	-320 F.	77	40	.050		
6	HAZ	VEE	-320 F.	72.8	40	.045		
7	BASE	VEE	-320 F.	77	40	.044		
8	BASE	VEE	-320 F.	86.8	40	.052		
9	BASE	VEE	-320 F.	79.8	40	.056		

Welder's Name: Sergio Perez Stamp: O S.S.#: 466-73-3165
Test conducted by:GOOLSBY TESTING LAB. Laboratory Test No.:04-04-36996

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: Curtis Kelly Inc.
Date:04/06/04 By: Phillip Hernandez
Phillip Hernandez

Recertified to incorporate an editorial change in QW407 (n/a to none), uphill weld progression that was omitted in error & editorial change mils to inchs.

Date: 6/15/06 By: Phillip Hernandez

GOOLSBY TESTING LABORATORIES, INC.
2620 WILSON ROAD - P.O. BOX 1416
HUMBLE, TEXAS 77347-1416
(281) 540-1255 FAX (281) 540-8125

TO: CURTIS KELLY, INC.	DATE: 04/06/04
P.O. BOX 450608	LABORATORY TEST NO: 04-04-36996
HOUSTON, TEXAS 77245	MATERIAL: SA-240-304L HT# 39601FC
GTAW ER316L WILLIAMS WELDING ALLOY HT# 1Y438	GTL# 4563 PQR#
MATERIAL THICKNESS: 3/16"	SPECIFICATIONS: ASME SECT. IX

TENSILE TEST

SPEC. NO.	WIDTH	THK. NESS	SQ.IN. AREA	ULT.LD YIELD	YIELD PSI	ULT.LD TENSILE	TENSILE PSI	%EL IN 2"	% ROA	FRAC. LOC.
QW462.1A	.756	.297	.224			19750	88170			BASE
QW462.1A	.753	.288	.216			19300	89352			BASE

IMPACT TEST

TESTING MACHINE: BALDWIN SATEC S1-1			TEST METHOD: SIMPLE BEAM CHARPY		
LINEAR VELOCITY OF HAMMER: 17 FT/SEC.			EFFECTIVE ENERGY: 240 FT/LBS.		
SPECIMEN TYPE: ASTM TYPE A LVNC			SPECIMEN SIZE: 6 MM X 10 MM		
SPECIMEN TEMP: -320 DEG.F.			ACCEPTANCE CRITERIA: .021" MIN LATERAL EXP.		
SPECIMEN LOCATION	WIDTH	EFFECTIVE SECTION SIZE	IMPACT VALUES FOOT POUNDS	% SHEAR FRACTURE	LATERAL EXPANSION
			REAL / ITERP.		
WELD	.236	.315	42 / 58.8	40	.034
WELD	.236	.315	47 / 65.8	40	.041
WELD	.236	.315	52 / 72.8	40	.044
HAZ	.236	.315	41 / 57.4	40	.037
HAZ	.236	.315	55 / 77	40	.050
HAZ	.236	.315	52 / 72.8	40	.045
BASE	.236	.315	55 / 77	40	.044
BASE	.235	.315	62 / 86.8	40	.052
BASE	.236	.315	57 / 79.8	40	.055

BEND TEST

SPEC.# AND TYPE	RESULTS	SPEC.# AND TYPE	RESULTS
QW462.3A ROOT	SATISFACTORY	QW462.3A FACE	SATISFACTORY
QW462.3A ROOT	SATISFACTORY	QW462.3A FACE	SATISFACTORY

ACCEPTABLE < XX > REJECTABLE < > PER APPLICABLE SPECIFICATIONS.
ACTUAL WELDING WAS < > WAS NOT < X > WITNESSED BY GTL.

GOOLSBY TESTING LABORATORIES, INC.
W. Keith Goolsby
PER: _____
W. KEITH GOOLSBY PRESIDENT / LEVEL III

Our letters and reports are for the use of our clients to whom they are addressed. Our name may be used only with our prior written approval. Our letters and reports apply only to the sample tested and / or inspected, and do not necessarily represent the quality of other apparently similar or identical materials.

FROM : GOOLSBY TESTING FAX NO. : 2815408125 Apr. 06 2004 11:38AM P3

WILLIAMS
WELDING
ALLOYS

CERTIFICATE OF COMPLIANCE

Control # Lot/Heat #	Description	Specification	Classification
1Y438	ALLOY 316L .093 X 36"	AWS A5.9	ER316L

CHEMICAL ANALYSIS AND MECHANICAL PROPERTIES OF WIRE OR WELD METAL

CHEMICAL COMPOSITION

☑ **Actual:** As reported by the producing mill* ☐ **Typical:** From data obtained from numerous tests of similar material

C	Mn	Fe	P	S	Si	Cu	Ni	Co	Al	Ti	Cr	Mo	V	W	OTHER
.018	1.91		.025	.011	.54	.11	13.78				18.67	2.60			

MECHANICAL PROPERTIES

☐ Actual ☐ Typical ☐ As Welded ☐ Heat Treated

Tensile KSI	Yield KSI	Elong % 2"	Red Area %	Impact Temp	Average Value	Other

REMARKS

N .027
1992 WRC FERRITE 3.9FN

* This data has been transcribed from the manufacturer's test reports after verification by WWA for completeness and accuracy.

Date: 4-1-07

By: Dave Davis

8500 A Market Street
Houston, TX 77029

Pho: 866-231-WELD
713-675-1545

Fax: 713-675-1966

Bureau Veritas Inspection Limited	**Procedure Qualification Records (PQR)** For ASME Section IX Range of Qualification Meeting Combined Testing of EN-15614-1 & Section IX	**PED PQR**
	Reference Specifications: 97/23/EC Directive, ASME Section IX & EN-15614-1	Page: 1 of 2

Record Actual Conditions Used to Weld Test Coupon

Company Name CURTIS KELLY INC.

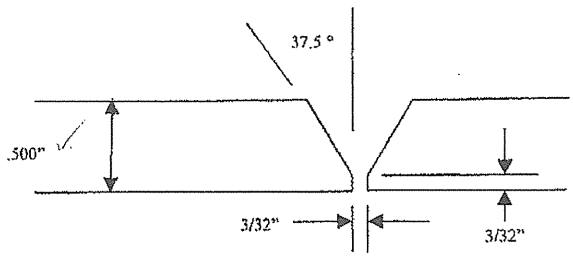
Procedure Qualification Record No. 306 Date June 19, 2007

WPS No. 273

Welding Process(es) GTAW Type(s) Manual

(Automatic, Manual, Machine, or Semi-Auto-I

JOINTS (OW.402)



Backing ☒ Yes / ☐ No
Retainers ☐ Yes / ☒ No

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. SA240-304/304L
Type or Grade
P-No. 8 GROUP 1 to P-No. 8 GROUP 1
Thickness of Test Coupon .500"
Diameter of Test Coupon Plate
Other Ht #836815-1B

FILLER METALS (QW-404)

SFA Specification	5.9	
AWS Classification	ER308L	
Filler Metal F-No.	6	
Weld Metal Analysis A-No.	8	
Size of Filler Metal	3/32" – 1/8"	
Other	Oxford Alloys	3/32" Ht# 2F720
		1/8" Ht# 2G997
Weld Metal Thickness	.500	

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

PREHEAT (QW-406)
Preheat Temp. 60 DEG. F
Interpass Temp. 350 DEG. F
Other

POSTWELD HEAT TREATMENT (QW.407)
Temperature N/A
Time N/A
Other N/A

GAS (QW-408)

	Gas(es)	Percent Composition (Mixture)	Flow Rate
Shielding	Argon	100%	29 CFH
Trailing			
Backing	Argon	100%	29 CFH

ELECTRICAL CHARACTERISTICS (OW-409)
Current DC
Polarity Straight
Amps. See Page 2 Volts See Page 2
Tungsten Electrode Size 1/8" 2% Thoriated
Other

TECHNIQUE IQW.4101
Travel Speed 1.5~3.5 IPM
String or Weave Bead String
Oscillation None
Multipass or Single Pass per side) MULTIPLE
Single or Multiple Electrodes SINGLE
Other
Peering ☐ Yes / ☒ No

ASME/PED PQR (Back)

PQR No. 305

Tensile Test (QW-150)

Specimen No.	Width	Thickness	Area	Ultimate Total Load lb	Ultimate Unit Stress psi	Type of Failure & Location
T-1	.748	.294	.2199	18,921	86,043	Weld/Ductile----Satisfactory
T-2	.746	.287	.2141	18,937	87,982	Weld/Ductile----Satisfactory

Guided-Bend Tests (QW-160)

Type	Figure No.	Result
Side	QW462.2	Pass
Side	QW462.2	Pass
Side	QW462.2	Pass
Side	QW462.2	Pass

Toughness Tests (QW-170)

Specimen No.	Notch Location	Specimen Size	Test Temp.	Impact Values			Drop Weight Break (Y/N)
				Ft. lbs.	% Shear	Mils	
1	Weld	7.5 X 10	-320 F	45/42/34	20/20/20	38/36/34	YES
2	HAZ	7.5 X 10	-320 F	60/69/68	30/40/40	44/42/41	YES

Type of test	Performed and Acceptable	Not Required	Type of test	Performed and Acceptable	Not Required
Visual	☒	☐	Fracture	☒	☐
Radiography	☒	☐	Bend	☒	☐
Magnetic particle/ penetrant	☒	☐	Additional Tests*		
Macro	☒	☐	Hardness Testing	☒	

WELD LAYERS	PROCESS	FILLER METAL		CURRENT		VOLTS	TRAVEL SPEED	OTHER
		CLASS	DIA.	POLAR.	AMP			
1	GTAW	ER308L	3/32"	STRAIGHT	118	13.5	1.5"	63,720 J/In.
2	GTAW	ER308L	3/32"	STRAIGHT	154	13.8	2"	63,756 J/In.
REMAINDER	GTAW	ER308L	1/8"	STRAIGHT	192	15	3.5	49,371 J/In.

Note: Made correction to travel speed for the 1/8" filler on 7-17-13. Richard V. Rocha

Antonio Ponce	N/A	"P"
Welder's Name	Clock No.	Stamp No.
Dynamic Laboratories	06/07/07	WP07-454
Laboratory Name.	Date	Test Report No(s).
Curtis Kelly Inc.	06/19/07	
Organisation/Manufacturer	Date	Signature
Bureau Veritas Inspection Limited (0041)	06.27.	
Inspection Organization	Date	Signature

BUREAU VERITAS INSPECTION LIMITED Notified Body No. 0041

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.

Dynamic Laboratories Inc.
3650 Underwood ~ La Porte, TX 77571 ~ U.S.A.
Phone – 281-478-0239 ~ Fax – 281-478-0259

Mechanical Test Requirements: ASME. IX - AWS D1.1 - AWS D1.6 - ASTM

DateRec'd 6-4-2007	Date Due 6-7-2007	Lab# WP07-455
Customer Curtis Kelly		PO#
Job #	WPS – PQR# WPS 273 / PQR 306	
Mat'l ID ½" Plate SA240-304/304L HT# 83,815-1B		Carbon & Low Alloy –Stainless & Alum.-High Alloys
Process – Filler – Dep welder P GTAW		Process – Filler – Dep

Testing Required

Tensiles	2-Ten	Charpy's	Yes	Chemistry	
Bends	4-Bends	NDT		Monitor	
Hardness		PWHT		WPS - PQR	
Base Mat'l		Consumeables		Freight	

Tensile Tests

	1a	1b	2a	2b
Size inches	.743 X .437		.744 X .438	
Area inches	.3246		.3258	
Load	28,773		29,242	
Tensile	88,641		89,754	
Fracture	weld Duct		weld Duct.	

Bend Tests — **Side** — **Face / Root**

S-1 E-~~1~~	Pass	S-3 R-~~1~~	Pass
S-2 E-~~2~~	Pass	S-4 R-~~2~~	Pass

Hardness – Rockwell B / C – Brinell – ~~Vickers~~ – kg - Knoops g

Location	
Base	
HAZ	
Weld	
Yellow Haz	
Yellow Base	

WITNESS

Jason Tow 6-7-07

Charpy Impacts Size- 10mm X 10mm

Temp	Location	Ft Lbs / Joules	% Shear	Mils Lat Exp
-320 F	Weld	53/46/59	30/30/40	40/33/40
-320 F	HAZ	107/100/95	90/90/90	55/50/51

PWHT

Chemistry

Notes MACRO Examination Pass

This is to verify that all inspection & testing relative this order has been completed, & the results are accurate. All required documentation is available & approved.

Inspector: Jon T. Boss Date: 6-7-07

Spitzer INDUSTRIES

Welding Code: ASME Sect. IX • Welding Procedure Specification No.: AS-P1-P1-F-A-26 Revision No.: 7 Date: 12-21-15 By: R.Rocha
Supporting PQR No. (s): AS-P1-F-A-26-1 Welding Process(es): FCAW/SAW
Process Type: Manual ☐ Semi-Auto ☒ Automatic ☐ Machine ☒

Joints (QW-402)

Joint Design: All Grooves and Fillets
Root Spacing: 0.125" +/-.062" Root Face Dimension: 0.062" +/- 0.062"
Groove Angle: 60° +10°/-5° Radius (J-U) NA
Backing: Yes ☒ With backing or back gouge No ☐ _____
Material Type: ☒ Metal ☐Nonmetallic ☐Nonfusing ☐ Other
Retainers ☐ Yes ☒ No,

Base Metals (QW-403)

P No.: 1 Group No.: 1 & 2 to P No.: 1 Group No.: 1 & 2
Specification Type/Grade/UNS No.: N/A to Specification Type/Grade/UNS No.: ---
Thickness Range W/O CVN: Base Metal: Groove 0.187" to 1.5" Fillet All Maximum Pass Thickness ≤ ½": ☒ Yes ☐ No
Thickness Range W/CVN: Base Metal: Groove 0.625" to 1.5" Fillet All Maximum Pass Thickness ≤ ½": ☒ Yes ☐ No

Filler Metals (QW-404)

Variables/Process(es)	FCAW	SAW
SFA Classification	5.20	5.17
AWS Classification	E71T-12MJ	EH11K
F No.	6	6
A No.	1	EH11K
Size of Filler Metal	0.045" / 0.062"	0.125" / 0.156"
Thickness Range	1.500"	1.500"
Filler Manf./Trade Name	N/A	Lincolnweld L-56
Electrode-Flux (Class)	NA	F7A6EH11K
± Flux	None Used	With Flux
Flux Trade Name	NA	Lincoln 880M
Consumable Insert	None	None
Product Form	Fluxed Cored	Solid Wire
± Supplemental	None Used	None Used
± Filler	With Filler	With Filler

APPROVED FOR CONSTRUCTION NOT TO SCALE 12/29/15 2132 Chris Kelly, Inc.

Positions (QW-405)

Position of Groove: 1G Position of Fillets: 1F, 2F Welding Progression: Flat
Note: Without CVN-Position of Groove Any for FCAW, Welding progression Flat or Up.

Postweld Heat Treatment (QW-407)

Temperature Range: As Welded °F Time Range: -
Note: -

Preheat (QW-406)

Preheat Temp Min.: <1" 100°F / ≥ 1.0" 200°F
Interpass Temp. Max.: 600 °F
Preheat Maintenance: None

Gas (QW-408)

Process FCAW Shielding Gas Argon/CO_2 Mixture 75%/25% Flow Rate 35-50 CFH
Process - Shielding Gas - Mixture - Flow Rate -
Backing/Trailing Req.: None

Electrical Characteristics (QW-409)

Tungsten Electrode Type and Size: NA Mode of Metal Transfer for GMAW/FCAW: FCAW-Globular Pulse Current: None Wire Feed Speed (IPM): NA

Weld Layer	Process	Class	Dia.	Current	Amps.	Volts.	T/Speed	Max. Heat Input
All or	FCAW	E71T-12MJ	0.045"	DCEP	200-275	26.0-32.0	7.0-14.0	51.6 kj/in See note 3
All or	FCAW	E71T-12MJ	0.062"	DCEP	265-350	28.0-34.0	10.0-16.0	51.6 kj/in See note 3
All or	SAW	F7A6EH11K	0.125"	DCEP	450-550	29.0-34.0	16.0-16.0	61.3 kj/in
All or	SAW	F7A6EH11K	0.156"	DCEP	480-575	29.0-34.0	17.0-19.0	61.3 kj/in

Technique (QW-410)

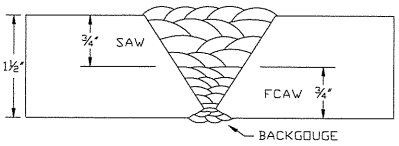
Bead Type: ☒ Sting ☐ Weave • CTWD: See note 2 below • Orifice Cup Size:5/8" • Oscillation: N/A • Multiple or Single Electrodes: Single
Multiple or Single Pass: Multiple • Peening: Not Allowed • Method of Back Gouging: Carbon Air Arc and grind to clean metal.
Use of Thermal Processes ☐ Yes ☒ No • Initial and Interpass Cleaning: Grind/brush 1/2" on each side of bevel and bevel areas to remove scale, rust, paint, oil, grease or other deleterious materials. Interpass cleaning to include grinding, brushing or chipping to remove slag and prepare area for additional weld layers.

Notes: 1. Minimum preheat must be maintained during all tacking operations.
2. CTWD - FCAW-5/8" - 1.0", SAW-1.0" - 1.50".
3. FCAW maximum bead width for wire diameters, .045" = 5/8", .062" = 7/8".
4. The use of recrushed slag is not allowed.

THE SPITZER COMPANIES

Welding Code: ASME Sect. IX • Procedure Qualification Record No.: AS-P1-F-A-26-1 Date: 11-7-11
Welding Process(es): FCAW / SAW Process Type: Manual ☐ Semi-Auto ☒ Automatic ☐ Machine ☒

Joints (QW-402)
Joint Design: Single V
Actual: Groove Angle: 60° Root Spacing .187" Root Face .000"
Backing: Yes ☒ Weld metal backgouge No ☐ _____
Material Type: ☒ Metal ☐Nonmetallic ☐Nonfusing ☐ Other
Retainers ☐ Yes ☒ No,



Base Metals (QW-403)
P No.: 1 Group No.: 1 to P No.: 1 Group No.: 2
Specification Type/Grade/UNS No.: SA-516-65 to Specification Type/Grade/UNS No.: SA516-70
Thickness of Test Coupon: 1.50" Diameter of Test Coupon: Plate Maximum Pass Thickness: ≤ 1/2"

Filler Metals (QW-404)

Variables/Process(es)	FCAW	SAW
SFA Classification	5.20	5.17
AWS Classification	E71T-12MJ	EH11K (L-56)
Filler Metal F No.	6	6
Weld Metal Analysis A No.	1	1
Filler Metal Product Form	Flux Cored	Bare Wire
Supplemental Filler Metal	N/A	None Used
Electrode-Flux Classification	N/A	F7A6-EH11K
Filler Manf./Trade Name	Lincoln/UltraCore 712A80	Lincoln / L-56
Flux Type	N/A	Neutral
Flux Trade Name	N/A	Lincoln 880M
Weld Metal Thickness	0.750"	0.750"
Other	N/A	N/A

Positions (QW-405)
Position of Groove: 1G
Welding Progression: ☐ Up ☐ Down ☒ N/A

Preheat (QW-406)
Preheat Temp Min.: 200 °F
Interpass Temp. Max.: 565 °F

Postweld Heat Treatment (QW-407)
Temperature Range: N/A °F
Time Range: -
Note: -

Gas (QW-408)
Process FCAW Shielding Gas Argon/CO_2 Mixture 75/25% Flow Rate 50 CFH
Backing Gas N/A Shielding Gas - Mixture - Flow Rate -
Backing/Trailing Req.: None

Electrical Characteristics (QW-409)
Tungsten Electrode Type and Size: N/A Mode of Metal Transfer for GMAW/FCAW: FCAW-Globular

Weld Layer	Process	Class	Dia.	Current	Amps.	Volts.	T/Speed (IPM)	Heat Input
8 Layers	FCAW	E71T-12MJ	.045"	DCEP	211-237	28.8-30.2	7.5-13.2	51.6 kj/in
Balance	SAW	F7A6-EH11K	.156"	DCEP	406-520	31.4-33.7	16.0-25.5	61.3 kj/in

Electrical Characteristics stated above for Amps, Volts, Travel Speed and Heat Input are the average of each stated layer

Technique (QW-410)
Bead Type: ☒ String ☐ Weave • CTWD: FCAW - .750" / SAW - 1.250" • Oscillation: N/A • Multiple or Single Electrodes: Single
Multiple or Single Pass: Multiple Use of Thermal Processes ☐ Yes ☒ No Type: _____
Notes:
1. No recrushed slag used.
–
–

THE SPITZER COMPANIES

Welding Code: ASME Sect. IX • Procedure Qualification Record No.: AS-P1-F-A-26-1 Date: 11-7-11

Tensile Test (QW-150)

Specimen No.	Size (in)	Area (in²)	0.20% YS (psi)	Ultimate Total Load (psi)	Ultimate Unit Stress (psi/MPa)	Type of Failure and Location
1	0.506	.201	54,200	15,780	78,500	Base (Ductile)
2	0.506	.201	55,400	15,631	77,700	Base (Ductile)
3	0.508	.203	55,300	15,810	78,000	Base (Ductile)
4	0.508	.203	52,700	15,765	77,800	Base (Ductile)

Guided-Bend Tests (QW-160)

Type and Figure No.	Result
Four (4) Side Bends	Acceptable

Toughness Test (QW-170)

Specimen No.	Notch Location	Specimen Size (mm)	Test Temp. (°F)	Impact Values			
				Energy Absorbed (ft-lb)	Avg. (ft-lb)	% Shear	Mils Lat. Exp.
1	Weld Metal (SAW)	V-10 x 10	-50.0	118-100-115	111.0	60-55-60	91-82-87
2	Weld Metal (FCAW)	V-10 x 10	-50.0	21-57-77	51.6	30-55-65	21-48-53
3	HAZ (SAW)	V-10 x 10	-50.0	98-92-108	99.3	50-50-60	73-70-81
4	HAZ (FCAW)	V-10 x 10	-50.0	109-103-25	79.0	60-65-15	77-73-21

Notes:

Fillet-Weld Test (QW-180)

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

Macro – Results: Acceptable

Other Tests

Type of Test: Hardness Survey. See attached Report No. 529822.00

Deposit Analysis: N/A

Other: Visual Examination - Accepted

Welder's Name: Arnoldo Ramirez Clock No.: _____ Stamp: T

Test Conducted By: AccuTest Laboratory Test No.: 529822.00

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 Boiler and Pressure Vessel Code.

Manufacturer or Contractor : The Spitzer Companies

Date: 11-7-11

Certified By: _____

Accu Test Labs L.L.P P.O. Box 802404 ◆ Houston, TX 77280-2404 ◆ Telephone (713) 460-3655 ◆ FAX (713) 460-3695

Report Date: 11/07/11
Report No: **529822.00**
Rev.: A
Cust Acct: SPI041

To: Spitzer Industries, Inc. (Industrial Rd)
Attn: Loretta Falcon
P.O. Box 96097
Houston, TX 77213

Ordered By: Richard Rocha PO#: J-1952-009
Material: SA516-60/70 1-1/2"THK Weld Coupon
ID/Heat: WPS:AS-P1-F-A-26-1 FCAW/SAW
Job Info: ASME IX; ASME VIII UG-84, Spitzer requirements

Tensile Test Results

No./Location	Size (in.)	Area (in^2)	Ult. Load (lbs.)	Yield (psi)	Tensile (psi)	Elong. (%)	R. of A. (%)	Hardness
1/Cap SAW	.506	.201	15,780	54,200	78,500	30.2	70.9	
2/Cap SAW	.506	.201	15,631	55,400	77,700	29.4	71.1	
3/Root FCAW	.508	.203	15,810	55,300	78,000	29.3	70.7	
4/Root FCAW	.508	.203	15,765	52,700	77,800	30.2	71.3	

Unless otherwise stated, yield stress is 0.2% offset, gage length is 2 in. for 1/2 in. bars or 1 in. for 1/4 in. bars.

Notes:
Fracture #1 - #4: Base

Charpy Test Results

No.	Temp	Location	Foot-Pounds	% Shear	Mils Lat Exp
1	-50℉	Weld Metal Cap SAW	118-100-115	60-55-60	91-82-87
2	-50℉	Weld Metal Root FCAW	21-57-77	30-55-65	21-48-53
3	-50℉	HAZ Cap SAW	98-92-108	50-50-60	73-70-81
4	-50℉	HAZ Root FCAW	109-103-25	65-60-15	77-73-21

Unless otherwise stated, Charpy Impact specimens are V-notch 10 x 10 mm.

Notes:
Location: 1/16" from respective surfaces.

Bend Test Results

No.	Type of Test	Results
1	Four Side Bends	Satisfactory

Signed: Chris Briggs

Our reports are for the exclusive use of our customer and our name may be used only with prior written approval. Our reports apply only to the sample tested or inspected and do not necessarily represent the quality of other apparently similar or identical materials. All test specimens and testing conforms to ASTM A-370 requirements unless otherwise stated. This test report shall not be reproduced, except in full, without the written approval of Accu-Test Labs LLP.

Accu Test Labs L.L.P P.O. Box 802404 ◆ Houston, TX 77280-2404 ◆ Telephone (713) 460-3655 ◆ FAX (713) 460-3695

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P.O. Box 96097
Houston, TX 77213

Ordered By: Richard Rocha PO#: J-1952-009
Material: SA516-60/70 1-1/2"THK Weld Coupon
ID/Heat: WPS:AS-P1-F-A-26-1 FCAW/SAW
Job Info.: ASME IX; ASME VIII UG-84, Spitzer requirements

Macro Evaluation

The weld was sectioned transversely to the direction of welding to expose a full cross section of the weld metal, HAZ's and base metal on either side of the weld metal. The section was ground smooth and etched with a solution of nitric acid and ethanol to reveal the macrostructure. The full cross section was examined at 1X to 5X magnifications. We did not observe any cracks. We did not observe any lack of fusion or penetration between the weld metal and the base metal, nor between the weld metal passes.

Signed: Chris Briggs

Chris Briggs

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Accu Test Labs L.L.P
P.O. Box 802404 ◆ Houston, TX 77280-2404 ◆ Telephone (713) 460-3655 ◆ FAX (713) 460-3695

Report Date: 11/07/11
Report No: **529822.00**
Rev.: A
Cust Acct: SPI041

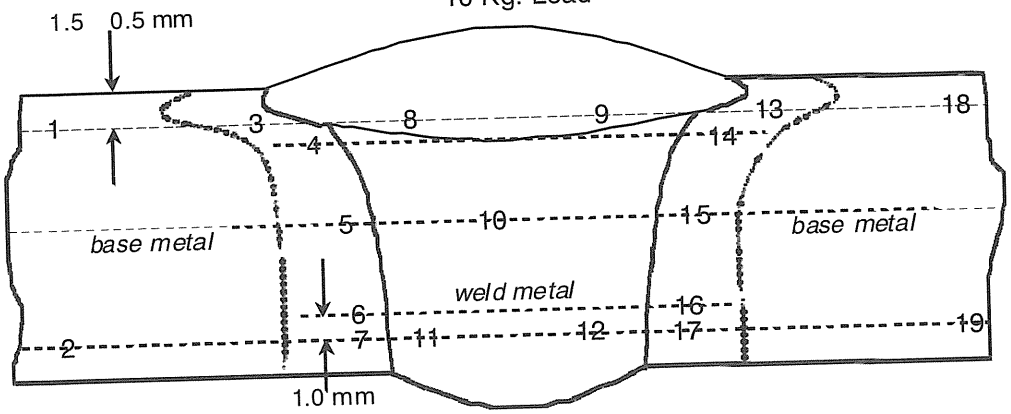
To: Spitzer Industries, Inc. (Industrial Rd)
Attn: Loretta Falcon
P.O. Box 96097
Houston, TX 77213

PO#: J-1952-009

Ordered By: Richard Rocha
Material: SA516-60/70 1-1/2"THK Weld Coupon
ID/Heat: WPS:AS-P1-F-A-26-1 FCAW/SAW
Job Info: ASME IX; ASME VIII UG-84, Spitzer requirements

NACE MR0175/ISO Vickers Hardness Survey

V-Groove
10 Kg. Load



1.	154	3.	212	8.	208	13.	213	18.	153
2.	154	4.	220	9.	193	14.	209	19.	152
		5.	220	10.	210	15.	182		
		6.	225	11.	213	16.	219		
		7.	240	12.	208	17.	235		

Readings 3-7 and 13-17 are entirely within the HAZ and located as close to the fusion line as possible. Re adings on the top line are positioned so that readings 3 and 13 coincide with the HAZ of the final run or change of profile of the fusion line associated with the final run.

Signed: Chris Briggs

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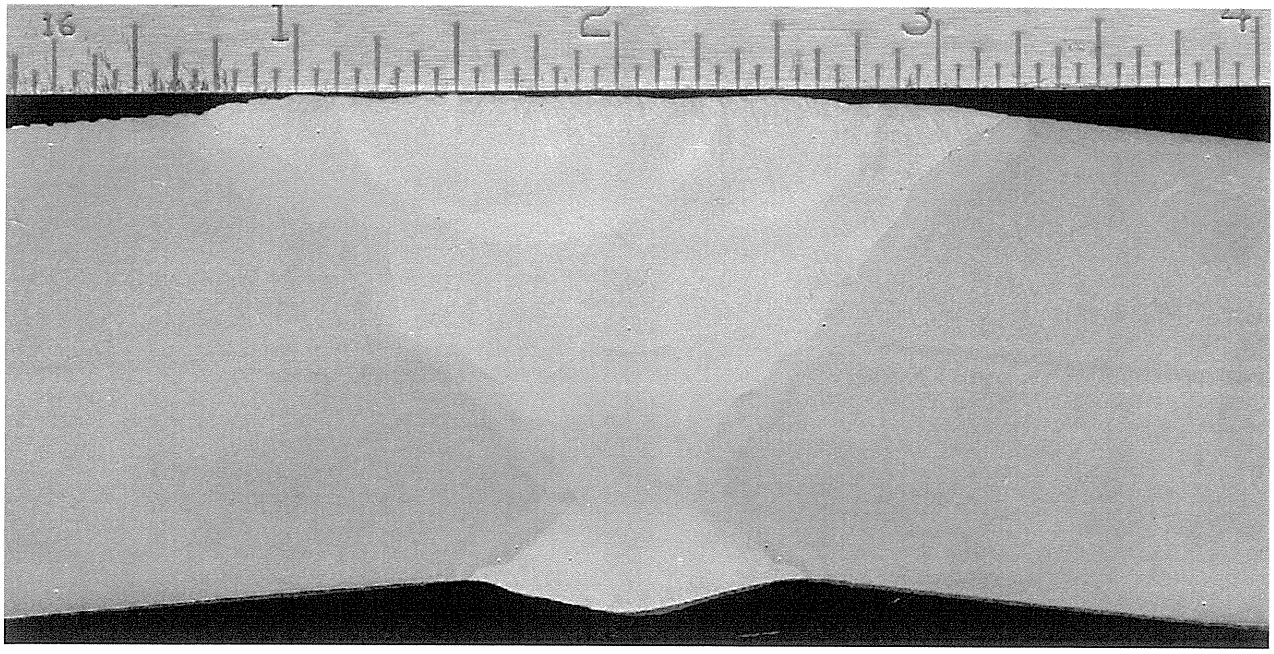
Accu Test Labs L.L.P P.O. Box 802404 ◆ Houston, TX 77280-2404 ◆ Telephone (713) 460-3655 ◆ FAX (713) 460-3695

Report Date: 11/07/11
Report No: **529822.00**
Rev.: A
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To: Spitzer Industries, Inc. (Industrial Rd)
Attn: Loretta Falcon
P.O. Box 96097
Houston, TX 77213

Ordered By: Richard Rocha PO#: J-1952-009
Material: SA516-60/70 1-1/2"THK Weld Coupon
ID/Heat: WPS:AS-P1-F-A-26-1 FCAW/SAW
Job Info: ASME IX; ASME VIII UG-84, Spitzer requirements

Photomacrograph of Weld Cross Section with Vickers Hardness Survey



Signed: Chris Briggs

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A and M Technical Services Inc.

4102 Lauder Road, Houston, Texas 77039
P.O. Box 690347, Houston, Texas 77269
Phone (281) 227-0588, Fax (281) 227-0590

Spitzer HFD/Curtis Kelly

13863 Industrial Rd.
Houston, Texas 77015
Attn.: Richard V. Rocha Sr.
Cell: (281) 733-5459

Report No 15-4193-1

Date: November 13, 2015
P.O. No.: J-2110
Phone: (713) 230-4239
Fax: (713) 230-4250

Sample: As-P1-P1-F-A-26 Rev. 2, Pipe OD, Plate 1.5", material-SA-516-70, Test Matrix#1 Rev. 0.

Charpy impact test:

Tested per ASTM A370, E23

Weld 1/16" from Face	Specimen 1	Specimen 2	Specimen 3	Average	size 10 x 10 mm
Ft*lbs	72	64	52	62.6	
Mils	51	46	38		Temperature -20°F
% shear	80	80	80		

Weld Metal (Mid T)	Specimen 1	Specimen 2	Specimen 3	Average	size 10 x 10 mm
Ft*lbs	70	102	90	87.3	
Mils	54	75	69		Temperature -20°F
% shear	100	100	100		

HAZ (1/4T) Face	Specimen 1	Specimen 2	Specimen 3	Average	size 10 x 10 mm
Ft*lbs	58	46	92	65.3	
mils	40	32	60		Temperature -20°F
% shear	60	80	100		

HAZ (1/4T) Root	Specimen 1	Specimen 2	Specimen 3	Average	size 10 x 10 mm
Ft*lbs	66	52	78	65.3	
Mils	49	40	55		Temperature -20°F
% shear	100	100	100		

Anthony Rudnicki MS
Chief Metallurgist

ISO 9001:2008 Certificate File Number 802083

All test specimens will be discarded after 30 days.

Thank You for Your Business

A and M Technical Services Inc.

4102 Lauder Road, Houston, Texas 77039
P.O. Box 690347, Houston, Texas 77269
Phone (281) 227-0588, Fax (281) 227-0590

Spitzer HFD/Curtis Kelly

13863 Industrial Rd.
Houston, Texas 77015
Attn.: Richard V. Rocha Sr.
Cell: (281) 733-5459

Report No 15-4193-2

Date: November 13, 2015
P.O. No.: J-2110
Phone: (713) 230-4239
Fax: (713) 230-4250

Sample: As-P1-P1-F-A-26 Rev. 2, Pipe OD, Plate 1.5", material-SA-516-70, Test Matrix#2 Rev. 0.

Charpy impact test:

Tested per ASTM A370, E23

Weld 1/16" from Face	Specimen 1	Specimen 2	Specimen 3	Average	size 10 x 10 mm
Ft*lbs	21	42	52	38.3	
Mils	14	25	37		Temperature -20°F
% shear	60	60	60		

Weld Metal (Mid T)	Specimen 1	Specimen 2	Specimen 3	Average	size 10 x 10 mm
Ft*lbs	102	30	64	65.3	
Mils	73	22	44		Temperature -20°F
% shear	100	60	80		

HAZ (1/4T) Face	Specimen 1	Specimen 2	Specimen 3	Average	size 10 x 10 mm
Ft*lbs	24	22	26	24.0	
mils	18	16	20		Temperature -20°F
% shear	60	60	60		

HAZ (1/4T) Root	Specimen 1	Specimen 2	Specimen 3	Average	size 10 x 10 mm
Ft*lbs	112	54	134	100.0	
Mils	74	31	79		Temperature -20°F
% shear	100	80	100		

Anthony Rudnicki MS
Chief Metallurgist

ISO 9001:2008 Certificate File Number 802083

All test specimens will be discarded after 30 days.

Thank You for Your Business

A and M Technical Services Inc.

4102 Lauder Road, Houston, Texas 77039
P.O. Box 690347, Houston, Texas 77269
Phone (281) 227-0588, Fax (281) 227-0590

Spitzer HFD/Curtis Kelly

13863 Industrial Rd.
Houston, Texas 77015
Attn.: Richard V. Rocha Sr.
Cell: (281) 733-5459

Report No 15-4193-3

Date: November 13, 2015
P.O. No.: J-2110
Phone: (713) 230-4239
Fax: (713) 230-4250

Sample: As-P1-P1-F-A-26 Rev. 2, Pipe OD, Plate 1.5", material-SA-516-70, Test Matrix#3 Rev. 0.

Charpy impact test:

Tested per ASTM A370, E23

Weld 1/16" from Face	Specimen 1	Specimen 2	Specimen 3	Average	size 10 x 10 mm
Ft*lbs	28	44	38	36.6	
Mils	24	36	33		Temperature -20°F
% shear	60	60	60		

Weld Metal (Mid T)	Specimen 1	Specimen 2	Specimen 3	Average	size 10 x 10 mm
Ft*lbs	20	92	82	64.6	
Mils	15	66	61		Temperature -20°F
% shear	80	100	100		

HAZ (1/4T) Face	Specimen 1	Specimen 2	Specimen 3	Average	size 10 x 10 mm
Ft*lbs	118	100	132	116.6	
mils	82	76	85		Temperature -20°F
% shear	100	100	100		

HAZ (1/4T) Root	Specimen 1	Specimen 2	Specimen 3	Average	size 10 x 10 mm
Ft*lbs	60	42	66	56.0	
Mils	43	31	48		Temperature -20°F
% shear	60	60	60		

Anthony Rudnicki MS
Chief Metallurgist

ISO 9001:2008 Certificate File Number 802083

All test specimens will be discarded after 30 days.

Thank You for Your Business

SPITZER INDUSTRIES, INC.
HEAVY FABRICATION DIVISION

INSPECTION REPORT

NAME OF CUSTOMER: SII

INSPECTION REPORT NO.: 2571

PROJECT DESCRIPTION: Procedure Qualification

DATE OF TEST/EVALUATION: 10/10/2011

CUSTOMER P.O. NO.: 1952

SII JOB NUMBER: J-1952

DRAWING NUMBER: N/A

PART NUMBER: N/A

TYPE OF TEST:

- [ ] DOC. REVIEW
- [X] V.T. (accepted)
- [ ] M.T.
- [ ] U.T.
- [ ] ATTACHMENT
- [ ] R.T.
- [ ] A.V.
- [ ] DIMENSION
- [ ] OTHER

W/S – B | Arnoldo Ramirez | WPS: AS-P1-F-A-26-1

Undercut – No visible signs of undercut

Overall visual appearance – Acceptable.

EVALUATION PERFORMED BY: *Billy Free*

Billy Free CWI# 94060281

DATE: *10/11/2011*

RADIOGRAPHIC TEST REPORT

Fugro Consultants, Inc.
2410 East Pasadena Freeway
Pasadena, TX 77506
Ph: 713-475-0100 Fax 713-475-0107

ISO 9001:2008 Registered

REPORT#: 1407 RT1

Page 1 of 1

Client: SPITZER INDUSTRIES INC Project #: 04-1711-1217 Date: 10-10-2011
Address/Location: INDUSTRIAL ROAD W.O. #: 1952 P.O. #:
Project: Technique # Remarks:

Terms & Abbreviations

BT...Burn Through TG...Tungsten CR...Crack EU...External Undercut SL...Slag Line SI...Slag Inclusion LP...Lack of Penetration LC...Low Crown SM...Surface Marks
LF...Lack of Fusion AR...Artifact PO...Porosity IU...Internal Undercut GL...Ground Low HB...Hollow Bead IC...Internal Concavity NC...No Comment WC...Within Code

Weld or Part #:	Pipe Dia.	Thickness	Film View	Accept	Reject	Line #	Welder ID	S.F.D.	Types of Defects/Comments
W-1	PLATE	1.5"	1-2	✓		WPS# AS-D1-F-A-26-1	"R"	30"	
						FCAW-SAW			
						END OF REPORT			

Note: Results relate only to items tested above.

Gamma Source: Ir192	X-Ray KV:	Film Type: (AGFA)	# of Film:	IQI:	IQI Placement:
Size: 124	MA:	☐ D7 ☐ D5 ☑ D4 ☐ D3	X 10"	Penetrameter/Wire	☑ Source Side
Curies: 49	Focal Size:	☐ Other:	4.5 X 17" 1	Size(s): B C	☐ Film Side
Radiographer: MATT HO - [illegible]		Level: II	Assistants: R MUDGEN		
Total Hours: 12	Total Welds: 1	Mileage:	Exposure Technique(s):	DW SWE1SWV	
Procedure #: MPI 3.5	Rev #: 3	Acceptance Code:	ASME SECTION IX		
Level III Signature:		Client Signature: Billy Grell	Date: 10/11/11		

Note: By signing this report the client representative is certifying the HOURS and MILES to be approved for payment by client.

SIZE

THE LINCOLN ELECTRIC COMPANY
22801 St. Clair Avenue
Cleveland, Ohio 44117-1199

CERTIFIED MATERIAL TEST REPORT

4639396 ES-ZAXX .045" ULTRACORE 712A80 (33# SPOOL VFB) 14,751 Lbs.

Supplied To: SPITZER INDUSTRIES
13863 INDUSTRIAL ROAD
HOUSTON, TX 77015

Customer PO: BLANKET PO
Q3 Lot®: 987L

This is to certify that the material listed above was manufactured under Lot Control Number AWS A5.01-2008. This material meets the requirements of AWS A5.20-2005 for type E71T-1MJ, E71T-9MJ, E71T-12MJ, E71T-1MJH8, E71T-9MJH8 and E71T-12MJH8.

The product stated herein was manufactured and supplied in accordance with the Quality System Program of The Lincoln Electric Co., Cleveland, Ohio, U.S.A. as outlined in our Quality Assurance Manual. The Quality System Program of The Lincoln Electric Co. has been accepted by ASME and approved by VdTUV, and is certified to ISO 9001.

Test Conditions

Electrode Size (Inches)	.045
Electrode Polarity	DC+
CTWD (Inches)	7/8
Amperage(Amps)	205
Arc Voltage (Volts)	25
Preheat/Interpass Temp (°F)	70 / 325
Gas Type	75% Ar 25% CO_2
Plate ID	25576

Mechanical Properties	Plate 25576	AWS A5.20-2005
Yield Strength, .2% offset method (ksi)	81	58 ksi min.
Tensile Strength (ksi)	87	70 - 90 ksi min.
% Elongation	27	22% min.
Heat Input (avg) kJ/in	36	25 – 55 avg.

Impact Properties	Plate 25576	
Joules @ -40°C (Ft.-lbs @ -40°F)	**137, 142, 134 = 138 avg.** (101, 105, 99 = 102 avg.)	**27 Joules avg.** (20 Ft.-lbs avg.)

Radiographic Requirements

Plate 25576	PASSED

Chemical & Physical Tests
Reviewed and Accepted
By _____ Date 2/18/11

9/B275-11
1/2

SII

Q3 LOT® 987L

Deposit Chemistry	Plate 25576	AWS A5.20-2005
% Carbon	0.04	0.12 max
% Manganese	1.52	1.60 max
% Silicon	0.35	0.90 max
% Sulfur	0.01	0.03 max
% Phosphorus	0.01	0.03 max
% Chromium	0.05	0.20 max
% Nickel	0.40	0.50 max
% Molybdenum	0.00*	0.30 max
% Vanadium	0.02	0.08 max
% Copper	0.04	0.35 max
% Aluminum	0.007	No Spec

Diffusible Hydrogen

Per AWS A4.3 (mL/100 grams)	3.4, 4.1, 3.9, 4.2 = 3.9 avg.	8.0 mL/100 grams max avg.

Fillet Weld Usability

SIZE	LOT NO.	POSITION	AMPS/VOLTS	SIZE FILLET	RESULT
.045	987L	3F	200 / 23	9/32	Accept
.045	987L	4F	185 / 24	15/64	Accept

* Results below the detection limits of the instrument or lower than the precision required by specification are reported as zero.

The strength and elongation properties were obtained from 12.5 mm (0.500 in), A4 tensile specimen artificially aged at 105 °C (220 °F) for 48 hours, as permitted by AWS A5.20-2005. A naturally aged tensile specimen may take months to achieve the specified properties. See AWS A5.20-2005, paragraph A8.3. The time required for the natural aging of weld deposits is dependent upon ambient conditions, weldment geometry, the metallurgical structure of the weld deposit and other factors.

This is to certify that the contents of this report are correct and accurate as contained in the records of The Lincoln Electric Company.

2/15/11
Ed Linsky Date
Manager, Quality Assurance

15 FEB 11
James T. Byall Date
Manager, Special Products

"Note: The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes including Federal Law, Title 18, Chapter 47."

Chemical & Physical Tests Reviewed and Accepted
By _____ Date 2/18/11

DW 2/14/11

2/2

THE LINCOLN ELECTRIC COMPANY
22801 St. Clair Avenue
Cleveland, Ohio 44117-1199

CERTIFICATE OF ACTUAL RESULTS

This is to certify that the following was manufactured under Lot Control per AWS A5.01, Class S4 Schedule H. The following test was run on 5/32 in. LINCOLNWELD L-56 (Q1 LOT 12226971). Procedures in accordance with AWS A5.17 and A5.23, for classification EH11K were followed. This test report is in accordance with 3.1 per EN 10204 for wire chemical composition.

The product stated herein was manufactured in the U.S.A. and supplied in accordance with the Quality System Program of the Lincoln Electric Company, Cleveland, Ohio, U.S.A., as outlined in our Quality Assurance Manual which meets the requirements of ISO 9001, NCA 3800, AWS A5.01, and other specifications, as appropriate. The Quality System Program has been approved by ASME, ABS, and VdTUV and is certified to ISO 9001.

Chemical Composition	Lot 12226971	AWS A5.17 and A5.23 for EH11K
% Carbon	0.09	0.06 - 0.15
% Manganese	1.70	1.40 - 1.85
% Silicon	0.95	0.80 - 1.15
% Phosphorus	0.004	0 - 0.030
% Copper	0.12	0 - 0.35
% Sulfur	0.007	0 - 0.030

This is to certify that the contents of this report are correct and accurate as contained in the records of The Lincoln Electric Company

Ed Linsky — Quality Assurance

6/9/2010 — Date

"Note: The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal statues including federal Law, Title 18, Chapter 47."

THE LINCOLN ELECTRIC COMPANY
22801 St. Clair Avenue
Cleveland, Ohio 44117-1199

CERTIFICATE OF ACTUAL RESULTS
(INSPECTION CERTIFICATE 3.1)

This is to certify that the following was manufactured under Lot Control per AWS A5.01, Class F2 Schedule K. The following tests were run on 880M FLUX (Q1 LOT 12539375). The test report is in accordance with 3.1 per EN 10204.

The product stated herein was manufactured in the U.S.A. and supplied in accordance with the Quality System Program of the Lincoln Electric Company, Cleveland, Ohio, U.S.A., as outlined in our Quality Assurance Manual which meets the requirements of ISO 9001, NCA 3800, AWS A5.01, and other specifications, as appropriate. The Quality System Program has been approved by ASME, ABS, and VdTUV and is certified to ISO 9001.

Chemical Composition:

	Weight %*
SiO2	15
MgO	27
CaF2	27
Al2O3	18
CaO	7
Na2O	2
MnO	1
K2O	1

*Determined from elemental analysis by X-Ray Fluorescence and conversion to oxides or fluorides.

Moisture Content:
% at 1800°F (982°C): 0.03%

Flux Sizing Distribution:

	Weight %
+20 MESH	30
-20 / +60 MESH	69
-60 MESH	1

This is to certify that the contents of this report are correct and accurate as contained in the records of The Lincoln Electric Company.

Ed Linsky — 5/26/2011
Quality Assurance — Date

"Note: The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal statues including federal Law, Title 18, Chapter 47."

07/05/2011 From: AMERICAN ALLOY STEEL To: SPITZER INDUSTRIES
P.O.# :16150 S.O.# :395356 AA PL#:5107805
Item :1 (1 PC) 1-1/2" X 6" X 24" (MARK DOR) P-25778

ArcelorMittal Burns Harbor Plate

QUALITY ASSURANCE
REPORT OF TEST AND ANALYSES

SHIPMENT NO.	DATE SHIPPED	CAR OR VEHICLE NO.		
802-30579	04-29-11	CN-WCHGO-UP	ICG 978976	PAGE 3

SOLD TO:
AMERICAN ALLOY STEEL INC
PO BOX 40469
HOUSTON TX 77040-0469

SHIP TO:
AMERICAN ALLOY STEEL INC
BNSF TR# 7226 MILE 66.4 LN SEG 492
6230 N HOUSTON ROSSLYN RD
HOUSTON TX

NOTES	SERIAL NUMBER	PAT NO	HEAT NUMBER	NO PCS	SIZE AND QUANTITY: THICKNESS	WIDTH OR DIA	LENGTH	WEIGHT	YIELD POINT	TENSILE STRENGTH	ELONG	RED
					INCHES	INCHES	INCHES	POUNDS	PSI	PSI	IN	% %

QUALITY STEEL ~~MELTED & MANUFACTURED~~ IN THE U. S. A.
PLATES - ASME SA516 GR 70 PVQ 2010 EDITION,
ASME SA516 GR 65 PVQ 2007 EDITION
2008 ADD, ASME SA516 GR 60 PVQ 2007
EDITION 2008 ADD, CE-V SA20S5 PLT L
15/12 FTLBS AT -40F --- PLT NORM &
COOL IN STILL AIR --- TEST CERTS
ARE PREPARED IN ACCORD WITH
PROCEDURES OUTLINED IN EN
10204:2004 TYPE 3.1
NO WELD REPAIR WAS PERFORMED ON BELOW PLATE(S)
CO# 84555 GH 361-7872AE
PLATES HEAT TREATED - TEST SPECIMENS ATTACHED & YIELD STRENGTH @ .5% EUL

J001650

J930950	823S72480	1	1.5	120	360	18377	49600	79300	2	33	
			N 1650 DEG F - 72 MIN								
J930951	823S72480	1	1.5	120	360	18377	49900	78500	2	33	
			N 1650 DEG F - 72 MIN								
J930952	823S72480	1	1.5	120	360	18377	49900	78500	2	36	
			N 1650 DEG F - 72 MIN								

Q-QUENCH TEMPERATURE T-TEMPER TEMPERATURE N-NORMALIZE TEMPERATURE

Chemical & Physical Tests
Reviewed and Accepted
By _____ Date JUL 12 2011

SERIAL NUMBER	PAT NO	HEAT NUMBER	HARD BHN	BEND	THICKNESS INCHES	TYPE	SIZE	DR	TEST TEMP F	CHARPY IMPACT ENERGY FT LBS 1	2	3	SHEAR(%) 1	2	3	LAT. EXP MILS 1	2	3
J930950		823S72480			1.500	V	FULL	L	-40	91	113	127						
J930951		823S72480			1.500	V	FULL	L	-40	121	114	103						
J930952		823S72480			1.500	V	FULL	L	-40	94	97	147						

Certified a true copy of the original, retained in our file.
AMERICAN ALLOY STEEL
Revi...
D05bie/11

HEAT NUMBER	CHEMICAL ANALYSIS C	Mn	P	S	Si	Cu	Ni	Cr	Mo	V	Ti	Al	B	Cb	N	Sn	MOLD GRAIN SIZE
823S72480	.18	1.17	.016	.006	.37	8.023	.02	.12	.085	.002	.002	.038	.0002	.002	.006	.007	

AMERICAN ALLOY
PLATE 5107805

I certify that the above results are a true and correct copy of actual results contained in records maintained by ArcelorMittal Burns Harbor and are in full compliance with the requirements of the specification cited above. This test report cannot be altered and must be transmitted intact with any subsequent third party test reports, if required.

D. W. ELWOOD PER WMK

BHPLTRPT.TP SUPV. QUALITY ASSURANCE

SECTION 11
INSPECTION AND TEST PLAN

Curtis Kelly A SPITZER COMPANY	**INSPECTION AND TEST PLAN (ITP) for PRESSURE VESSELS AND COLUMNS**	**Job No.: 2132** **Item No.: T-501** **ITP Revision No.: 0**

CURTIS KELLY, INC.
13863 INDUSTRIAL ROAD
HOUSTON, TEXAS 77015
(713) 230-4200

CLIENT: THOMAS RUSSELL CO.
CONTACT: XXXXXXXX (XXX) XXX-XXXX
EQUIPMENT: DEMETHANIZER TOWER
P.O.# 4500739178 / J-447XX

APPROVED FOR CONSTRUCTION
WJ 2132 10/31/16
Curtis Kelly, Inc.

Activity No.	Activity Description	Control Procedure/ Specification	Acceptance Criteria	Objective Evidence	Participants					
					CKI		UOP			
1	**Pre-Inspection Meeting** (PIM) 1. Review Purchase Order 2. Review Specifications	Purchase Order Code requirements	Purchase Order Code requirements	Before Fabrication	H		H			
2	**Issue AFC Vessel Drawings**	Customer Approved Construction Drawings 2132		Project Drawing Register	R					
3	**Material Inspection and Traceability** 1. Verify size, grade, quantity, specification, flange finish & rating, thk / schedule & check against purchase order 2. Verify proper documentation & identification (MTRs, chemical analysis, impacts & heat treatment as applicable) 3. Verify material origin & heat numbers 4. Check all sealing surfaces for damage	Purchase Order SII OP 8.0 SII OP 9.0 SII OP 10.0 ASME/ASTM Customer AFC Drawings	SII ITP MTR Maps Code requirements Traceability Records	Pressure Vessel Shop Traveler	H	DR 3/28/17	R			
4	**Base Template verification** Verify bolt hole diameter, size, lay-out.	Drawings 2132	Approved drawing	Before fabrication	H	DR 2/13/17	R			
5	**Lay-out Inspection** Verify all cut lengths & plate dimension prior to cutting. Verify All Nozzles orientation and elevation prior to cutting holes in shell. Verify All Clips & Internals are correct. Check all dimension, material & location prior to Welding.	ASME Drawings 2132	Code Requirements	Pressure Vessel Shop Traveler	H	DR 6/20/17	M			
6	**Fit-up Inspection** Check alignment, bevel, landing, root gap, bolt hole alignment & dimensional requirements prior to any welding. **Note: First operation witness by customer representative**	UG-80 UW-33	Drawings 2080	Pressure Vessel Shop Traveler	W	DR 6/8/17	M			
7	**Weld Procedures & Welder Qualification** Verify all WPS & PQR are correct for each application, Verify the welder utilized is qualified for each application	WPS 62D, 64, 69, 114IT & AS-P8-P8-A-36	ASME Sect IX	Before Fabrication	W	DR	R			
8	**NDE Procedure Review** Radiographic Testing Liquid Penetrant Testing Ultrasonic Testing Magnetic Particle Testing	RT-3 Rev 6 PT 03.01 Rev 1 with Addendum PT 03.02 Rev 0 ASME UT 05.01 Rev 0 UT-4 Rev 2 MT 02.1 Rev 4 with Addendum MT 02.02 Rev 0 ASME	Code Requirements	Before NDE work	H	DR	R			
9	**Welding**	WPS 62D, 64, 69, 114IT & AS-P8-P8-A-36	Code Requirements	Pressure Vessel Shop Traveler Weld Map	M	DR	M			

Curtis Kelly A SPITZER COMPANY	**INSPECTION AND TEST PLAN (ITP) for PRESSURE VESSELS AND COLUMNS**	**Job No.: 2132** **Item No.: T-501** **ITP Revision No.: 0**

CURTIS KELLY, INC.
13863 INDUSTRIAL ROAD
HOUSTON, TEXAS 77015
(713) 230-4200

CLIENT: THOMAS RUSSELL CO.
CONTACT: XXXXXXXX (XXX) XXX-XXXX
EQUIPMENT: DEMETHANIZER TOWER
P.O.# 4500739178 / J-447XX

Activity No.	Activity Description	Control Procedure/ Specification	Acceptance Criteria	Objective Evidence	Participants					
					CKI		UOP			
10	**Weld Inspection** Verify final welds are free from burrs, spatter, excessive reinforcement & are proper size	UW-35	Code requirements	Pressure Vessel Shop Traveler Weld Matrix	W	DR 8/4/17	W			
11	**Radiographic Examination** Review all Radiographs and reader sheets Confirm all radiography is complete & acceptable as required by this P.O & ASME code. **Kodak AA or equivalent film to be used.**	RT-3 Rev 6 UW-51 & 52	Code requirements	RT Reader Sheets & Film	H	DR 6/15/17	H/R			
12	**Nozzle Reinforcement Pad Test** Pneumatically test all nozzle reinforcement pads in accordance with Pneumatic Leak Test Procedure. Confirm all Nozzle Reinforcement Pads were tested @ 15 psi. This examination shall be performed with approved procedure for this P.O.	SII LWI 043 PNEUMATIC LEAK TEST PROCEDURE	Code requirements	Pneumatic Test Report	W	DR 6/26/17	R			
13	**Penetrant Testing Examination** Penetrant Testing Examination shall be in accordance with the approved procedure Shall be performed as required by the ASME Code and P.O Verify all required inspections are performed and all personnel are qualified as per procedure.	PT 03.01 Rev 1 with Addendum PT 03.02 Rev 0 Per Code requirements	Code requirements	PT Reports	W	DR 6/25/17	R			
14	**Ultrasonic Testing Examination** Ultrasonic Testing Examination shall be in accordance with the approved procedure Shall be performed as required by the ASME Code and P.O Verify all required inspections are performed and all personnel are qualified as per procedure.	UT 05.01 Rev 0 UT-4 Rev 2 Per Code requirements	Code requirements	UT Reports	W	DR 3/2/17	R			
15	**Magnetic Particle Testing Examination** Magnetic Particle Testing Examination shall be in accordance with the approved procedure Shall be performed as required by the ASME Code and P.O Verify all required inspections are performed and all personnel are qualified as per procedure.	MT 02.01 Rev 4 with Addendum MT 02.02 Rev 0 Per Code requirements	Code requirements	MT Reports	W	DR 3/20/17	R			
16	**Tray Installation** Trial fit trays as applicable and mark per the P.O. requirements.	Drawings 2132	Drawings 2132		W	DR 7/31/17	H			
16a	**Ladder/Platform installation**	Drawings 2132	Drawings 2132		W	~~DR~~ N/A	H			
17	**Internal Inspection** Verify all Inlet Baffles, Vortex Breakers, Dip Pipes, Mesh Pad are installed correctly if reqd Confirm installation is correct (orientation and elevation) Confirm correct grade & specification of materials is used	Drawings 2132	Drawings 2132	Pressure Vessel Shop Traveler	H	DR 8/4/17	H			
18	**Final Dimensional Inspection** Verify that all "As-Built" dimensions are in compliance with the tolerances indicated on the approved drawing. **Note: Chamfer or radius on all internal connections.**	Drawings 2132	Drawings 2132	Pressure Vessel Shop Traveler	H	DR 8/4/17	W/H			

Curtis Kelly A SPITZER COMPANY	**INSPECTION AND TEST PLAN (ITP) for PRESSURE VESSELS AND COLUMNS**	**Job No.: 2132** **Item No.: T-501** **ITP Revision No.: 0**

CURTIS KELLY, INC.
13863 INDUSTRIAL ROAD
HOUSTON, TEXAS 77015
(713) 230-4200

CLIENT: THOMAS RUSSELL CO.
CONTACT: XXXXXXXX (XXX) XXX-XXXX
EQUIPMENT: DEMETHANIZER TOWER
P.O.# 4500739178 / J-447XX

Activity No.	Activity Description	Control Procedure/ Specification	Acceptance Criteria	Objective Evidence	Participants					
					CKI		UOP			
19	**Post Weld Heat Treat (PWHT) Non Applicable**	-NA-	-NA-			N/A				
20	**Hydrostatic Test** Hydro test the Vessel in accordance with the UG-99 of the ASME Code Sec. VIII Div. 1, All applicable components of the vessels are to be installed for the test (I hour min. HOLD time with chart)	LWI-039 Hydro test procedure	Hydro test procedure	Hydro test Traveler	H	DR 7/8/17	H			
21	**Drainage & Drying** Completely drain the unit to dry immediately after the hydro tests			Visual inspection	W	DR 7/6/17	W			
22	**Nameplate Application** Verify the correct stamping of the nameplates Confirm they are installed correctly on the Vessel	Drawings 2132	Drawings 2132	Pressure Vessel Shop Traveler	H	DR 7-6-17	H			
23	**Sandblast / Paint** Verify correct anchor profile, paint system and lot & batch number of paint Confirm environmental conditions are suitable for application Check the DFT of each Coat and Total DFT completed paint application	AFC Drawings SSPC-SP6 ENG-36C-System #3	Painting procedure	Paint report	W	DR 8/18/17	W			
24	**Insulation** Attach insulation when applicable	By Others	Drawings 2132		M	N/A	M			
25	**Data Book** Review all completed data & verify all are complete & legible Check MTR's Radiograph reader sheets hydro tests certification Check Reinforcement Pad Test Certification Check DPT examination Certification U1A/U4, Partial Data Reports and Name Facsimile as applicable	Approved Table of Contents	Table of Contents	Signature of Approval for Data Book	H	WS	R			
26	**Preparation for Shipment** Verify all required components are installed correctly on the Vessel Verify interior of the Vessel is clean and free from dirt and debris Confirm all shipping covers are installed on the Vessel Verify Nameplates are installed and Confirm all required markings are in place.	SII OP 16.0 Drawings 2132	Drawings 2132	Before Shipment	W	DR 8/21/17	W			

Curtis Kelly A SPITZER COMPANY	INSPECTION AND TEST PLAN (ITP) for PRESSURE VESSELS AND COLUMNS	Job No.: 2132
		Item No.: T-501
		ITP Revision No.: 0

CURTIS KELLY, INC.
13863 INDUSTRIAL ROAD
HOUSTON, TEXAS 77015
(713) 230-4200

CLIENT: THOMAS RUSSELL CO.
CONTACT: XXXXXXXX (XXX) XXX-XXXX
EQUIPMENT: DEMETHANIZER TOWER
P.O.# 4500739178 / J-447XX

Activity No.	Activity Description	Control Procedure/ Specification	Acceptance Criteria	Objective Evidence	Participants		
					CKI	UOP	
	Legend: H = Hold Point, which must be witness and accepted by Contractor and Company or their Authorized Representative, Vendor or its Sub-Vendor shall not allowed to continue until Contractor official consent to proceed with further process. W =Witness Point which must be witness and accepted by Contractor and Company or their Authorized Representative. The Vendor or its Sub-Vendor may proceed with manufacturing and pass a Witness point if Contractor or Company Inspector does not attend the scheduled witness inspection. (W) = Spot Witness, means that the activity is to be randomly carried out by Contractor and based on Vendor experience and current QA/QC performance. M = Surveillance Monitoring, A process of observing manufacturing, QC and testing activities either through continuous presence or periodic visit to Vendor and its Sub-Vendor shop. R = Document Review Point, verification and endorsement by Contractor, Buyer or their Authorized Representative of the quality records pertaining to the product supplied. CK = Vendor (Curtis Kelly), TRC = Purchaser- CONTRACTOR = Buyer/COMPANY AI = Authorized Inspector						

Special Requirements:

1. CUSTOMER NOTIFICATIONS – 48 HOURS FOR WITNESS POINTS AND FOR HOLD POINTS
2. STENCIL TAG NUMBER ON TWO SIDES OF VESSEL IN 3" HIGH LETTERS

P.O. NUMBER: 4500739178
UOP Job# J-447XX

SECTION 12
COATING REPORT

COATING INDUSTRIES, INC.
6414 Thomas Road ~ Houston, TX 77041
Tel no : (713) 937-8581

DAILY INSPECTION REPORT

Job No	Customer	Description	P.O. No.	Reference Spec
17- 0369	Curtis Kelly	1 - 60" ID x 8' S/S Vessel C.S. Skirt ONLY	J2132-037	

CONDITIONS

Ambient Condition	Surface Prep.	Primer	Int. I	Int. II	Finish
Date Time	5/15/2017 8:51 AM	5/15/2017 10:42 AM	5/16/2017 11:10AM		5/17/2017 9:30 AM
Surface Temp. °F	76	92	84		82
Dry Bulb °F	79	91	85		85
Wet Bulb °F	70	77	73		76
R.H. %	64	53	57		66
Dew °F	66	72	68		73

ABRASIVE BLAST

Type & Grade of Abrasive	Starblast XL Fine
Specification Standard	SSPC-SP-6 Commercial
ASTM 4285 "Blotter Test"	Passed - Dry Air
ASTM 4417 Anchor profile	2.5 Mils
Surface Check for Cleanliness	Yes
Pressure at Nozzle	100 PSI
Comments	N/A

PAINT APPLICATION

Coat	Manufacturer	Paint Description	Color	Thinner	Location of Operation
Primer	Sherwin Williams	646	White	R7K15	@SII HFD Yard
Int I	Sherwin Williams	646	Buff	R7K15	@SII HFD Yard
Int II					
Finish	Sherwin Williams	Hi-Solids Poly - SW 4031	Structural Gray		@SII HFD Yard

Coat	Batch No "A"	Batch No "B"	Batch No "C"	Cumulative D.F.T.	Comments
Primer	XM1017MB	XM0907LZ	0681G00785	6.0	N/A
Int I	XM0207GE	XM0117LZ	0681G00785	10.6	N/A
Int II					
Finish	XM3505HG	MQ1896AY	0681G00785	14.0	N/A
Application Method	Conventional Airspray	Holiday Testing	N/A		

Testex PRESS-O-FILM™ HT X-Coarse
www.testextape.com
2.6 .
1.5 to 4.5 mil
38 to 115 µm
Made in USA

Testex PRESS-O-FILM™ HT X-Coarse
www.testextape.com
2.4 .
1.5 to 4.5 mil
38 to 115 µm
Made in USA

CERTIFIED NACE INTERNATIONAL COATING INSPECTOR
#6753
NACE
EXP: 30 NOV 2017

QC APPROVED: Ronnie Lauranoff Date: 05/24/2017

Ronnie Lauranoff

COATING INDUSTRIES, INC.
6414 Thomas Road ~ Houston, TX 77041
Tel no : (713) 937-8581

DAILY INSPECTION REPORT

Job No	Customer	Description	P.O. No.	Reference Spec.
17- 0369	Curtis Kelly	1 - 60" ID x 8' S/S Vessel C.S. Skirt ONLY	J2132-037	RE-WORK

CONDITIONS

Ambient Condition	Surface Prep.	Primer	Int. I	Int. II	Finish
Date Time	8/16/2017 2:45 PM	8/16/2017 2:45 PM	8/17/2017 10:24 AM		8/18/2017 9:52 AM
Surface Temp °F	101	101	93		87
Dry Bulb °F	100	100	95		90
Wet Bulb °F	83	83	80		81
R.H. %	49	49	52		68
Dew °F	78	78	75		78

ABRASIVE BLAST

Type & Grade of Abrasive	Starblast XL Fine
Specification Standard	SSPC-SP-6 Commercial
ASTM 4285 "Blotter Test"	Passed - Dry Air
ASTM 4417 Anchor profile	
Surface Check for Cleanliness	Yes
Pressure at Nozzle	100 PSI
Comments	N/A

PAINT APPLICATION

Coat	Manufacturer	Paint Description	Color	Thinner	Location of Operation
Primer	Sherwin Williams	646	White		@SII HFD Yard
Int I	Sherwin Williams	646	Buff		@SII HFD Yard
Int II					
Finish	Sherwin Williams	Hi-Solids Poly - SW 4031	Structural Gray		@SII HFD Yard

Coat	Batch No "A"	Batch No "B"	Batch No "C"	Cumulative D.F.T.	Comments
Primer	XM1977XA	XM1657FG		5.7	N/A
Int I	XM0207GE	XM0117LZ		12.0	N/A
Int II					
Finish	XM3505HG	MQ1896AY		14.5	N/A
Application Method	Conventional Airspray	Holiday Testing	N/A		

Rework - 02

QC APPROVED: Ronnie Lauranoff Date: 08/22/2017

SECTION 13
AS BUILT DRAWINGS

KEY | ■ APPLIES | N/A NOT APPLICABLE

DESIGN DATA

VESSEL DESIGNED PER THE 2015 EDITION OF THE ASME CODE SECTION VIII DIVISION 1, N/A ADDENDA
CODE CASE(S): N/A
CODE STAMP: R&OD SERIAL NO: 2132 NATIONAL BOARD NO: XXX
DESIGN PRESSURE INTERNAL: 400 PSI @ 200 DEG F
DESIGN PRESSURE EXTERNAL: N/A
HYDRO TEST: 520 PSI @ 70 DEG F

MAWP: 400 PSI @ 200 DEG F LIMITED BY: DESIGN
MAP: 400 PSI @ 70 DEG F LIMITED BY: DESIGN
MDMT: -200 DEG F PWHT: N/A
CORROSION ALLOWANCE: HEAD/SHELL: 0" NOZZLES: 0" SUPPORT: 0"
LIQUID LEVEL: 5'-0" ABOVE WORKLINE SPEC. GRAVITY: 1.0

ESTIMATED WEIGHT: FABRICATION: 48,834 LBS (BARE VESSEL WT)
SHIPPING: 56,409 LBS (FAB WT + PACKED BEDS)
LIFT: 70,616 LBS (SHIPPING WT + INSULATION + PIPING)
EMPTY: 70,616 LBS
OPERATING: 78,581 LBS
TEST: 140,655 LBS

INSULATION: 1 1/2", 2 1/2", 3", & 3 1/2" (BY OTHERS) FIRE PROOFING: NONE

GENERAL NOTES

1. INSPECTION BY: ONEBEACON AMERICA INS. CO.
2. ALL FLANGE BOLT HOLES SHALL STRADDLE VESSEL CENTERLINES UNLESS OTHERWISE SHOWN OR NOTED.
3. ALL TAIL DIMENSIONS ARE FROM WORK LINE UNLESS OTHERWISE SHOWN OR NOTED.
4. SPLICES IN SEGMENTS OF VACUUM STIFFENING RINGS SHALL BE JOINED BY FULL PENETRATION BUTTWELDS.
5. PROJECTION SHOWN IN THE NOZZLE SCHEDULE IS FROM THE CENTERLINE OF VESSEL UNLESS NOTED OTHERWISE.
6. INSIDE PROJECTION SHOWN IN THE NOZZLE SCHEDULE IS MINIMUM ONLY.
7. ALL FLANGE FACE FINISHES ARE TO BE 125-250 Ra.
8. LONGITUDINAL SEAMS SHALL BE STAGGERED 180° IF POSSIBLE
9. NOZZLE PROFILE AT THE SHELL ID SHALL BE:

N/A FLUSH & SQUARE - ALL NOZZLES UNLESS NOTED BELOW
■ FLUSH & CONTOURED - VENT, DRAIN, BOTTOM HEAD NOZZLES & NOZZLES WITHIN PACKED BED SECTIONS
N/A OTHER: SEE NOZZLE SCHEDULE

■ WIND DESIGN

CODE: ASCE 7-10
WIND SPEED: 120 MPH
RISK CATEGORY: III
EXPOSURE CATEGORY: C
Ct: 0.7
MAX. ALLOW. DEFLECTION: 10"/100 FT.

■ SEISMIC DESIGN

CODE: ASCE 7-10
SITE CLASS: D
IMPORTANCE FACTOR: 1.25
Ss: 100 %
S1: 40 %

CAPACITY: 9,438 GALLONS

U
W
RT-1

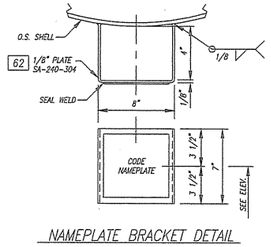
NB XXX

CERTIFIED BY:
CURTIS KELLY INC.
A SUBSIDIARY OF SPITZER INDUSTRIES INC.
13863 INDUSTRIAL
HOUSTON, TEXAS

MAX. ALLOW. WORK. PRESS.	400	P.S.I. AT	200	°F	
MAX. ALLOW. EXT. WORK. PRESS.	-	P.S.I. AT	-	°F	
MIN. DESIGN METAL TEMP.	-200	°F AT	400	P.S.I.	
SERIAL NO.	2132	DATE	2017	WT.	70,644 LBS
MAX. TEST PRESS.	P.S.I.	520	O.D.	*	
SHELL THK.	**	HD. THK.	***	ITEM No.	T-501

P.O. NO. 4500739178
* UPPER SECTION = 61.25" O.D., LOWER SECTION = 43" O.D.
** UPPER SECTION = .625", CONE = .75", LOWER SECTION = .5"
*** TOP HEAD = .602" MIN., BOTTOM HEAD = .425" MIN.
DEMETHANIZER

CODE NAMEPLATE DETAIL



NAMEPLATE BRACKET DETAIL

POSITIVE MATERIAL IDENTIFICATION (PMI): N/A

RADIOGRAPHIC EXAMINATION (RT): ■

RADIOGRAPH: HEAD/SHELL: FULL UW-11(a) JOINT EFF.: HEAD/SHELL: 1.0
SHELL CIRC: FULL UW-11(a) SHELL CIRC: 1.0
SHELL LONG: FULL UW-11(a) SHELL LONG: 1.0

N/A BEFORE PWHT N/A AFTER PWHT
N/A BUTT WELDED NOZZLE CONNECTIONS
■ SPECIAL REQUIREMENTS: 1.) 100% X-RAY ALL ROLLED AND WELDED NOZZLE NECKS

CHARPY IMPACT TESTING: N/A

LIQUID PENETRANT EXAMINATION (PT): ■

■ LIQUID PENETRANT EXAMINATION PER ASME APP. 8
■ MANDATORY PER ASME UHA-34 FOR AUSTENITIC CR-NI S.S. > 3/4" THK.
N/A MEDIUM, WATER SOLUBLE
N/A MEDIUM, SOLVENT BASE
N/A BEFORE PWHT N/A AFTER PWHT
N/A BEFORE HYDROTEST N/A AFTER HYDROTEST
N/A NOZZLE OPENINGS BEFORE FIT-UP & WELDING
N/A BACK GOUGE AREA, NOZZLE TO SHELL ATTACHMENTS
N/A NOZZLE TO SHELL ATTACHMENT WELDS
N/A REINFORCING PAD FINISH WELD
■ LIFTING LUG FINISH WELD
N/A BACK GOUGE AREA OF BUTT WELDS
N/A FINAL PASS OF BUTT WELDS
N/A EXTERNAL CLIPS
N/A INTERNAL CLIPS
N/A TRAY RING AND DOWNCOMER BAR ATTACHMENT WELDS
N/A WELD REPAIRS AND ARC STRIKES AFTER PROPER REPAIRS TO PARENT METAL
N/A CLAD RESTORATION
N/A BLIND FLANGE OVERLAY
N/A FLANGE FACE OVERLAY
N/A NOZZLE NECK OVERLAY
N/A SKIRT TO BOTTOM HEAD WELD
N/A AREAS WHERE TEMPORARY ATTACHMENTS WERE REMOVED
N/A SPECIAL REQUIREMENTS:

MAGNETIC PARTICLE EXAMINATION (MT): ■

■ MAGNETIC PARTICLE EXAMINATION PER ASME APP. 6
N/A MEDIUM, DRY
N/A MEDIUM, WET FLUORESCENT
N/A BEFORE PWHT N/A AFTER PWHT
N/A BEFORE HYDROTEST N/A AFTER HYDROTEST
N/A NOZZLE OPENINGS BEFORE FIT-UP AND WELDING
N/A BACK GOUGE AREA, NOZZLE TO SHELL ATTACHMENT WELD
N/A NOZZLE TO SHELL ATTACHMENT WELDS
N/A REINFORCING PAD FINISH WELD
■ TAILING LUG FINISH WELD
N/A BACK GOUGE AREA OF BUTT WELDS
N/A FINAL PASS OF BUTT WELDS
N/A EXTERNAL CLIPS
N/A INTERNAL CLIPS
N/A TRAY RING AND DOWNCOMER BAR ATTACHMENT WELDS
N/A WELD REPAIRS AND ARC STRIKES AFTER PROPER REPAIRS TO PARENT METAL
N/A C.S. BEFORE CLAD RESTORATION
N/A SKIRT TO BOTTOM HEAD WELD
N/A AREAS WHERE TEMPORARY ATTACHMENTS WERE REMOVED
N/A SPECIAL REQUIREMENTS:

ULTRASONIC EXAMINATION (UT): N/A

N/A BASELINE THICKNESS READINGS
■ LIFTING LUG PLATE MATERIAL
N/A NON-BUTT WELDED NOZZLE CONNECTIONS
■ SPECIAL REQUIREMENTS: UT SHELL AREA UNDER LIFT LUGS PRIOR TO ATTACHING

DIMENSIONAL TOLERANCES:

DIMENSIONAL TOLERANCES SHALL COMPLY WITH: TR. CO. STD ENG-13ac

DOWNCOMER PIPING:

CODE: ASME B31.3
RADIOGRAPHY: 15% X-RAY REQUIRED
FLUID SERVICE: NORMAL FLUID SERVICE
DESIGN: 400 PSIG @ 200 DEG F
MDMT: -200 DEG F
CORROSION ALLOWANCE: 0"
HYDRO TEST: 600 PSIG @ 70 DEG F

BRINELL HARDNESS EXAMINATION: N/A

N/A BEFORE PWHT N/A AFTER PWHT
N/A WELD METAL
N/A HEAT AFFECTED ZONE
N/A PARENT METAL
N/A NOZZLE ATTACHMENT WELDS
N/A MAX. BHN VALUE _____ BNN
N/A CIRCUMFERENTIAL SEAM WELDS _____ %
N/A LONGITUDINAL SEAM WELDS _____ %
N/A NOZZLE ATTACHMENT WELDS _____ %
N/A SPECIAL REQUIREMENTS:

POSTWELD HEAT TREATMENT: N/A

1. HEAT TREATMENT PER ASME CODE SECTION VIII, DIVISION 1, UCS-56
   N/A A. VESSEL TO BE HEAT TREATED AS A WHOLE IN A CLOSED FURNACE.
   N/A B. VESSEL TO BE HEAT TREATED INTERNALLY AS A WHOLE UNDER INSULATING BLANKETS
   N/A C. VESSEL TO BE HEAT TREATED IN PARTS IN A CLOSED FURNACE. A LOCAL HEAT TREATMENT WILL BE PERFORMED ON THE CLOSING SEAM(S).
   N/A D. VESSEL TO BE PARTIALLY HEAT TREATED. HEAT TREAT FOLLOWING COMPONENTS ONLY:
2. TEMPERATURE OF FURNACE UPON ENTRANCE OF VESSEL, 800 °F MAXIMUM.
3. RATE OF HEATING ABOVE 800° F 200° F PER HOUR.
4. HOLDING TEMPERATURE: 1125 °F ± 25 °F
5. TEMPERATURE HOLDING PERIOD: 2 HOURS 15 MINUTES.
6. AFTER POSTWELD HEAT TREATMENT, COOL VESSEL TO 800 °F IN CLOSED FURNACE AND FINISH COOLING IN STILL AIR.
7. FURNACE COOLING RATE IN DEGREES FAHRENHEIT PER HOUR 250 °F.
8. COMMENTS:

TESTING REQUIREMENTS (ENG-13an)

A. ■ SHOP HYDROSTATIC TEST PER ■ 1.3 x MAWP (UG-99(b)) / N/A 1.3 x MAP (UG-99(c)) / N/A CLIENT DEFINED PRESSURE (1.5 x DESIGN PRESSURE)
B. ■ DESIGN ONLY: VESSEL DESIGNED FOR FIELD HYDROTEST @ 1.3 x MAWP
C. ■ HYDROTEST WATER SHALL HAVE A MAXIMUM OF 50 ppm CHLORIDE CONTENT, AT A MINIMUM TEMPERATURE OF 60 °F
D. ■ HOLD FOR 1 HOUR MINIMUM AND VISUALLY CHECK FOR LEAKS.
E. ■ HYDROTEST CHART IS REQUIRED W/TEMPERATURE.
F. N/A SHOP PNEUMATIC TEST WITH AIR AND SOAP SOLUTION.
G. ■ EACH REINFORCING PAD SEGMENT SHALL BE TESTED AT A PRESSURE OF 15 PSIG WITH AN AIR AND SOAP SOLUTION, PRIOR TO HYDROTEST.
H. N/A SPECIAL REQUIREMENTS:

NITROGEN PURGE: N/A

COATING REQUIREMENTS PER TRCO STD ENG 36C FOR J-361

■ ALL STAINLESS STEEL SURFACES
NO COATING REQUIRED

■ ALL EXTERNAL CARBON STEEL SURFACES PER SYSTEM #3:
1) SANDBLAST PER: SSPC-SP6, 1.5-3.0 MILS D.F.T.
2) PRIMER: SHERWIN WILLIAMS MACROPOXY 646 FAST CURE EPOXY B58-600, 4.0-6.0 MILS D.F.T.
3) INTERMEDIATE: SHERWIN WILLIAMS MACROPOXY 646 FAST CURE EPOXY B58-600, 4.0-6.0 MILS D.F.T.
4) FINISH: SHERWIN WILLIAMS HI-SOLIDS POLYURETHANE B65 SERIES/B60V30, 3.0-4.0 MILS D.F.T.
FINISH COLOR: SHERWIN WILLIAMS STRUCTURAL GRAY, SW4031

EXTERNAL STENCILING REQUIREMENTS: (ENG-13an)

STENCIL IN 3" HIGH LETTERS IN A CONSPICUOUS LOCATION ON (2) SIDES OF THE VESSEL SHELL

N/A P.O. NUMBER
■ VESSEL ITEM NUMBER
N/A VESSEL CENTER OF GRAVITY
N/A SHIPPING WEIGHT
N/A N, E, S, & W ORIENTATIONS
N/A "PWHT - NO WELDING PERMITTED ON THIS VESSEL"

PREPARATION FOR SHIPMENT

A. VESSEL SHALL BE THOROUGHLY DRAINED, DRIED, AND CLEANED OF ALL LOOSE SCALE, SPLATTER, FLUX, GREASE, DIRT, AND ALL LOOSE FOREIGN MATTER.
■ B. TEST HOLES SHALL BE PLUGGED WITH SILICONE PRIOR TO SHIPMENT
■ C. COAT (C.S.) FLANGE FACES & MACHINED SURFACES W/ GOOD GRADE RUST PREVENTATIVE
D. ALL OPENINGS SHALL BE COVERED FOR SHIPMENT AS FOLLOWS:

COVERS	GASKETS	BOLTING
■ PLYWOOD 1/2" MIN. THK	N/A RED RUBBER GASKET	■ SEE NOTE E
N/A STEEL _____ THK	N/A NEOPRENE GASKET	N/A FULL BOLTING 3/4"ø MAX.
N/A OTHER _____	■ NONE	
	N/A OTHER _____	

■ SPECIAL REQUIREMENTS: ALL FLANGES SHALL BE SUPPLIED WITH WOODEN SHIPPING COVERS.

E. MINIMUM OF (4) 3/8"ø BOLTS REQUIRED.

HARDWARE MATERIALS:

■ FLANGE STUD/NUT SPEC: SA-193-B8/SA-194-GR. 8 [58] [59]
■ COATING: ZINC OR CADMIUM PLATED
N/A SPARES: 10% EXTRA FOR EACH BLINDED CONNECTION (4 MIN. EA.)
■ GASKET SPEC: 1/8" THK. SPIRAL WOUND, CG FLEXICARB FILLED WITH 304SS WINDINGS [60] [61] & OUTER RINGS
N/A SPARES: (1) REQUIRED FOR EACH BLINDED CONNECTION
■ EXTERNAL STRUCTURAL BOLTING: TYPE: HHMB W/ NUT & FLAT WASHER SPEC: SA-193-B8/SA-194-GR.8
N/A SPARES: 10% EXTRA
■ INTERNAL BOLTING: TYPE: SA-193-B8/SA-194-GR.8 SPEC:

CUSTOMER TO PROVIDE LIST AND OTHER OUTSTANDING DETAILS

1.
2.
3.
4.
5.
6.
7.

APPROVED FOR CONSTRUCTION
RR 2132 11/14/16
CURTIS KELLY, INC.

REFERENCE DRAWINGS		REVISIONS				
NUMBER	DESCRIPTION	NO.	DESCRIPTION	BY	CHK	DATE
		0	ISSUED FOR CONSTRUCTION	MAK	RR	10/13/16

CONFIDENTIAL
THIS DRAWING IS THE PROPERTY OF AND CONTAINS CONFIDENTIAL AND PROPRIETARY INFORMATION BELONGING TO CURTIS KELLY, INC. IT MUST BE RETURNED IMMEDIATELY UPON REQUEST AND MUST NOT BE COPIED IN WHOLE OR IN PART NOR THE INFORMATION SHOWN THEREON DISCLOSED TO THIRD PARTIES OR OTHERWISE USED EXCEPT AS SPECIFICALLY PERMITTED BY CURTIS KELLY, INC.

CURTIS KELLY, INC.
HOUSTON, TEXAS

DESCRIPTION: 42" I.D. x 60" I.D. x 98'-0" SEAM / SEAM
DEMETHANIZER
ITEM: T-501

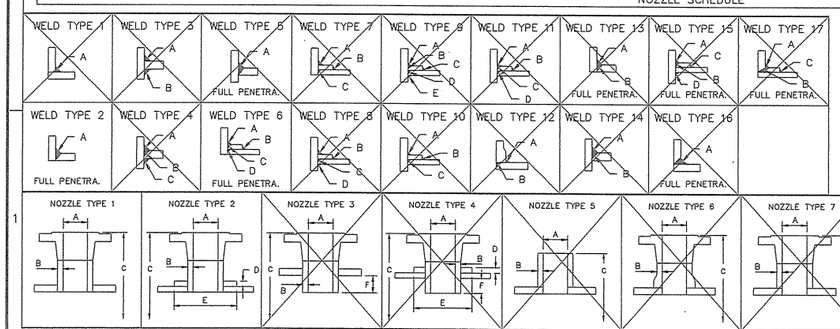
CUSTOMER: UOP RUSSELL LLC
UOP JOB J-447

SCALE : N.T.S.	DATE	P.O. No. : 4500739178	
DRAWN : MAK	10/13/16	FILE No. :	
CHECK : RR	10/13/16	DWG. NO. 2132	SHEET NO. 1 OF 11 / REV. 0
APVD :			

ITEM	QUANTITY	MATERIAL	DESCRIPTION
1	2	SA-240 304	CYLINDER – 60" ID x 5/8" WALL x 10'-0" LG
2	1	SA-240 304	CYLINDER – 60" ID x 5/8" WALL x 7'-9" LG
3	1	SA-240 304	CYLINDER – 42" ID x 1/2" WALL x 7'-3" LG
4	6	SA-240 304	CYLINDER – 42" ID x 1/2" WALL x 10'-0" LG
5	1	SA-240 304	CONE – 60" ID TO 42" ID x 3/4" WALL x 3'-0" LG
6	1	SA-240 304	2:1 HEAD – 60" ID x 0.602" MIN (5/8" NOM) THICK, 2" SF
7	1	SA-240 304	2:1 HEAD – 42" ID x 0.425" MIN (1/2" NOM) THICK, 2" SF
8	1	SA-240 304	SKIRT – 43" OD TO x 6'-0" LONG x 1" WALL
9	1	SA-516 70	SKIRT – 43" OD TO x 9'-8" LONG x 1" WALL
10	3	SA-182 F304	NOZZLE FLANGE – 6" 300# RFWN, BORE = SCH 40S
11	4	SA-182 F304	NOZZLE FLANGE – 8" 300# RFWN, BORE = SCH 40S
12	1	SA-182 F304	NOZZLE FLANGE – 12" 300# RFWN, BORE = SCH 40S
13	5	SA-182 F304	NOZZLE FLANGE – 1" 300# RFLWN x 9" LG
14	8	SA-182 F304	NOZZLE FLANGE – 12" 300# RFWN, BORE = SCH 40S WITH BLIND FLANGE/GASKET AND BOLTING
15	2	SA-182 F304	NOZZLE FLANGE – 4" 300# RFWN, BORE = SCH 40S
16	4	SA-182 F304	NOZZLE FLANGE – 20" RFWN, BORE = STD WT WITH BLIND FLANGE/GASKET AND BOLTING
17	1	SA-182 F304	NOZZLE FLANGE – 10" RFWN, BORE = SCH 40S
18	1'-2"	SA-312 TP304 WLD PIPE	NOZZLE NECK – 4" SCH 40S
19	5'-8"	SA-312 TP304 WLD PIPE	NOZZLE NECK – 6" SCH 40S
20	2'-9"	SA-312 TP304 WLD PIPE	NOZZLE NECK – 8" SCH 40S
21	8"	SA-312 TP304 WLD PIPE	NOZZLE NECK – 10" SCH 40S
22	6'-6"	SA-312 TP304 WLD PIPE	NOZZLE NECK – 12" SCH 40S
23	4'-2"	SA-240 304	NOZZLE NECK – 19.25 ID X 0.375 WALL
24	1	SA-240 304	REINFORCEMENT PAD – 8.5" OD x .625" THK
25	1	SA-240 304	REINFORCEMENT PAD – 8.5" OD x .375" THK
26	2	SA-240 304	REINFORCEMENT PAD – 11.625" OD x .375" THK
27	1	SA-240 304	REINFORCEMENT PAD – 11.625" OD x .5" THK (BOTTOM HEAD)
28	2	SA-240 304	REINFORCEMENT PAD – 14.625" OD x .5" THK
29	2	SA-240 304	REINFORCEMENT PAD – 14.625" OD x .375" THK
30	1	SA-240 304	REINFORCEMENT PAD – 19.75" OD x .625" THK (TOP HEAD)
31	1	SA-240 304	REINFORCEMENT PAD – 22.5" OD x .625" THK (CONE)
32	4	SA-240 304	REINFORCEMENT PAD – 21.75" OD x .5" THK
33	1	SA-240 304	REINFORCEMENT PAD – 22.75" OD x .625" THK
34	2	SA-240 304	REINFORCEMENT PAD – 22.75" OD x .375" THK
35	1	SA-240 304	REINFORCEMENT PAD – 23.75" OD x .625" THK
36	1	SA-240 304	REINFORCEMENT PAD – 32" OD x .75" THK (CONE)
37	1	SA-240 304	REINFORCEMENT PAD – 34" OD x .5" THK
38	1	SA-240 304	REINFORCEMENT PAD – 35" OD x .5" THK
39	1	SA-240 304	REINFORCEMENT PAD – 38" OD x .625" THK
40	1	SA-403 WP304	WELDELL – 6" SCH 40S L.R. 90°

MARK	IDENTIFIER	SIZE	FLANGE TYPE	FLANGE CLASS	NOZZLE STYLE	A	B	C	D	E	F	WELD TYPE	A	B	C	D	E	NOTES	BOLTING	GSKT	BLIND
SVI~2	SKIRT VENT	1.5						DETAIL					DETAIL								
SO	SKIRT SLEEVE	12						DETAIL					DETAIL								
SA	SKIRT ACCESS	12						DETAIL					DETAIL								
Q4	TW	1	LWN	300#	1	1	.56	29.5	–	–	–	2	.375	–	–	–	–				
Q3	TW	1	LWN	300#	1	1	.56	29.5	–	–	–	2	.375	–	–	–	–				
Q2	TW	1	LWN	300#	1	1	.56	29.5	–	–	–	2	.375	–	–	–	–				
Q1	TW	1	LWN	300#	1	1	.56	38.625	–	–	–	2	.375	–	–	–	–				
P	TE/TI	1	LWN	300#	1	1	.56	29.75	–	–	–	2	.375	–	–	–	–				
N4	MANWAY	20	WN	300#	2	19.25	.375	33.5	.5	35	–	6	.375	.375	.5	.5	–	W/BLIND, GASKET, BOLTING & DAVIT	58	60	102
N3	MANWAY	20	WN	300#	2	19.25	.375	33.5	.5	34	–	6	.375	.375	.5	.5	–	W/BLIND, GASKET, BOLTING & DAVIT	58	60	102
N2	MANWAY	20	WN	300#	2	19.25	.375	44	.75	32	–	6	.375	.5625	.75	.75	–	W/BLIND, GASKET, BOLTING & DAVIT	58	60	102
N1	MANWAY	20	WN	300#	2	19.25	.375	42.625	.625	38	–	6	.375	.5	.625	.625	–	W/BLIND, GASKET, BOLTING & DAVIT	58	60	102
M	EQUALIZATION	6	WN	300#	2	6.065	.28	29.5	.375	11.625	–	6	.375	.3125	.375	.5	–				
L	BOTTOMS OUT	6	WN	300#	2	6.065	.28	ELEV	.5	11.625	–	6	.375	.375	.5	.425	–	W/VORTEX BREAKER – SEE DETAIL			
K8	HANDHOLE	12	WN	300#	2	12	.375	31.5	.375	22.75	–	6	.375	.3125	.375	.5	–	W/BLIND, GASKET, & BOLTING	59	61	103
K7	HANDHOLE	12	WN	300#	2	12	.375	31.5	.5	21.75	–	6	.375	.375	.5	.5	–	W/BLIND, GASKET, & BOLTING	59	61	103
K6	HANDHOLE	12	WN	300#	2	12	.375	31.5	.5	21.75	–	6	.375	.375	.5	.5	–	W/BLIND, GASKET, & BOLTING	59	61	103
K5	HANDHOLE	12	WN	300#	2	12	.375	40.625	.625	23.75	–	6	.375	.5	.625	.625	–	W/BLIND, GASKET, & BOLTING	59	61	103
K4	HANDHOLE	12	WN	300#	2	12	.375	31.5	.375	22.75	–	6	.375	.3125	.375	.5	–	W/BLIND, GASKET, & BOLTING	59	61	103
K3	HANDHOLE	12	WN	300#	2	12	.375	31.5	.5	21.75	–	6	.375	.375	.5	.5	–	W/BLIND, GASKET, & BOLTING	59	61	103
K2	HANDHOLE	12	WN	300#	2	12	.375	31.5	.5	21.75	–	6	.375	.375	.5	.5	–	W/BLIND, GASKET, & BOLTING	59	61	103
K1	HANDHOLE	12	WN	300#	2	12	.375	40.625	.625	22.75	–	6	.375	.5	.625	.625	–	W/BLIND, GASKET, & BOLTING	59	61	103
J	PSV	6	WN	300#	2	6.065	.28	29.5	.375	11.625	–	6	.375	.3125	.375	.5	–				
H	FROM E-204 / E-207	8	WN	300#	2	7.981	.322	29.5	.375	14.625	–	6	.375	.3125	.375	.5	–	W/V-BAFFLE – SEE INTERNAL DWGS			
G	TO E-204 / E-207	8	WN	300#	2	7.981	.322	29.5	.375	14.625	–	6	.375	.3125	.375	.5	–				
F	FROM E-205	8	WN	300#	2	7.981	.322	29.5	.5	14.625	–	6	.375	.375	.5	.5	–	W/V-BAFFLE – SEE INTERNAL DWGS	73	72	
E	TO E-205	8	WN	300#	2	7.981	.322	29.5	.5	14.625	–	6	.375	.375	.5	.5	–	W/DOWNCOMER	73	72	
D	BOTTOM FEED	4	WN	300#	2	4.026	.237	29.5	.375	8.5	–	6	.375	.3125	.375	.5	–	W/V-BAFFLE – SEE INTERNAL DWGS	79	78	
C	TOP FEED	12	WN	300#	2	12	.375	37	.625	21.75	–	6	.375	.5	.625	.75	–	W/V-BAFFLE – SEE INTERNAL DWGS	68	67	
B	VAPOR OUTLET	10	WN	300#	2	10.02	.365	ELEV	.625	19.75	–	6	.375	.4375	.625	.602	–	W/DOWNCOMER	63	86	
A	REFLUX INLET	4	WN	300#	2	4.026	.237	38.625	.625	8.5	–	6	.375	.5	.625	.625	–	W/V-BAFFLE – SEE INTERNAL DWGS	79	78	

NOZZLE SCHEDULE



APPROVED FOR CONSTRUCTION
RR 2132 11/14/16
CURTIS KELLY, INC.

REFERENCE DRAWINGS

NUMBER	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	BY	CHK	DATE
0	ISSUED FOR APPROVAL	MAK	RR	10/13/16

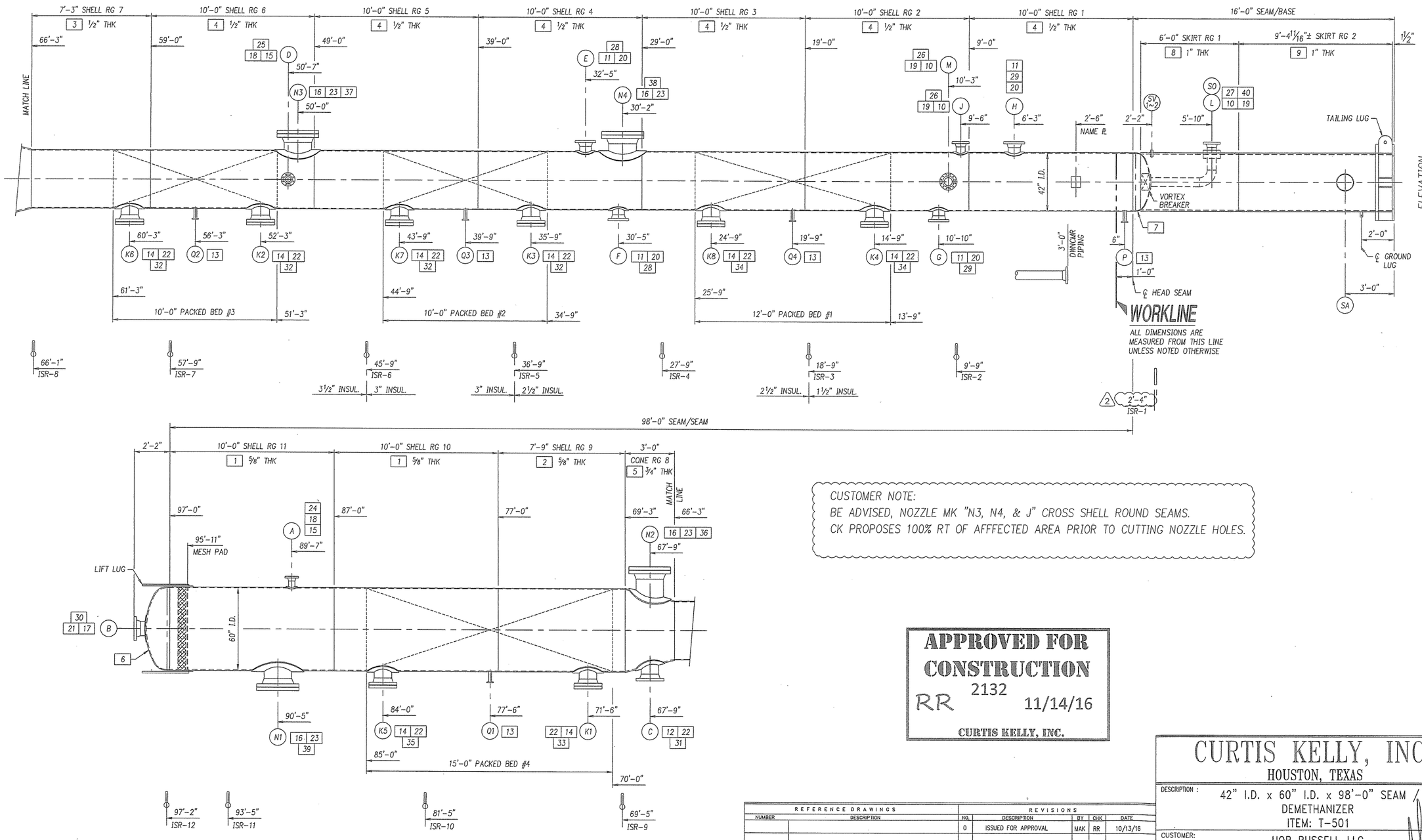
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CURTIS KELLY, INC.
HOUSTON, TEXAS

DESCRIPTION : 42" I.D. x 60" I.D. x 98'-0" SEAM / SEAM
DEMETHANIZER
ITEM: T-501

CUSTOMER: UOP RUSSELL LLC
UOP JOB J-447

SCALE : N.T.S.	DATE	P.O. No. : 4500739178	
DRAWN : MAK	10/13/16	FILE No. :	
CHECK : RR	10/13/16	DWG. NO. 2132	SHEET NO. 2 OF 11 / REV. 0
APVD :			



CUSTOMER NOTE:
BE ADVISED, NOZZLE MK "N3, N4, & J" CROSS SHELL ROUND SEAMS.
CK PROPOSES 100% RT OF AFFFECTED AREA PRIOR TO CUTTING NOZZLE HOLES.

APPROVED FOR CONSTRUCTION
RR 2132 11/14/16
CURTIS KELLY, INC.

REFERENCE DRAWINGS	
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REVISIONS				
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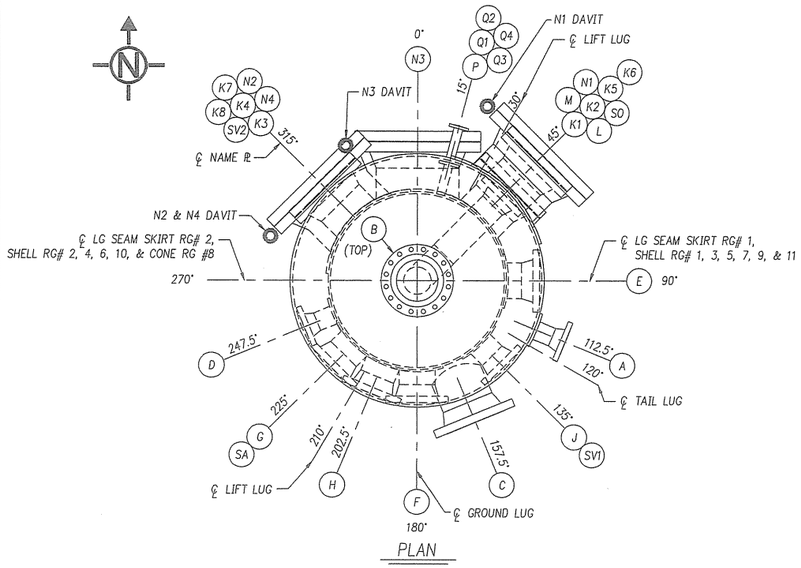
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CURTIS KELLY, INC.
HOUSTON, TEXAS

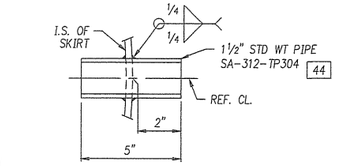
DESCRIPTION: 42" I.D. x 60" I.D. x 98'-0" SEAM / SEAM
DEMETHANIZER
ITEM: T-501

CUSTOMER: UOP RUSSELL LLC
UOP JOB J-447

SCALE : N.T.S.	DATE	P.O. No. : 4500739178	
DRAWN : MAK	10/13/16	FILE No. :	
CHECK : RR	10/13/16	DWG. NO. 2132	SHEET NO. 3 OF 11 / REV. 0
APVD :			

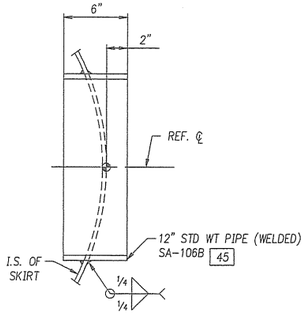


PLAN



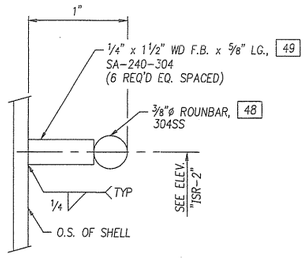
DETAIL OF 1 1/2" SKIRT VENTS

TWO (2) REQ'D MK "SV1 & SV2"



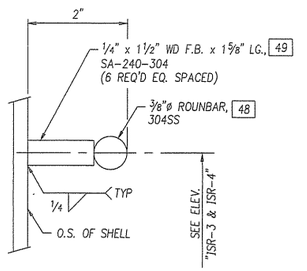
DETAIL OF 12" SKIRT ACCESS "SA"

ONE (1) REQ'D



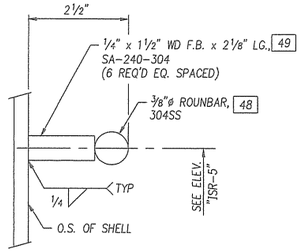
INSULATION SUPPORT RING

ONE (1) REQ'D MK "ISR-2"



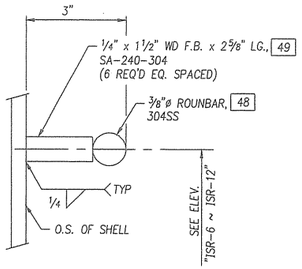
INSULATION SUPPORT RING

ONE (1) REQ'D EA. MK "ISR-3 & ISR-4"
TWO (2) TOTAL REQ'D



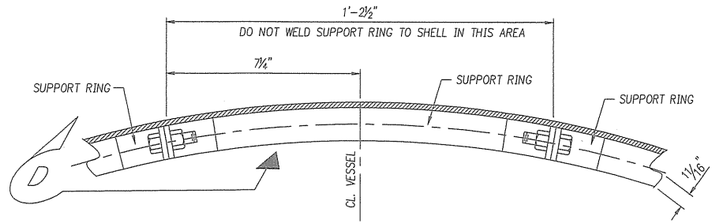
INSULATION SUPPORT RING

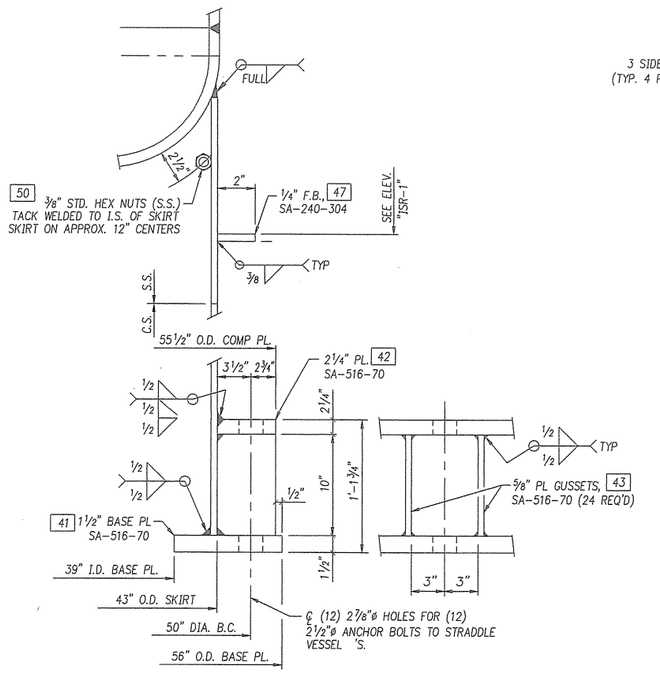
ONE (1) REQ'D MK "ISR-5"



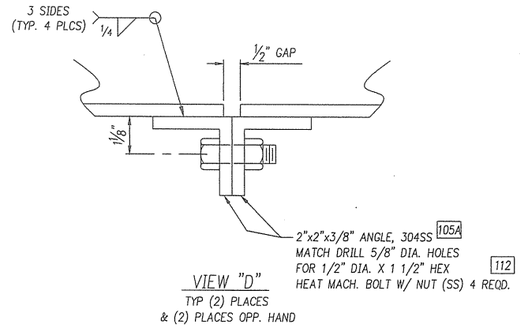
INSULATION SUPPORT RING

ONE (1) REQ'D EA. MK "ISR-6 ~ ISR-12"
SEVEN (7) TOTAL REQ'D



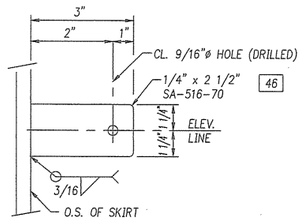


BASEPLATE DETAIL



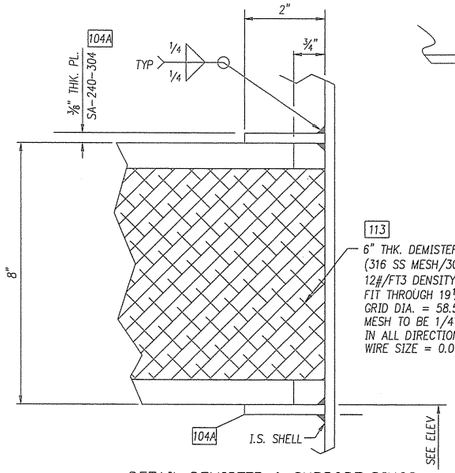
VIEW "D"

TYP (2) PLACES
& (2) PLACES OPP. HAND



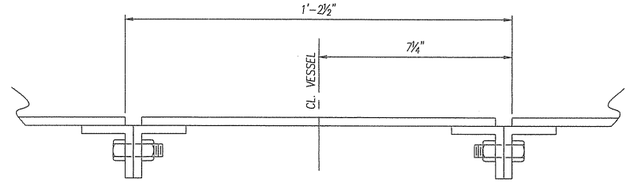
GROUNDING LUG DETAIL

ONE (1) REQ'D



DETAIL DEMISTER & SUPPORT RINGS

ONE (1) REQ'D



DETAIL OF MIST PAD SUPPORT DROPOUT

TYP (2) PLACES @ 180° APART

APPROVED FOR CONSTRUCTION
RR 2132 11/14/16
CURTIS KELLY, INC.

REFERENCE DRAWINGS	
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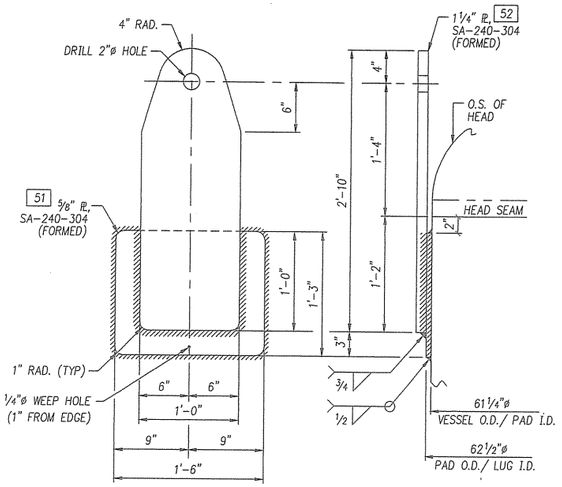
CURTIS KELLY, INC.
HOUSTON, TEXAS

DESCRIPTION : 42" I.D. x 60" I.D. x 98'-0" SEAM / SEAM
DEMETHANIZER
ITEM: T-501

CUSTOMER: UOP RUSSELL LLC
UOP JOB J-447

SCALE : N.T.S.	DATE	P.O. No. : 4500739178	
DRAWN : MAK	10/13/16	FILE No. :	
CHECK : RR	10/13/16	DWG. NO. 2132	SHEET NO. 4 OF 11 / REV. 0
APVD :			

FIELD NOTE:
SPREADER BAR SHALL BE USED BETWEEN LUGS DURING LIFTING OPERATIONS.

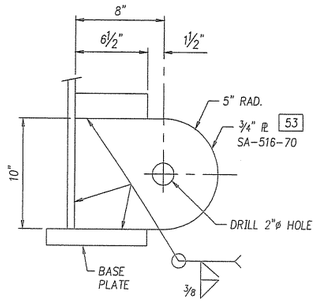


DETAIL OF LIFTING LUGS

TWO (2) REQ'D

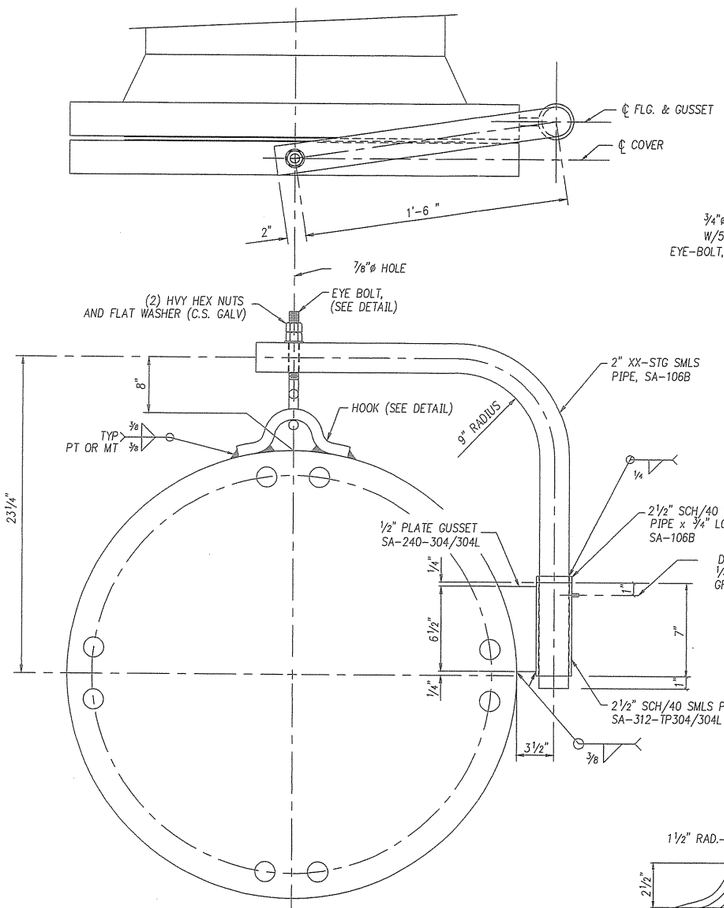
ROLL REPAD TO FIT SHELL CAN O.D. = 61.25"

FORM BOTTOM 16" OF LIFT LUG TO FIT REPAD O.D. = 62.5"



DETAIL OF TAILING LUG

ONE (1) REQ'D

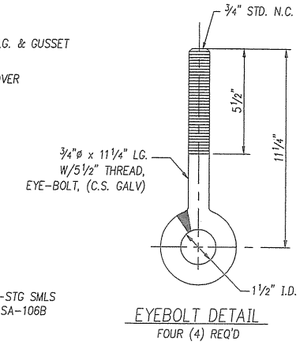


DETAIL OF 20" 300# MANHOLE DAVIT 57

ONE (1) EA. REQ'D FOR MK "N1, N2, N3, & N4"

FOUR (4) REQ'D

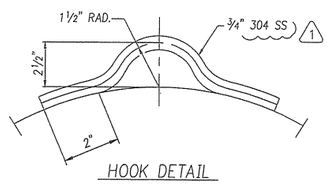
SEE PLAN FOR TRUE ORIENTATION



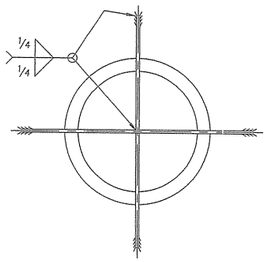
EYEBOLT DETAIL

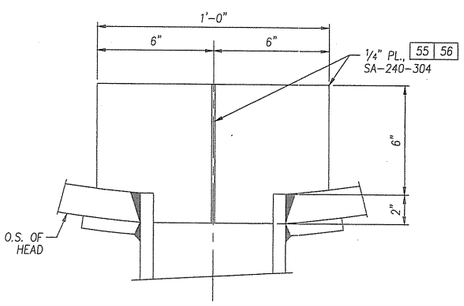
FOUR (4) REQ'D

SHOP NOTE:
GALVANIZE ARM



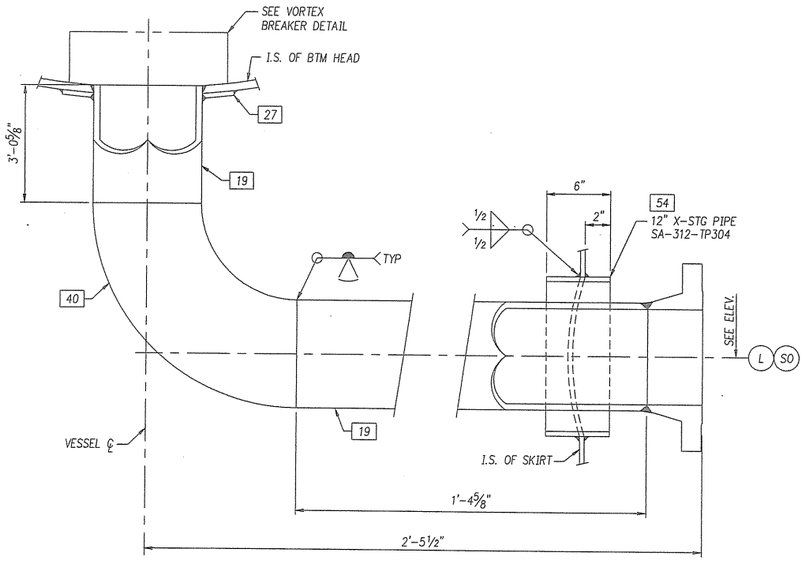
HOOK DETAIL





DETAIL OF VORTEX BREAKER

ONE (1) REQ'D @ NOZZLE MK "L"



DETAIL OF 6" 300# NOZZLE MK "L" WITH SLEEVE MK "SO"

ONE (1) REQ'D

APPROVED FOR CONSTRUCTION
RR 2132 11/14/16
CURTIS KELLY, INC.

REFERENCE DRAWINGS

NUMBER	DESCRIPTION

REVISIONS

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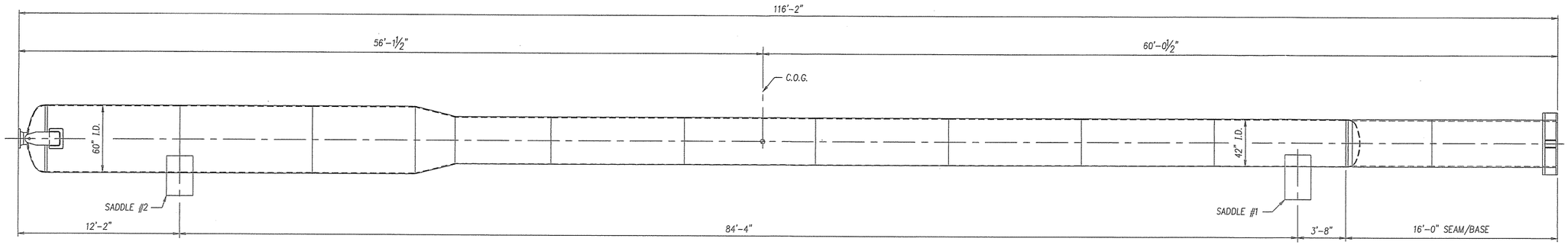
CURTIS KELLY, INC.

HOUSTON, TEXAS

DESCRIPTION : 42" I.D. x 60" I.D. x 98'-0" SEAM / SEAM
DEMETHANIZER
ITEM: T-501

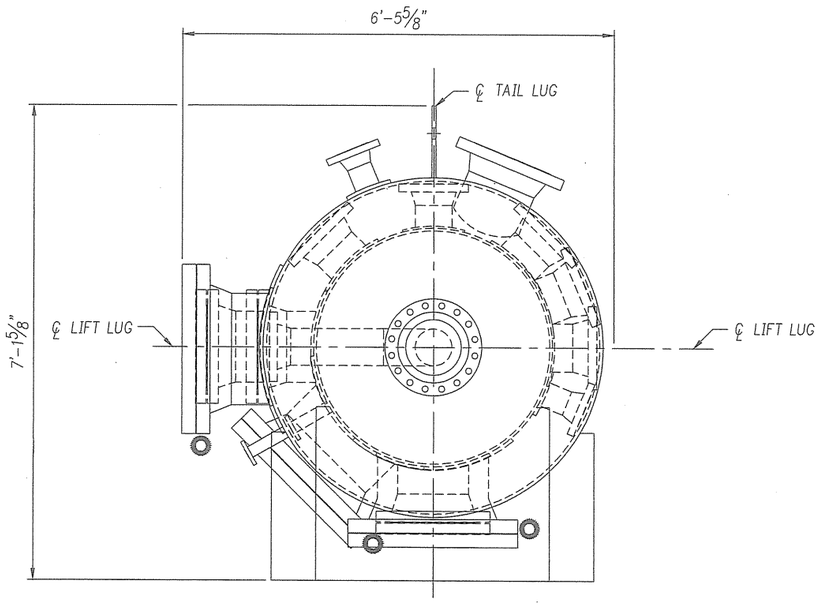
CUSTOMER: UOP RUSSELL LLC
UOP JOB J-447

SCALE : N.T.S.	DATE	P.O. No. : 4500739178	
DRAWN : MAK	10/13/16	FILE No. :	
CHECK : RR	10/13/16	DWG. NO. 2132	SHEET NO. 5 OF 11 / REV. 0
APVD :			

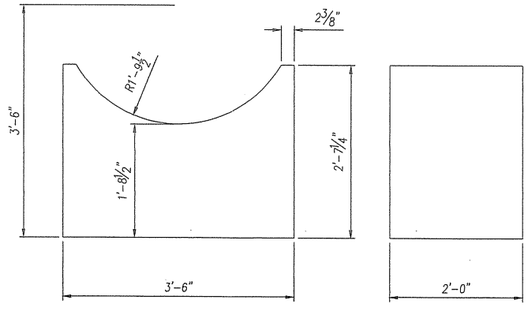


SIDE VIEW

ESTIMATED SHIPPING WEIGHT: 57,000 LBS (INCLUDES FAB. WT. & PACKED BEDS)

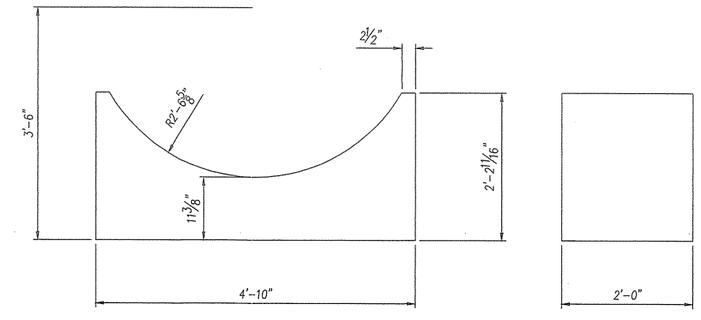


END VIEW



SHIPPING SADDLE #1 DETAIL

106A



SHIPPING SADDLE #2 DETAIL

107A

APPROVED FOR CONSTRUCTION
2132
RR 11/14/16
CURTIS KELLY, INC.

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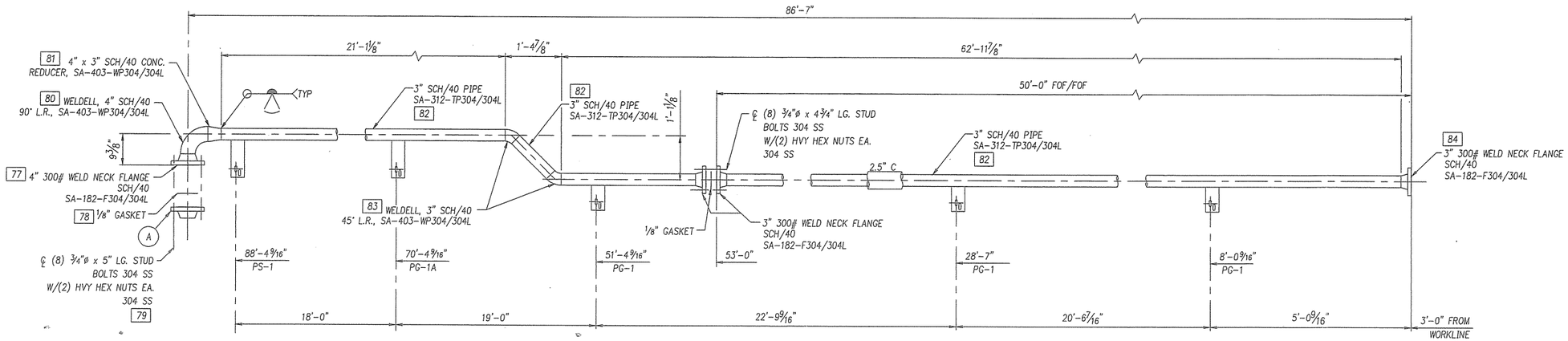
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CURTIS KELLY, INC.
HOUSTON, TEXAS

DESCRIPTION: 42" I.D. x 60" I.D. x 98'-0" SEAM / SEAM DEMETHANIZER
ITEM: T-501

CUSTOMER: UOP RUSSELL LLC
UOP JOB J-447

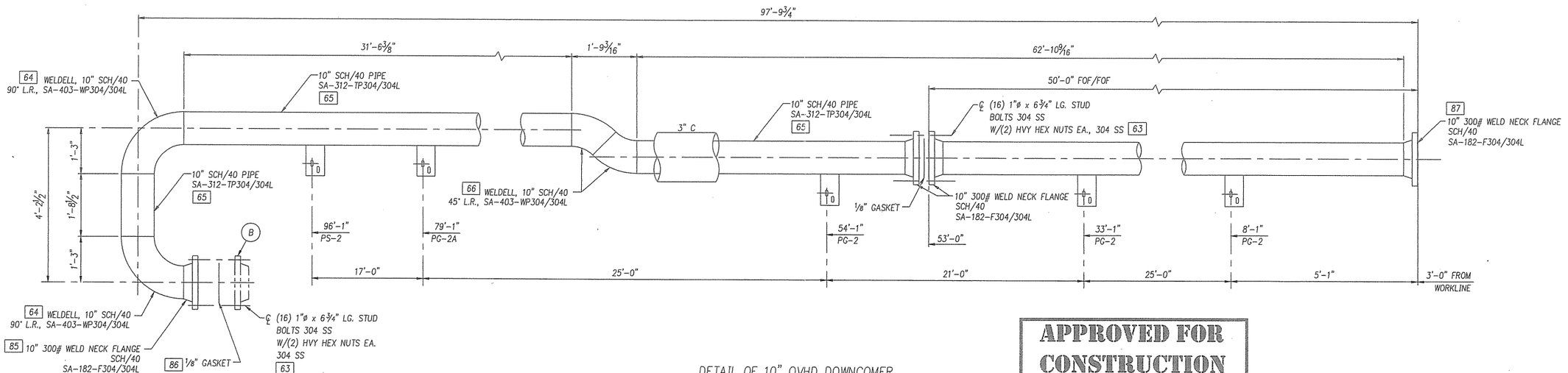
SCALE : N.T.S.	DATE	P.O. No. : 4500739178	
DRAWN : MAK	10/13/16	FILE No. :	
CHECK : RR	10/13/16	DWG. NO. 2132	SHEET NO. 6 OF 11 / REV. 0
APVD :			



DETAIL OF REFLUX DOWNCOMER

ONE (1) REQ'D @ NOZZLE MK "A"

PIPE INSULATION:
PID #361-232, REV 1
REFLUX INLET #161-B0-304SS-3" 2.5" C
INSULATION SPEC ENG-36d (10/2/12)



DETAIL OF 10" OVHD DOWNCOMER

ONE (1) REQ'D @ NOZZLE MK "B"

PIPE INSULATION:
PID #361-232, REV 1
VAPOR OUTLET #175-B0-304SS-10" 3" C
INSULATION SPEC ENG-36d (10/2/12)

APPROVED FOR CONSTRUCTION
2132
RR 11/14/16
CURTIS KELLY, INC.

REFERENCE DRAWINGS	
NUMBER	DESCRIPTION

REVISIONS				
NO.	DESCRIPTION	BY	CHK	DATE
0	ISSUED FOR APPROVAL	MAK	RR	10/13/16

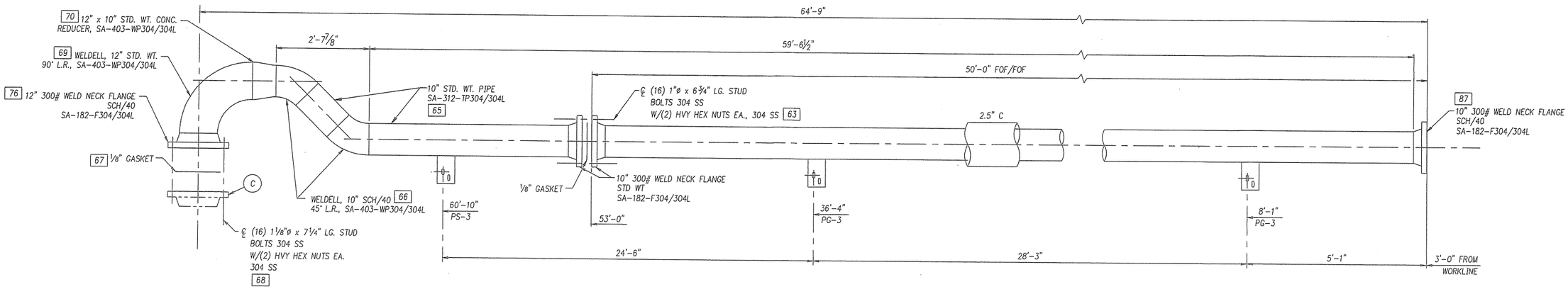
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CURTIS KELLY, INC.

HOUSTON, TEXAS

DESCRIPTION :	42" I.D. x 60" I.D. x 98'-0" SEAM / SEAM DEMETHANIZER ITEM: T-501
CUSTOMER:	UOP RUSSELL LLC UOP JOB J-447

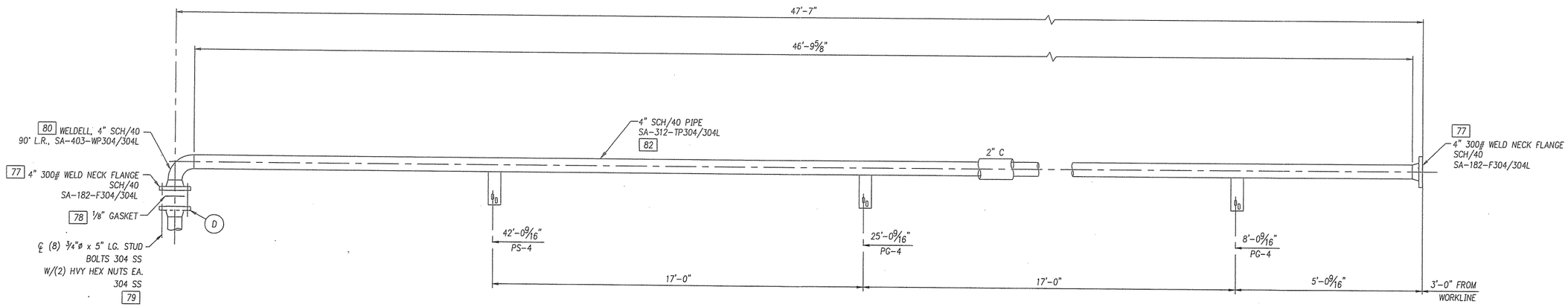
SCALE : N.T.S.	DATE	P.O. No. : 4500739178	
DRAWN : MAK	10/13/16	FILE No. :	
CHECK : RR	10/13/16	DWG. NO. 2132	SHEET NO. 1 OF 11 REV. 0
APVD :			



DETAIL OF TOP FEED DOWNCOMER

ONE (1) REQ'D @ NOZZLE MK "C"

PIPE INSULATION:
PID #361-232, REV 1
TOP FEED #166-B0-304SS-10" 2.5" C
INSULATION SPEC ENG-36d (10/2/12)



DETAIL OF BOTTOM FEED DOWNCOMER

ONE (1) REQ'D @ NOZZLE MK "D"

PIPE INSULATION:
PID #361-232, REV 1
BOTTOM FEED #171-B0-304SS-4" 2" C
INSULATION SPEC ENG-36d (10/2/12)

APPROVED FOR CONSTRUCTION
RR 2132 11/14/16
CURTIS KELLY, INC.

REFERENCE DRAWINGS	
NUMBER	DESCRIPTION

REVISIONS				
NO.	DESCRIPTION	BY	CHK	DATE
0	ISSUED FOR APPROVAL	MAK	RR	10/13/16

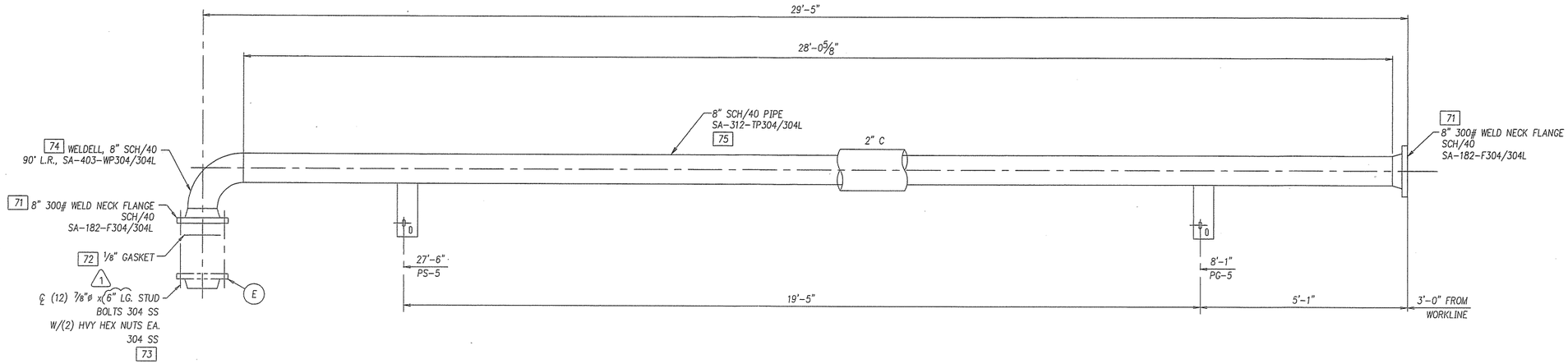
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CURTIS KELLY, INC.
HOUSTON, TEXAS

DESCRIPTION : 42" I.D. x 60" I.D. x 98'-0" SEAM / SEAM DEMETHANIZER ITEM: T-501

CUSTOMER: UOP RUSSELL LLC UOP JOB J-447

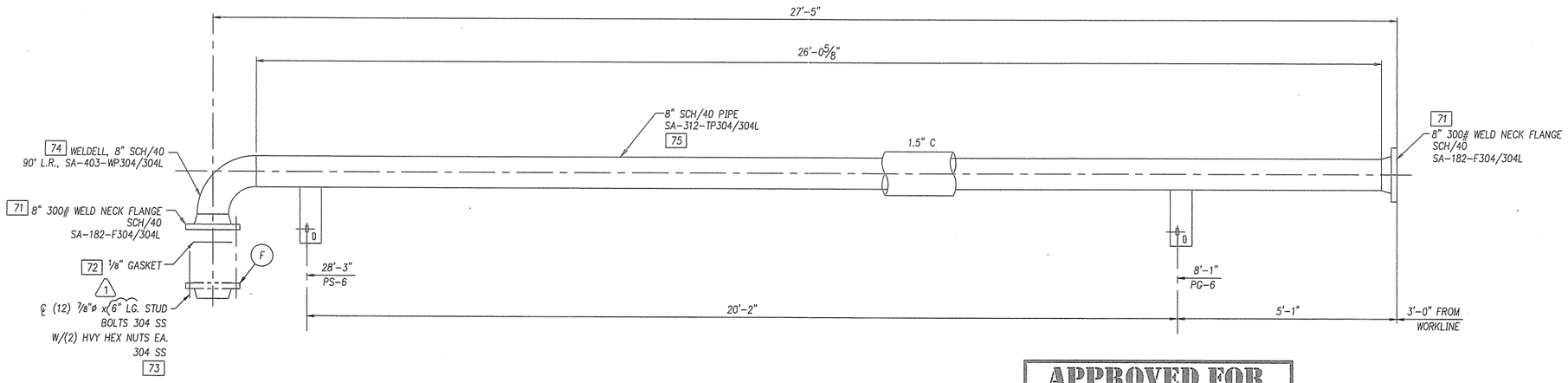
SCALE : N.T.S.	DATE	P.O. No. : 4500739178	
DRAWN : MM	10/13/16	FILE No. :	
CHECK : RP	10/13/16	DWG. NO. 2132	SHEET NO. 8 OF 11 / REV. 0
APVD :			



DETAIL OF 8" DOWNCOMER

ONE (1) REQ'D @ NOZZLE MK "E"

PIPE INSULATION:
PID #361-232, REV 1
TO E-205 #201-B0-304SS-6" 2" C
INSULATION SPEC ENG-36d (10/2/12)



DETAIL OF 8" DOWNCOMER

ONE (1) REQ'D @ NOZZLE MK "F"

PIPE INSULATION:
PID #361-232, REV 1
FROM E-205 #202-B0-304SS-8" 1.5" C
INSULATION SPEC ENG-36d (10/2/12)

APPROVED FOR CONSTRUCTION
RR 2132 11/14/16
CURTIS KELLY, INC.

REFERENCE DRAWINGS	
NUMBER	DESCRIPTION

REVISIONS				
NO.	DESCRIPTION	BY	CHK	DATE
0	ISSUED FOR APPROVAL	MAK	RR	10/13/16

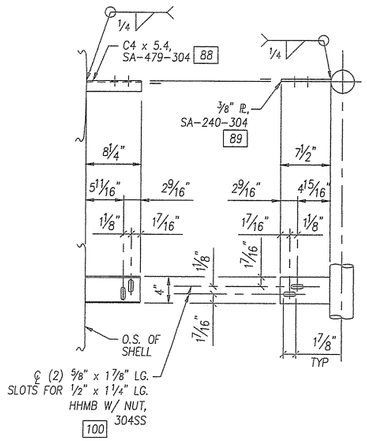
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CURTIS KELLY, INC.
HOUSTON, TEXAS

DESCRIPTION: 42" I.D. x 60" I.D. x 98'-0" SEAM / SEAM
DEMETHANIZER
ITEM: T-501

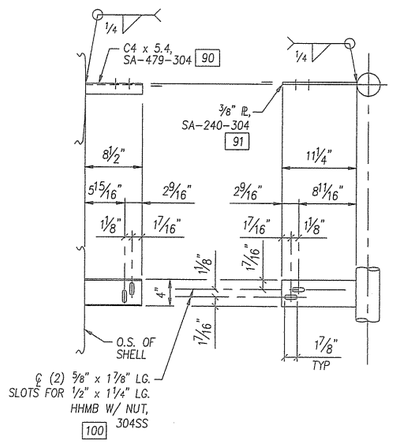
CUSTOMER: UOP RUSSELL LLC
UOP JOB J-447

SCALE : N.T.S.	DATE	P.O. No. : 4500739178	
DRAWN : MA	10/13/16	FILE No. :	
CHECK : RR	10/13/16	DWG. NO. 2132	SHEET NO. 9 OF 11 / REV. 0
APVD :			



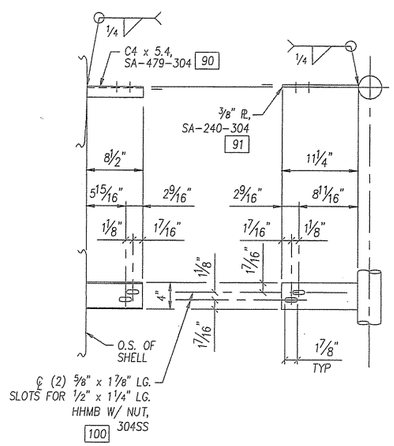
3" PIPE GUIDE DETAIL

THREE (3) SETS REQ'D MK "PG-1"



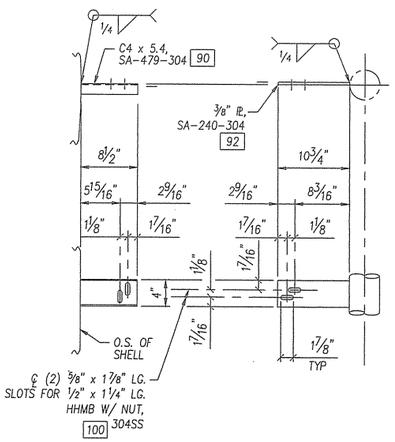
3" PIPE GUIDE DETAIL

ONE (1) SET REQ'D MK "PG-1A"



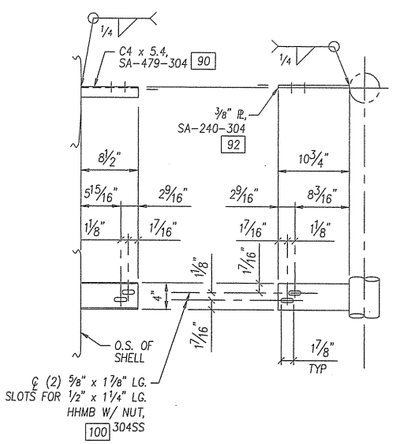
3" PIPE SUPPORT DETAIL

ONE (1) SET REQ'D MK "PS-1"



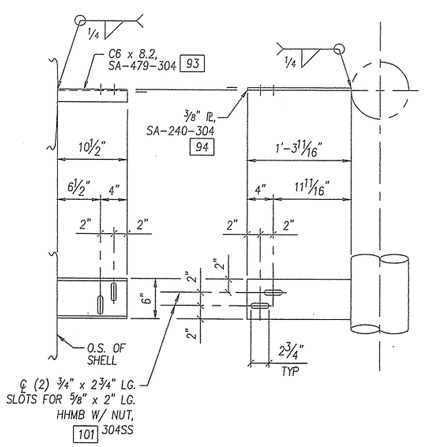
4" PIPE GUIDE DETAIL

TWO (2) SETS REQ'D MK "PG-4"



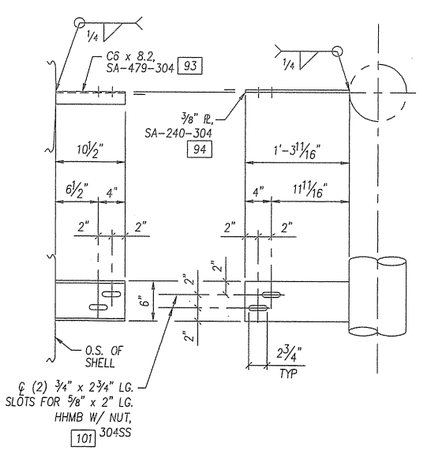
4" PIPE SUPPORT DETAIL

ONE (1) SET REQ'D MK "PS-4"



8" PIPE GUIDE DETAIL

ONE (1) SET REQ'D MK "PG-5"
ONE (1) SET REQ'D MK "PG-6"
TWO (2) SETS REQ'D TOTAL



8" PIPE SUPPORT DETAIL

ONE (1) SET REQ'D MK "PS-5"
ONE (1) SET REQ'D MK "PS-6"
TWO (2) SETS REQ'D TOTAL

APPROVED FOR CONSTRUCTION
2132
RR 11/14/16
CURTIS KELLY, INC.

REFERENCE DRAWINGS	
NUMBER	DESCRIPTION

REVISIONS				
NO.	DESCRIPTION	BY	CHK	DATE
0	ISSUED FOR APPROVAL	MAK	RR	10/13/16

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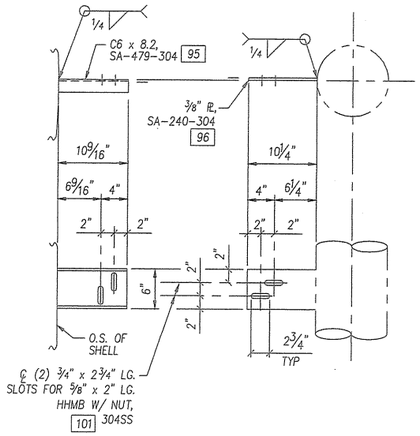
CURTIS KELLY, INC.

HOUSTON, TEXAS

DESCRIPTION : 42" I.D. x 60" I.D. x 98'-0" SEAM / SEAM
DEMETHANIZER
ITEM: T-501

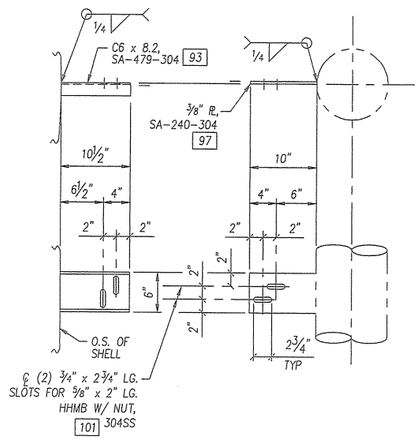
CUSTOMER: UOP RUSSELL LLC
UOP JOB J-447

SCALE : N.T.S.	DATE	P.O. No. : 4500739178	
DRAWN : MAL	10/13/16	FILE No. :	
CHECK : RP	10/13/16	DWG. NO. 2132	SHEET NO. 10 OF 11 / REV. 0
APVD :			



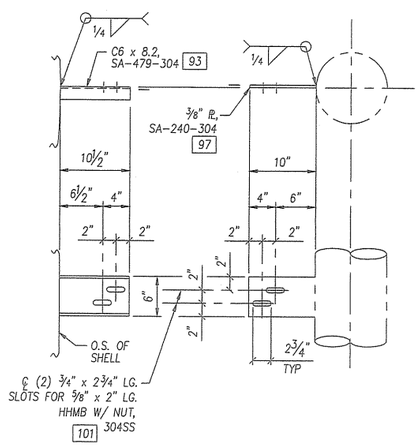
10" PIPE GUIDE DETAIL

THREE (3) SETS REQ'D MK "PG-2"



10" PIPE GUIDE DETAIL

ONE (1) SET REQ'D MK "PG-2A"



10" PIPE SUPPORT DETAIL

ONE (1) SET REQ'D MK "PS-2"

10" PIPE GUIDE DETAIL

TWO (2) SET REQ'D MK "PG-3"

10" PIPE SUPPORT DETAIL

ONE (1) SET REQ'D MK "PS-3"

APPROVED FOR CONSTRUCTION
2132
RR 11/14/16
CURTIS KELLY, INC.

REFERENCE DRAWINGS	
NUMBER	DESCRIPTION

REVISIONS				
NO.	DESCRIPTION	BY	CHK	DATE
0	ISSUED FOR APPROVAL	MAK	RR	10/13/16

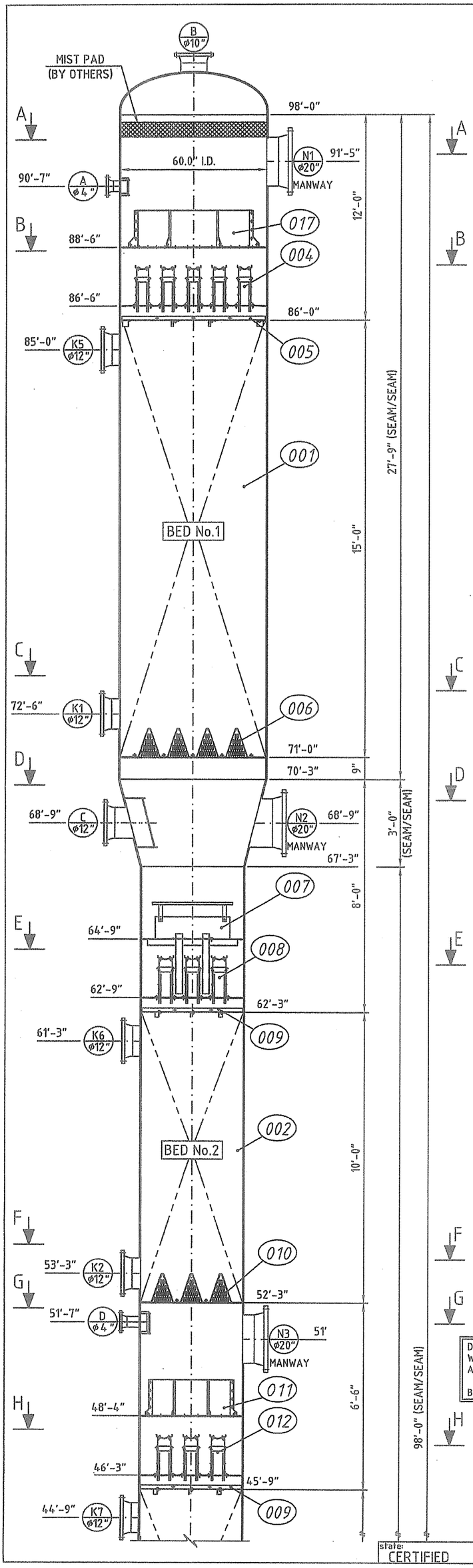
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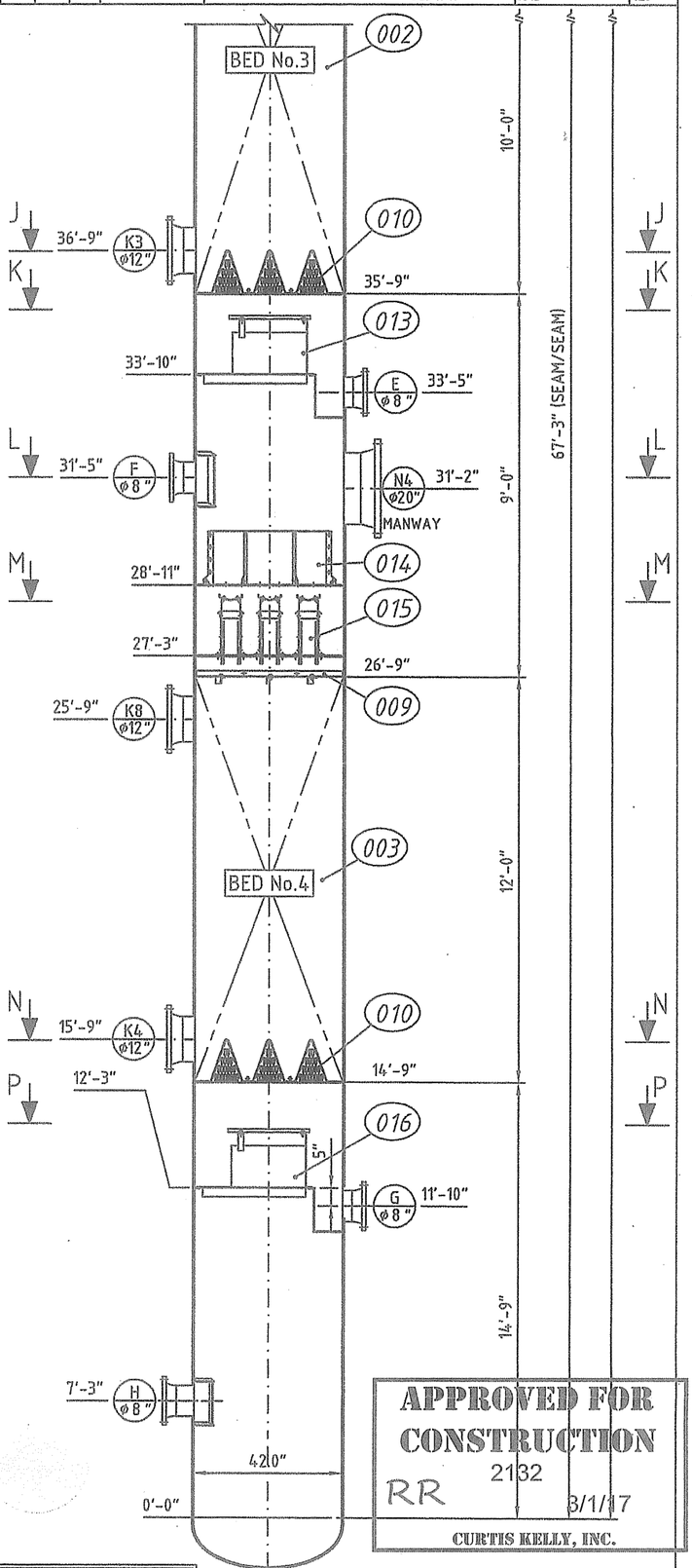
CURTIS KELLY, INC.
HOUSTON, TEXAS

DESCRIPTION: 42" I.D. x 60" I.D. x 98'-0" SEAM / SEAM
DEMETHANIZER
ITEM: T-501

CUSTOMER: UOP RUSSELL LLC
UOP JOB J-447

SCALE : N.T.S.	DATE	P.O. No. : 4500739178	
DRAWN : MAK	10/13/16	FILE No. :	
CHECK : RP	10/13/16	DWG. NO. 2132	SHEET NO. 11 OF 11 / REV. 0
APVD :			





item list								
item	set	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb.]
000	1	–	SET		GENERAL ARRANGEMENT			10000
001	318	–	FT3	203	No.2.0 NEXRINGS PACKING	BEDS No. 1	304	–
002	208	–	FT3	209	No.2.0 NEXRINGS PACKING	BEDS No. 2 & 3	304	–
003	125	–	FT3	216	No.1.5 NEXRINGS PACKING	BEDS No. 4	304	–
004	1	–	SET	SHEET No.04	VSIR DISTRIBUTOR	BED No.1	304L / 316L	400
005	1	–	SET	SHEET No.05	RPB BED LIMITER	BED No.1	304L / 316L	42
006	1	–	SET	SHEET No.06	GIS SUPPORT PLATE	BED No.1	304L	225
007	1	–	SET	SHEET No.07	SKH COLLECTOR TRAY	BED No.2	304L	153.5
008	1	–	SET	SHEET No.08	VSIR DISTRIBUTOR	BED No.2	304L / 316L	187
009	3	–	SETS	SHEET No.09	RPB BED LIMITER	BEDS No.2, 3, & 4	304L	50
010	3	–	SETS	SHEET No.10	GIS SUPPORT PLATE	BEDS No.2, 3, & 4	304L	132
011	1	–	SET	SHEET No.11	SKG GALLERY TRAY	BED No.3	304L	112.5
012	1	–	SET	SHEET No.12	VSIR DISTRIBUTOR	BED No.3	304L / 316L	187
013	1	–	SET	SHEET No.13	SKHW COLLECTOR TRAY	BED No.3	304L	120
014	1	–	SET	SHEET No.14	SKG GALLERY TRAY	BED No.4	304L	112.5
015	1	–	SET	SHEET No.15	VSIR DISTRIBUTOR	BED No.4	304L / 316L	187
016	1	–	SET	SHEET No.16	SKHW COLLECTOR TRAY	BED No.4	304L	120
017	1	–	SET	SHEET No.03	SKG GALLERY TRAY	BED No.1	304L	126

APPROVED FOR CONSTRUCTION
2132
RR 3/1/17
CURTIS KELLY, INC.

DUPLICATE OF SULZER JOB No.9018614-02 WITH THE FOLLOWING CHANGES:
A. PACKING TYPE CHANGED TO NEXRING (WAS NUTTER RING)
B. ITEM 009 WIRE CLOTH SIZE CHANGED.

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH SHEETS No.02 & 02a.

rev.	revision remarks	issued by	date	checked	date	approved	date
1	CERTIFIED ISSUE	TSa	2/17/17	RBo	2/17/17	DMi	2/17/17
0	ORIGINAL ISSUE	DMc	1/6/17	RBo	1/9/17	DMi	1/9/17

job no.: N/A	SULZER project no.: 9033982-02	size: 11x17	scale: %
col ID: 60.0" / 42.0"	customer: UOP RUSSELL LLC.	customer p.o.:	4500753897
col item: T-501	plant:	customer dwg.:	
bed: No.1 thru No.4	area:	ACAD 2002	

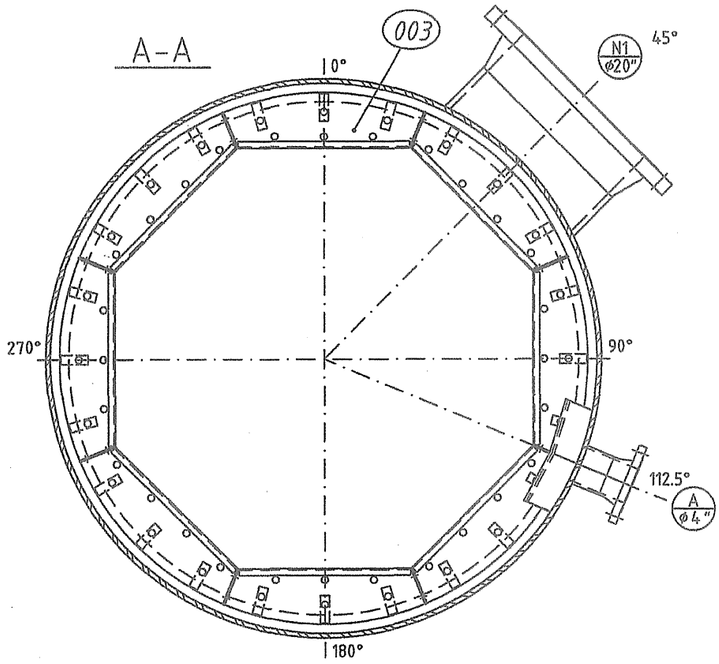
SULZER

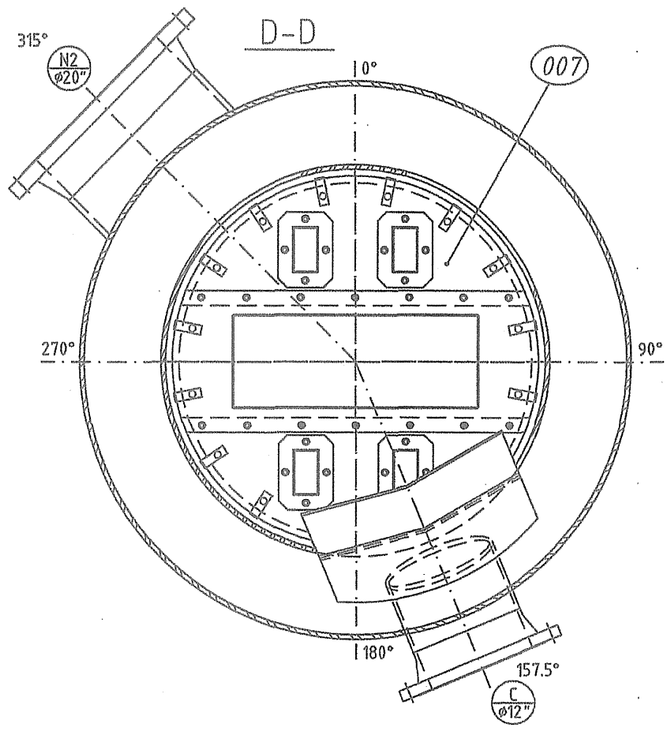
GENERAL ARRANGEMENT
DEMETHANIZER TOWER

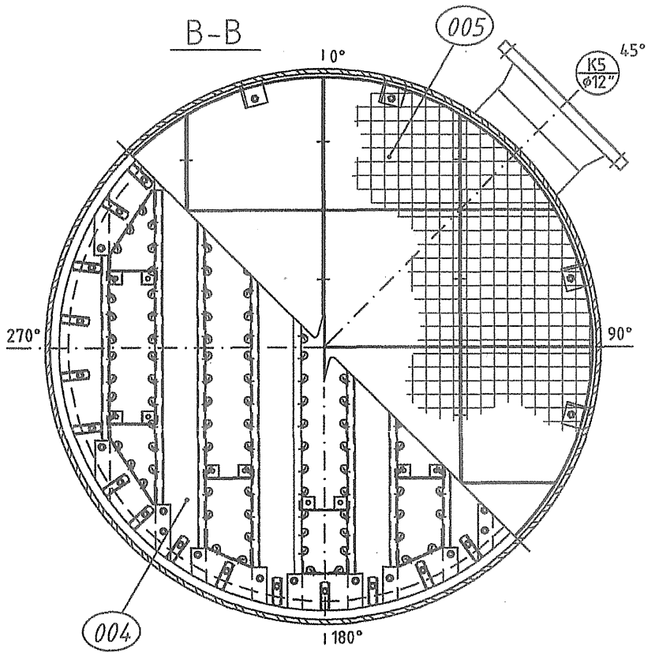
drawing no.: 9033982-02 sheet no.: 01

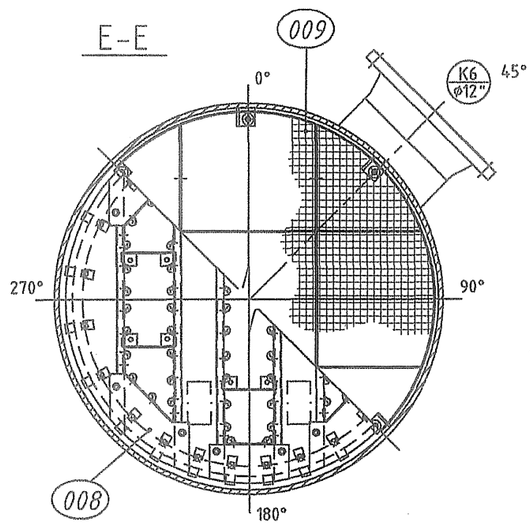
state: CERTIFIED

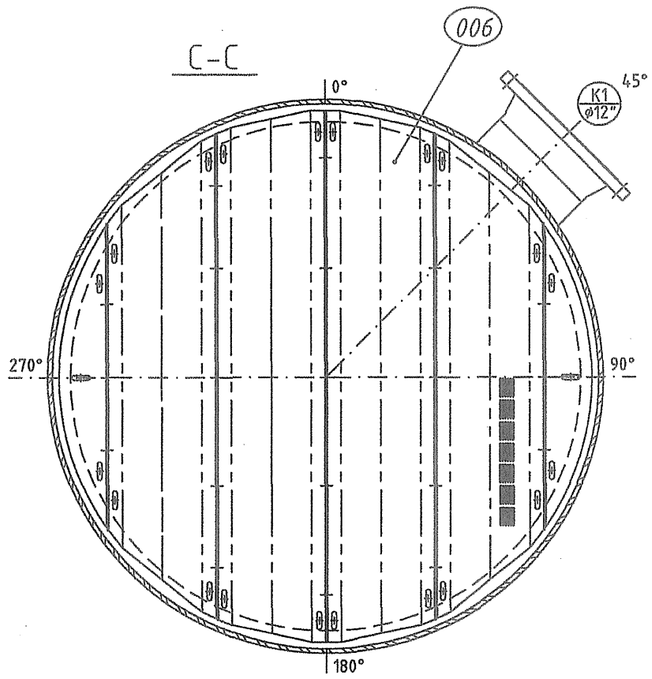
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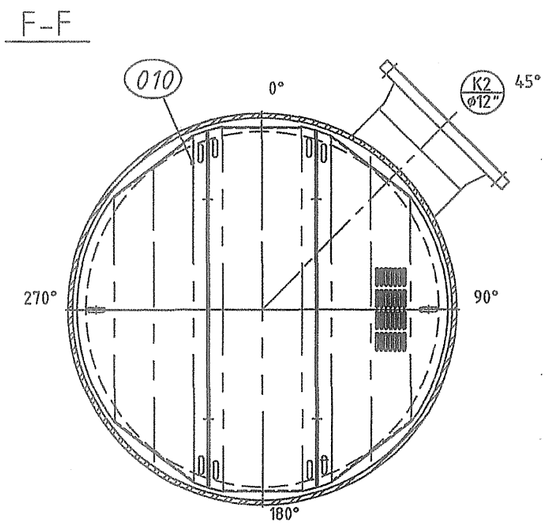












THIS DRAWING IS TO BE READ IN CONJUNCTION WITH SHEET No.01.

rev.	revision remarks	issued by	date	checked	date	approved	date
1	CERTIFIED ISSUE	TSa	2/17/17	RBo	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BMc	1/6/17	RBo	1/9/17	DWi	1/9/17

job no.: N/A	SULZER project no.: 9033982-02	size: 11x17	scale: %
col ID: 60.0" / 42.0"	customer: UOP RUSSELL LLC.	customer p.o.:	4500753897
col item: T-501	plant:	customer dwg.:	
bed: No.1 and No.2	area:	ACAD 2002	

SULZER

ORIENTATIONS

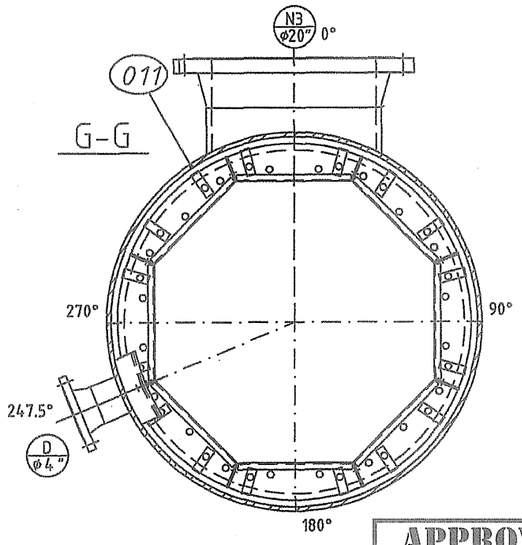
DEMETHANIZER TOWER (BEDS No.1 & 2)

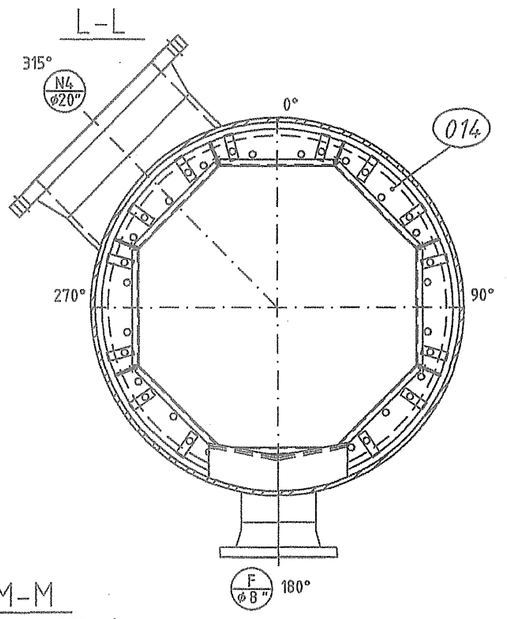
drawing no.: 9033982-02 sheet no.: 02

APPROVED FOR CONSTRUCTION
2132
RR 3/1/17
CURTIS KELLY, INC.

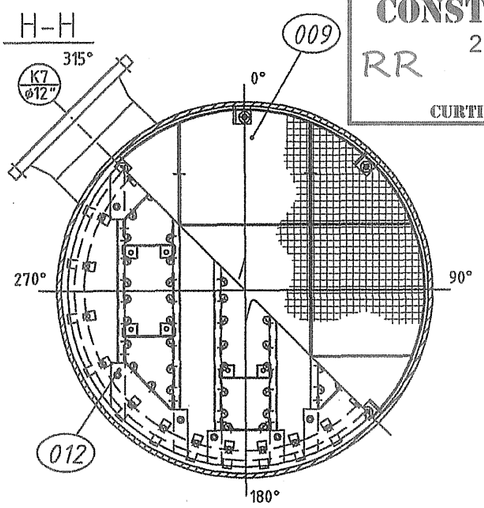
state: CERTIFIED

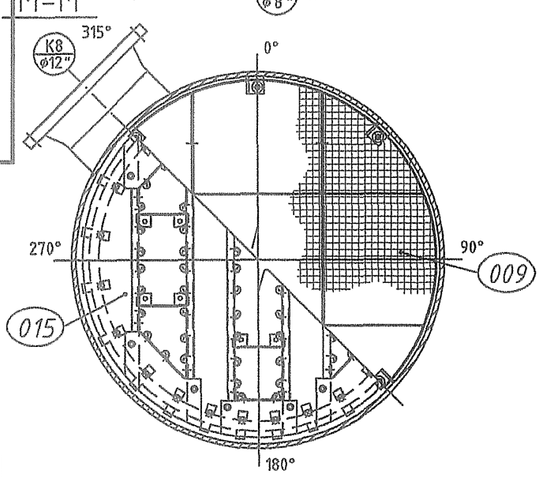
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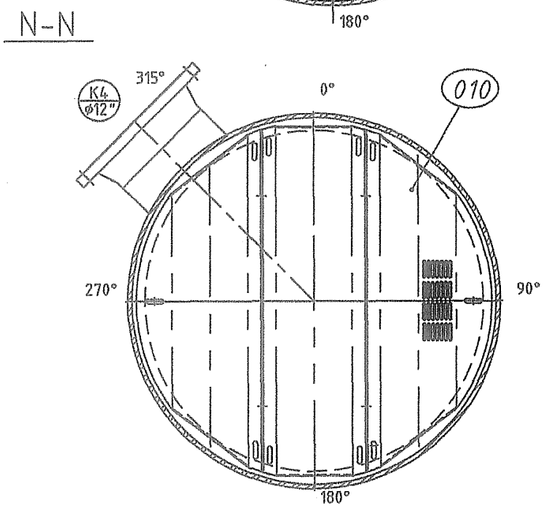


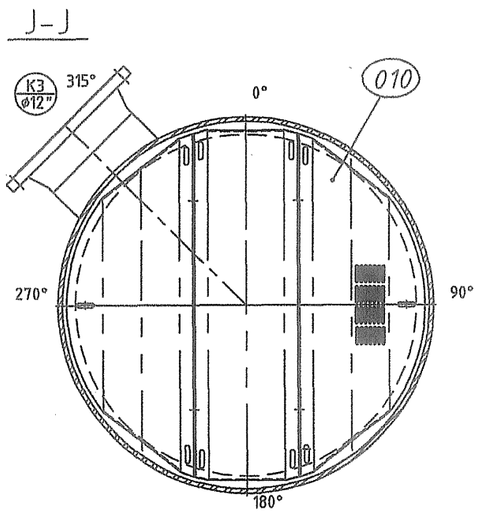


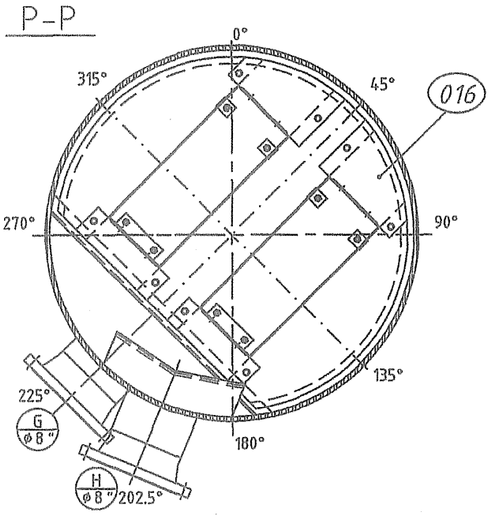
APPROVED FOR CONSTRUCTION
2132
RR 3/1/17
CURTIS KELLY, INC.

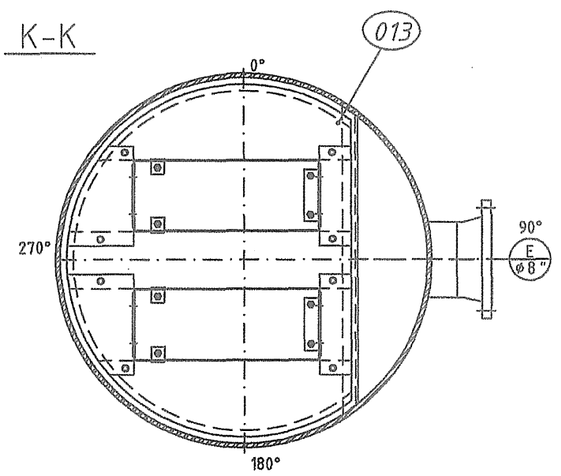












THIS DRAWING IS TO BE READ IN CONJUNCTION WITH SHEET No.01.

rev.	revision remarks	issued by	date	checked	date	approved	date
1	CERTIFIED ISSUE	TSa	2/11/11	RBo	2/11/11	DVi	2/11/11
0	ORIGINAL ISSUE	BHc	1/6/11	RBo	1/9/11	DVi	1/9/11

job no.: N/A	SULZER project no.: 9033982-02	size: 11x17	scale: %
col ID: 42.0"	customer: UOP RUSSELL LLC.	customer p.o.: 4500753897	
col item: T-501	plant:	customer dwg.:	
bed: No.3 and No.4	area:	ACAD 2002	

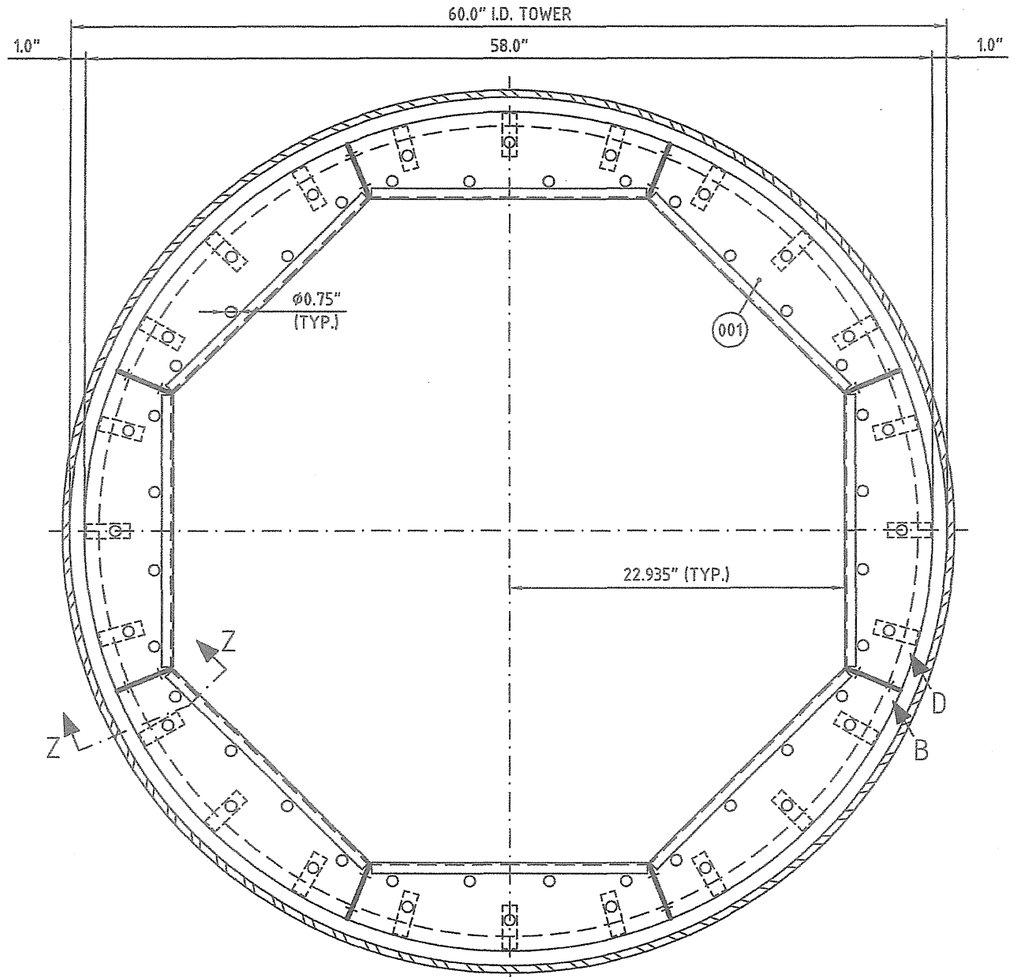
SULZER

ORIENTATIONS
DEMETHANIZER TOWER (BEDS No.3 & 4)

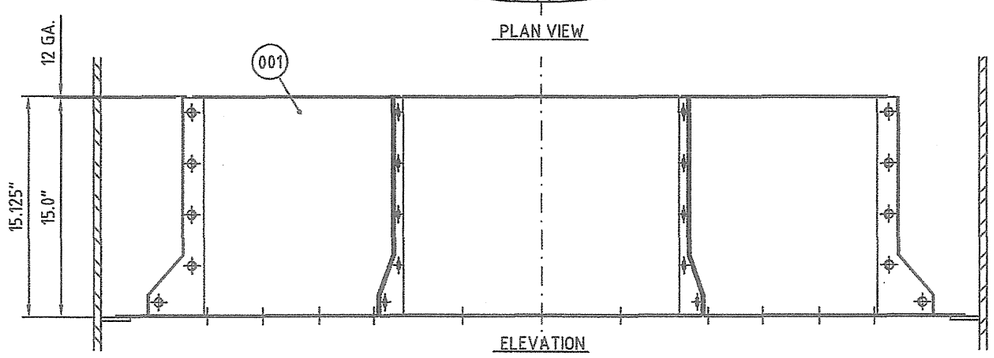
drawing no.: 9033982-02 sheet no.: 02a

state: CERTIFIED

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PLAN VIEW



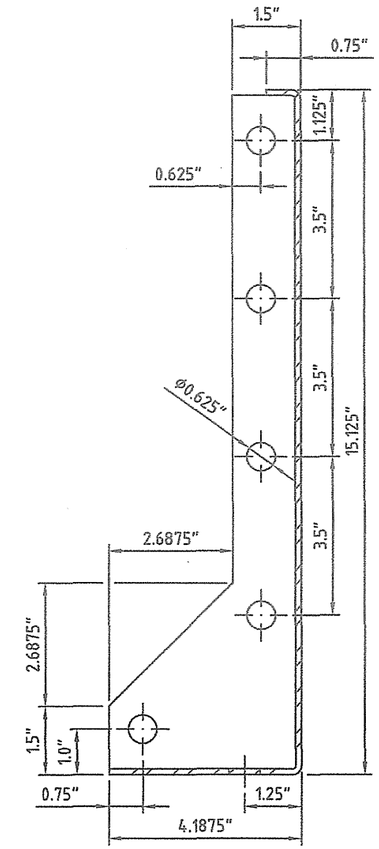
ELEVATION

APPROVED FOR CONSTRUCTION
2132
RR 3/1/17
CURTIS KELLY, INC.

item list

item	qty.	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb.]
000	1	–	set		SKG GALLERY TRAY	BED No.1	304L	126
001	8	–	pcs.		SKG SEGMENT		304L	
002	40	4	pcs.		HEX HEAD CAPSCREW - 3/8"-16 UNC x 1 1/4" LONG		304L	0.0485
003	104	10	pcs.		WASHER - 7/16" I.D. x 1 1/4" O.D.		304L	0.0331
004	24	3	pcs.		UNIVERSAL CLAMP - TWO WAY		304L	0.1900
005	24	2	pcs.		SQUARE STUD - 3/8"-16 x 2 1/2" LONG		304L	0.0610
006	88	9	pcs.		NUT - 3/8"-16 UNC HEX		304L	0.0160
100	25.4	–	ft2		SHEET - 12 GA.		304L	4.427

001 - 099: parts / 100 - 199: materials



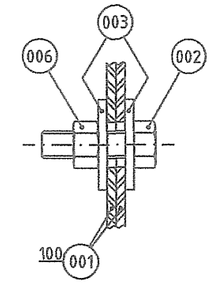
SECTION "Z-Z"

Gallery Tray Data

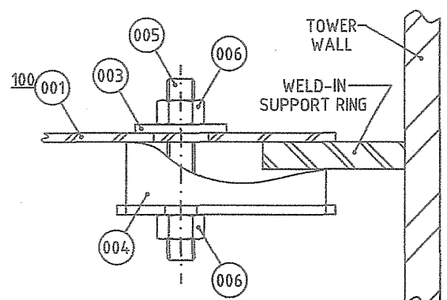
DN Inlet Tube	4.0 / 101.6 [in] / [mm] W/Feed Baffle
Number of Inlet Pipes	1 [-]
Number of Orifices	32 [-]
Orifice size:	0.75 / 19.05 [in] / [mm]

Flow Rates:

	Flow [gpm] / [m3/h]	levels above orifice [in] / [mm]
min.	13.7/3.1	0.03/1
max.	186.6/42.3	6.9/175



DETAIL "B"



DETAIL "D"

GENERAL NOTES
All parts shall pass through man ways:17.25" I.D.
All components are marked by SULZER.
The assembled part is checked after manufact.

state: CERTIFIED

rev.	revision remarks	issued by	date	checked	date	approved	date
1	CERTIFIED ISSUE	TSa	2/17/17	RBo	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BMc	1/6/17	RBo	1/9/17	DWi	1/9/17

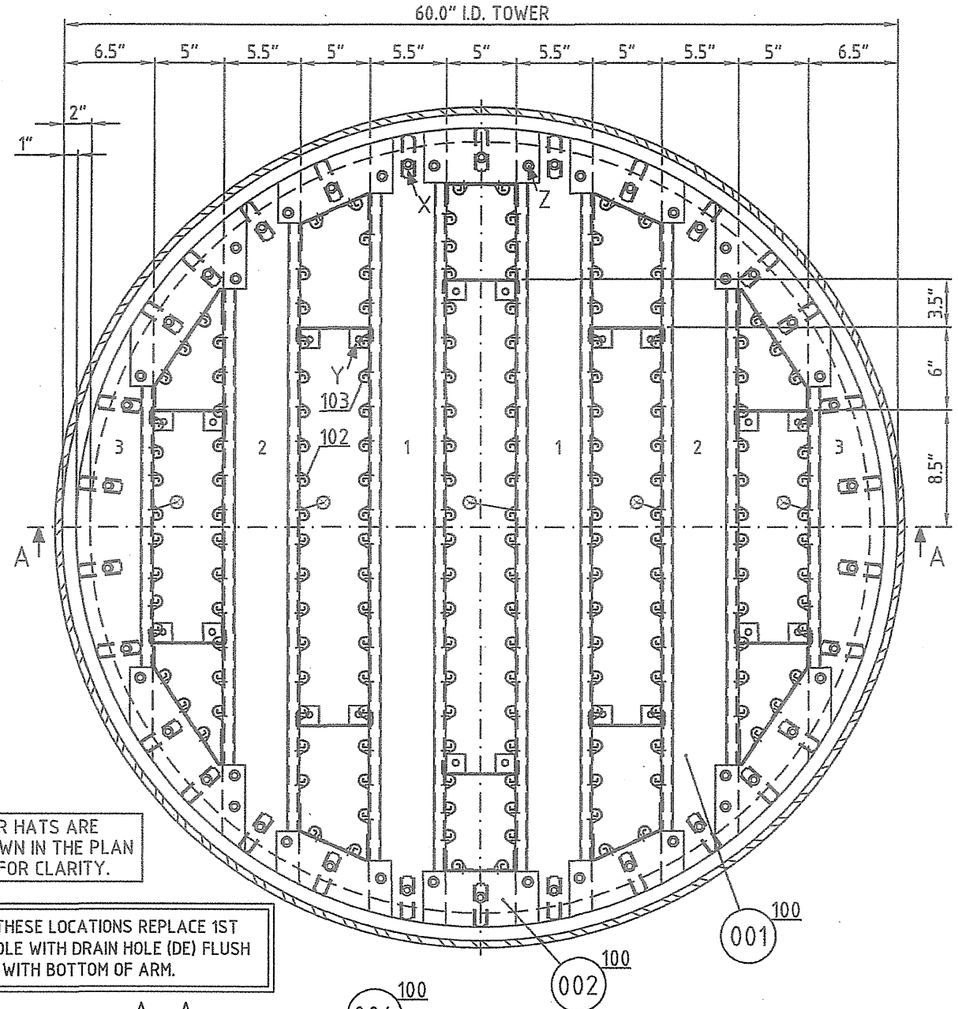
job no.: -205	SULZER project no.: 9033982-02	size: 11x17	scale: %
col.-I.D.: 60.0"	customer: UOP RUSSELL LLC.	customer p.o.: 4500753897	
col item: T-501	plant:	customer-dwg.:	
bed: No.1	area:	ACAD 2002	

SULZER

SKG GALLERY TRAY
DEMETHANIZER TOWER (BED No.1)

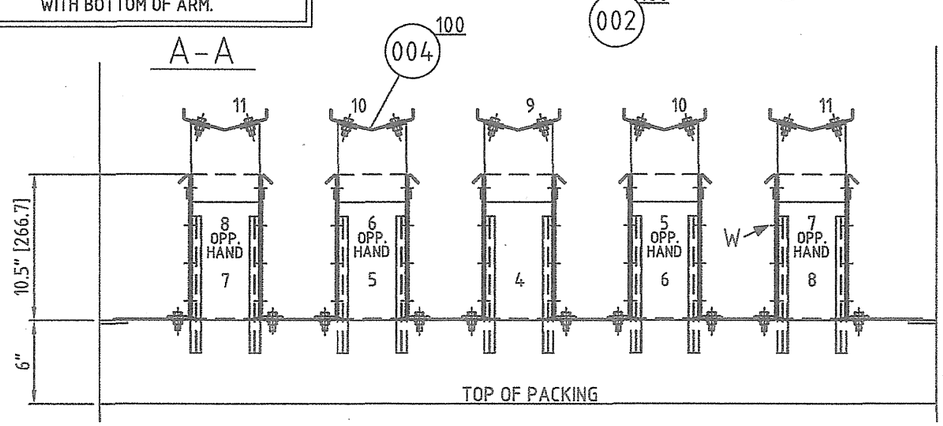
drawing no.: 9033982-02 sheet no.: 03

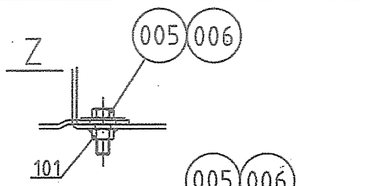
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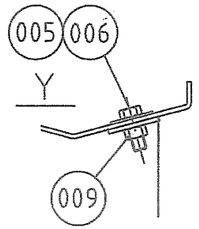


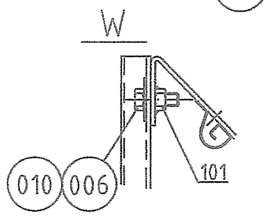
RISER HATS ARE NOT SHOWN IN THE PLAN VIEW FOR CLARITY.

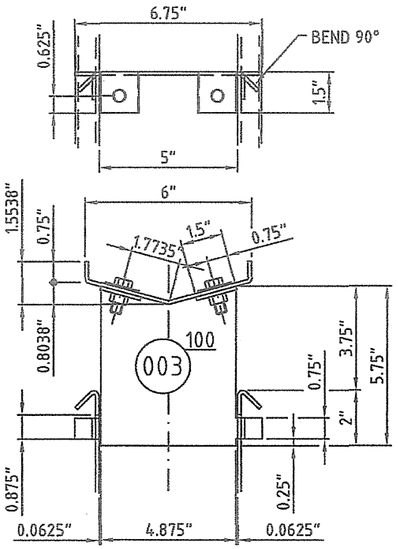
⊗AT THESE LOCATIONS REPLACE 1ST STAGE HOLE WITH DRAIN HOLE (DE) FLUSH WITH BOTTOM OF ARM.







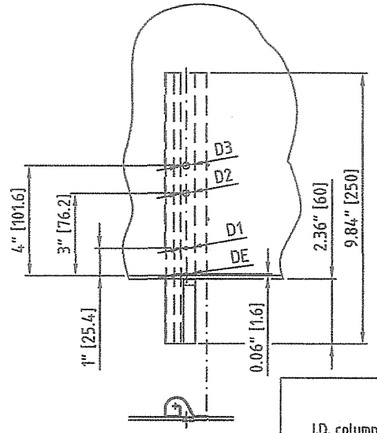




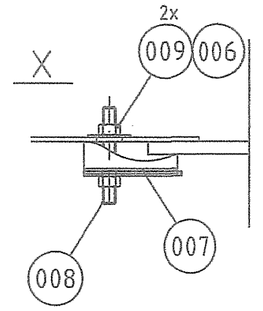
RISER HAT BRACKET MUST BE INSTALLED DURING RISER INSTALLATION.

item list								
item	qty	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb]
000	1	–	set		VSIR DISTRIBUTOR	BED No.1	304L / 316L	400
001	6	–	pcs.		ARM CHANNELS	2 x No. 1-3	304L / 316L	
002	10	–	pcs.		END PANELS	2 x No. 4-8	304L / 316L	
003	10	–	pcs.		HAT BRACKET		304L	
004	5	–	pcs.		RISER HAT	1 x No. 9 / 2 x No. 10-11	304L	
005	44	4	pcs.		HEX HEAD CAPSCREW – 3/8"-16 x 1 1/4" LONG		304L	0.0485
006	154	15	pcs.		WASHER – 7/16" I.D. x 1 1/4" O.D.		304L	0.0331
007	30	3	pcs.		UNIVERSAL CLAMP – TWO WAY		304L	0.1900
008	30	3	pcs.		SQUARE STUD – 3/8"-16 x 2 1/2" LONG		304L	0.0610
009	80	8	pcs.		NUT – 3/8"-16 UNC HEX		304L	0.0160
010	80	8	pcs.		HEX HEAD CAPSCREW – 3/8"-16 x 3/4" LONG		304L	0.0355
100	68	–	ft2		SHEET – 12 GA.		304L	4.427
101	104	–	pcs.		NUT – 3/8"-16 HEAVY HEX	TACKWELDED	304L	0.0314
102	86	–	pcs.		CURL TUBE – LEFT	L = 9.8425" [250mm]	316L	0.4500
103	86	–	pcs.		CURL TUBE – RIGHT	L = 9.8425" [250mm]	316L	0.4500

001 – 099: parts / 100 – 199: materials



ORIFICE DETAIL



Distributor Data

I.D. column	60 / 1067 [in] / [mm]
I.D. manway	17.25 / 438 [in] / [mm]
Number of drip points	172 [–]
Distribution density	7.4 / 80 [1/ft2] / [1/m2]
Orifice size: D3	0.236 / 6.0 [in] / [mm]
Orifice size: D2	0.236 / 6.0 [in] / [mm]
Orifice size: D1	0.110 / 2.8 [in] / [mm]
Drain size: DE	0.098 / 2.5 [in] / [mm]

CASE	Flow [gpm] / [m3/h]	Load [gpm/ft^2] / [m3/m2h]	levels above orifice [in] / [mm]
Min.	13.7/3.1	0.70/1.70	1.77/45
Max.	186.6/42.4	9.50/23.24	7.44/189

APPROVED FOR CONSTRUCTION
2132
RR 3/1/17
CURTIS KELLY, INC.

GENERAL NOTES
All parts shall pass through man ways: 17.25" I.D.
All components are marked by SULZER.
The assembled part is checked after manufact.

rev.	revision remarks	issued by	date	checked	date	approved	date
1	CERTIFIED ISSUE	TSa	2/17/17	RBo	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BMc	1/6/17	RBo	1/9/17	DWi	1/9/17

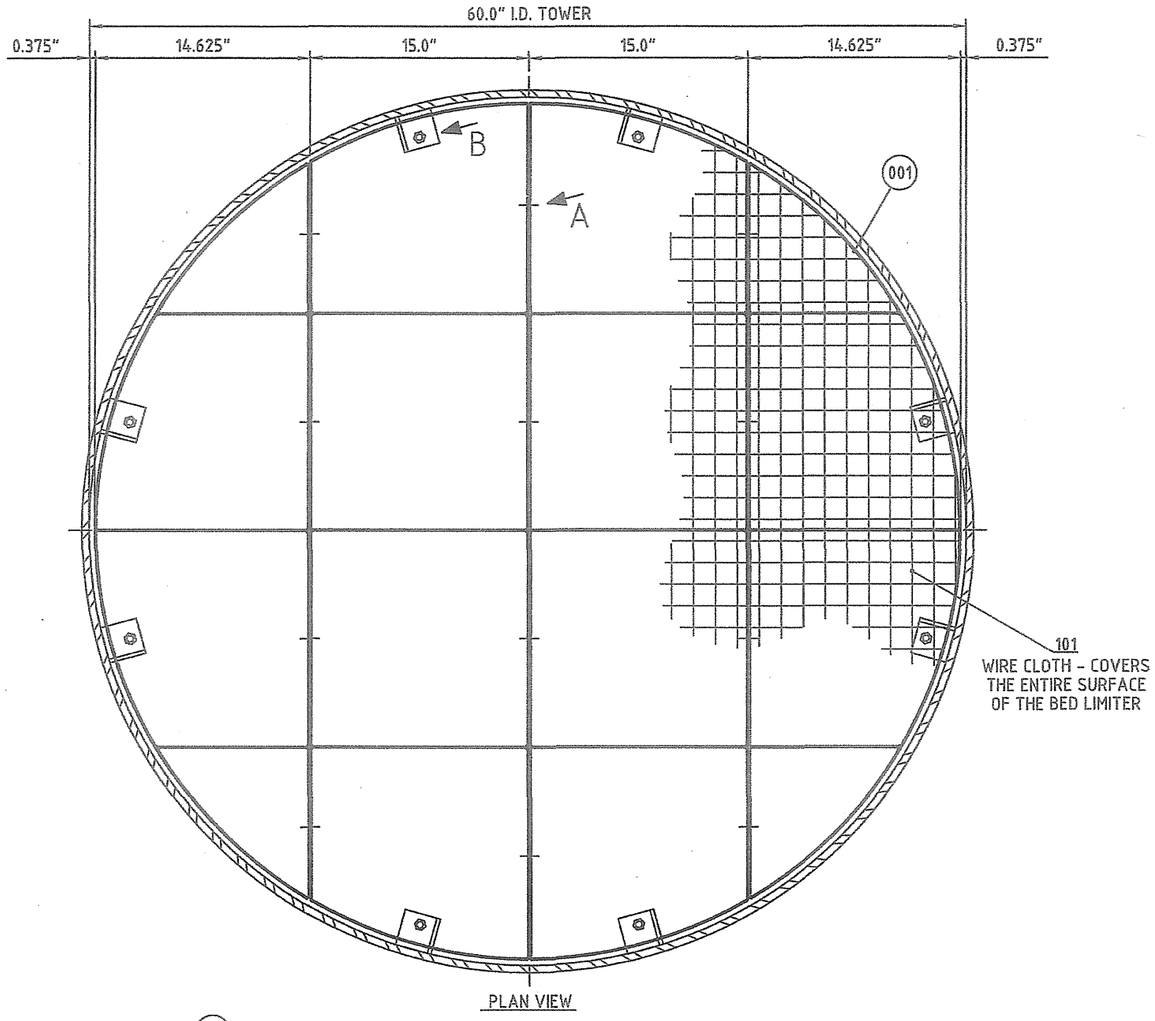
job no.: -204	SULZER project no.: 9033982-02	size: 11x17	scale: %
col ID: 60.0"	customer: UOP RUSSELL LLC.	customer p.o.: 4500753897	
col item: T-501	plant:	customer-dwg.:	
bed: No.1	area:	ACAD 2002	
SULZER	VSIR DISTRIBUTOR DEMETHANIZER TOWER (BED No.1)	drawing no.: 9033982-02	sheet no.: 04

state: CERTIFIED

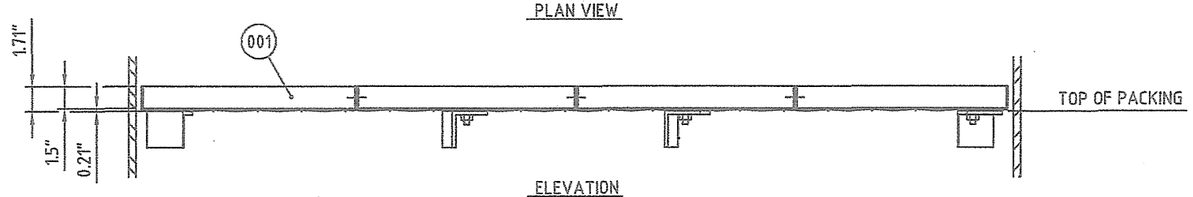
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item list								
item	qty.	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb.]
000	1	–	set		RPB BED LIMITER	BED No.1	304L / 316L	42
001	4	–	pcs.		RPB BED LIMITER PANEL		304L / 316L	
002	20	3	pcs.		HEX HEAD CAPSCREW – 3/8"-16 x 1 1/4" LONG		304L	0.0485
003	24	3	pcs.		WASHER – 7/16" I.D. x 1 1/4" O.D.		304L	0.0331
004	12	2	pcs.		NUT – 3/8"-16 HEX		304L	0.0160
005	8	2	pcs.		WASHER – 7/16" I.D. x 2" O.D.		304L	0.0820
100	6.95	–	ft2		SHEET – 12 GA.		304L	4.427
101	19.2	–	ft2		WIRE CLOTH- 0.75" x 0.75" x 0.08" ø		316L	0.4039

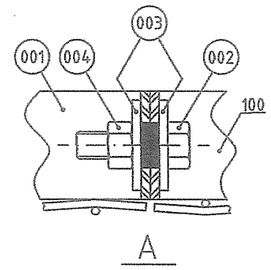
001 – 099: parts / 100 – 199: materials



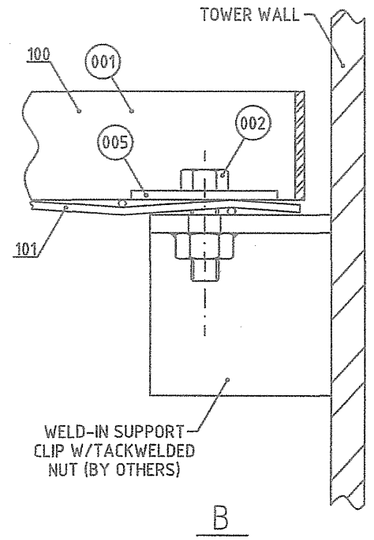
PLAN VIEW



ELEVATION



A



B

APPROVED FOR CONSTRUCTION
2132
RR 3/1/17
CURTIS KELLY, INC.

rev.	revision remarks	issued by	date	checked	date	approved	date
1	CERTIFIED ISSUE	TSa	2/17/17	RBo	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BMc	1/6/17	RBo	1/9/17	DWi	1/9/17

job no.: –207	SULZER project no.: 9033982-02	size: 11x17	scale: %
col I.D.: 60.0"	customer: UOP RUSSELL LLC.	customer p.o.: 4500753897	
col item: T-501	plant:	customer-dwg.:	
bed: No.1	area:	ACAD 2002	

SULZER

RPB BED LIMITER
DEMETHANIZER TOWER (BED No.1)

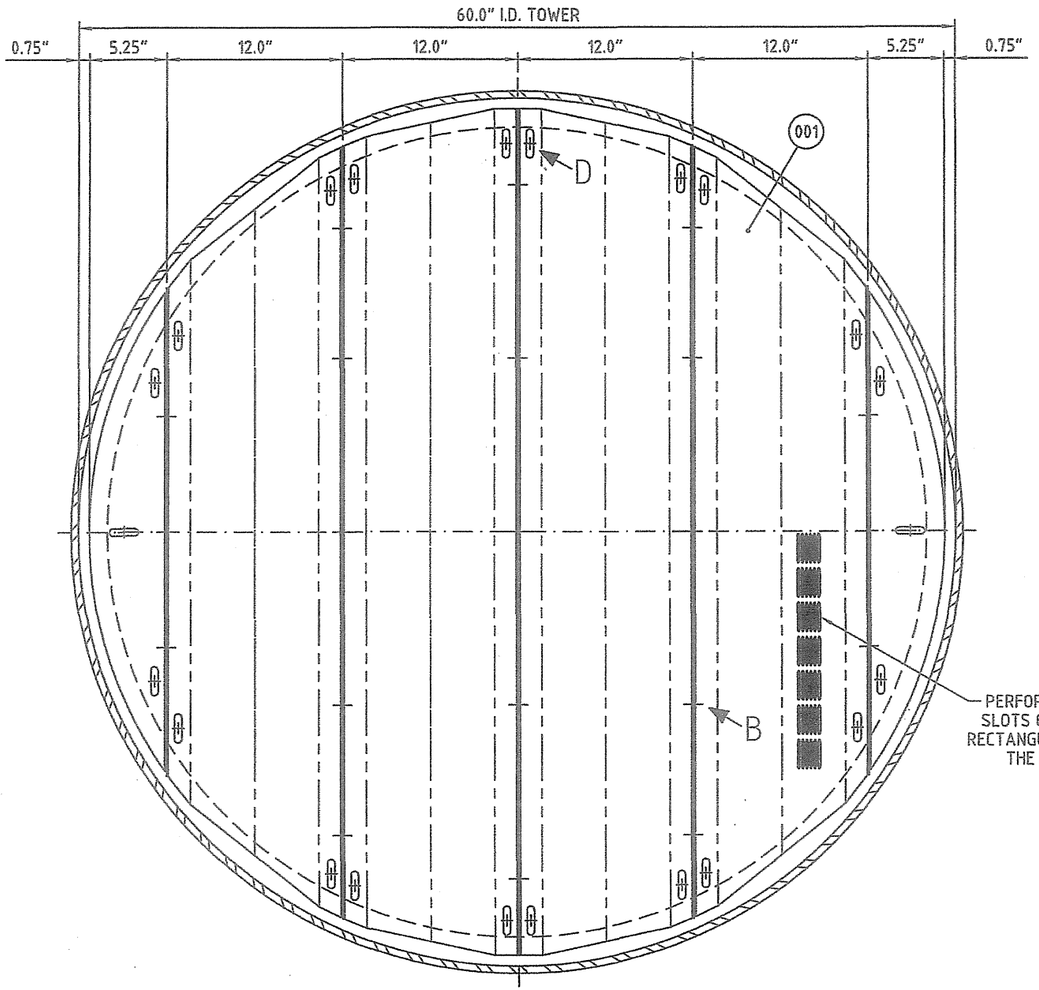
drawing no.: 9033982-02 sheet no.: 05

GENERAL NOTES

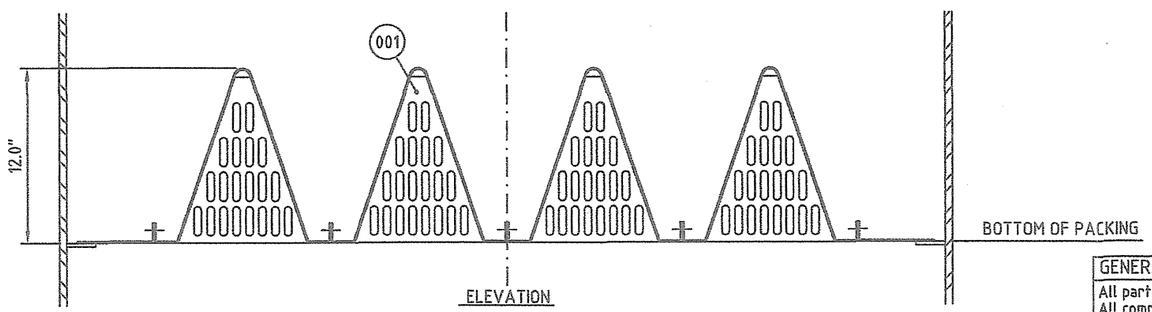
All parts shall pass through man ways:17.25" I.D.
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state: CERTIFIED

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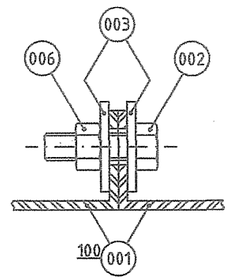
PLAN VIEW



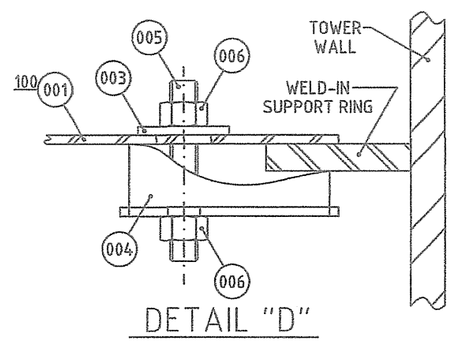
ELEVATION

item list							
item	qty.	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb.]
000	1	–	set		GIS SUPPORT PLATE	BED No.1	304L	225
001	6	–	pcs.		GIS SUPPORT PLATE PANEL		304L	
002	21	3	pcs.		HEX HEAD CAPSCREW - 3/8"-16 x 1 1/4" LONG		304L	0.0485
003	64	6	pcs.		WASHER - 7/16" I.D. x 1 1/4" O.D.		304L	0.0331
004	22	3	pcs.		UNIVERSAL CLAMP - TWO WAY		304L	0.1900
005	22	2	pcs.		SQUARE STUD - 3/8"-16 x 2 1/2" LONG		304L	0.0610
006	65	7	pcs.		NUT - 3/8"-16 HEX		304L	0.0160
100	48.5	–	ft2		SHEET - 12 GA.		304L	4.427

001 - 099: parts / 100 - 199: materials



DETAIL "B"



DETAIL "D"

APPROVED FOR CONSTRUCTION
2132
RR 3/1/17
CURTIS KELLY, INC.

GENERAL NOTES
All parts shall pass through man ways:17.25" I.D.
All components are marked by SULZER.
The assembled part is checked after manufact.

state: CERTIFIED

rev.	revision remarks	issued by	date	checked	date	approved	date
1	CERTIFIED ISSUE	TSa	2/17/17	RBo	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BMc	1/6/17	RBo	1/9/17	DWi	1/9/17

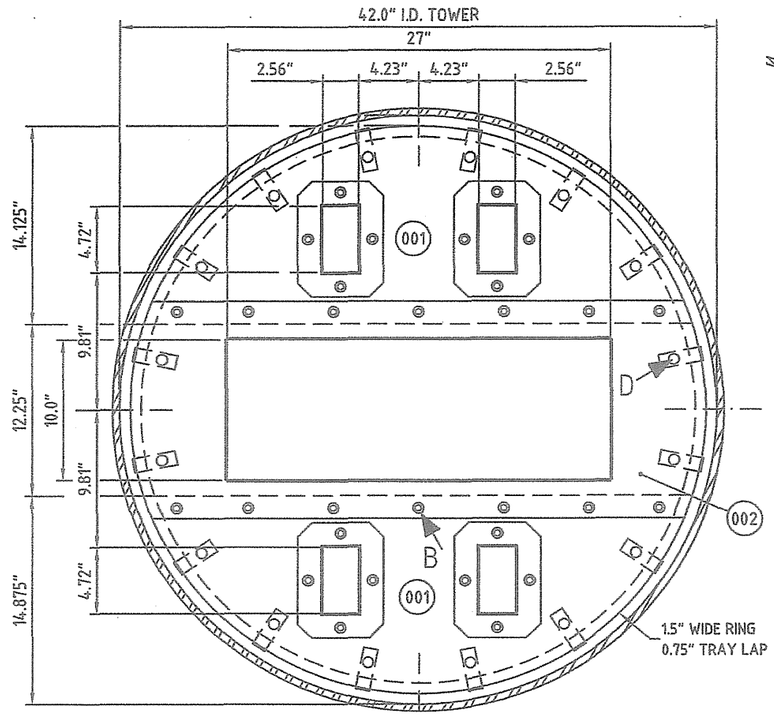
job no.: -206	SULZER project no.: 9033982-02		size: 11x17	scale: %
col.-I.D.: 60.0"	customer: UOP RUSSELL LLC.	customer p.o.: 4500753897		
col item: T-501	plant:	customer-dwg.:		
bed: No.1	area:	ACAD 2002		

SULZER

GIS SUPPORT PLATE
DEMETHANIZER TOWER (BED No.1)

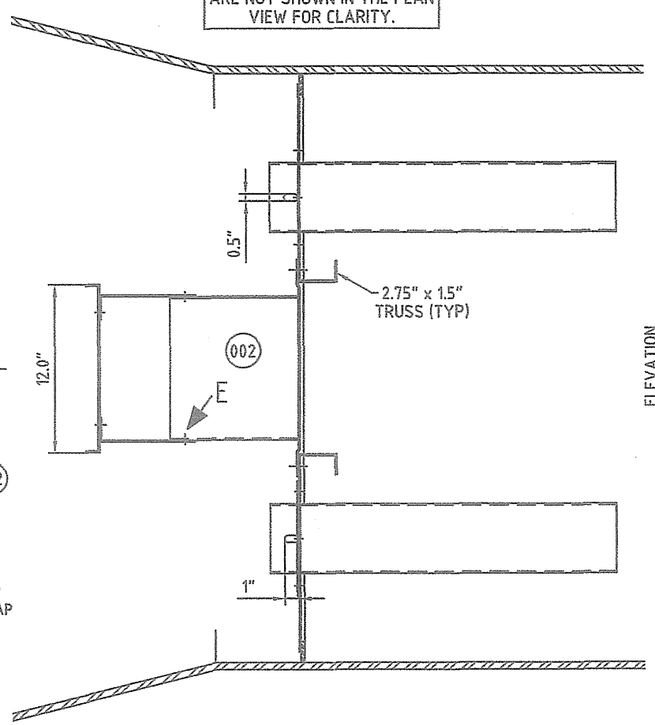
drawing no.: 9033982-02 sheet no.: 06

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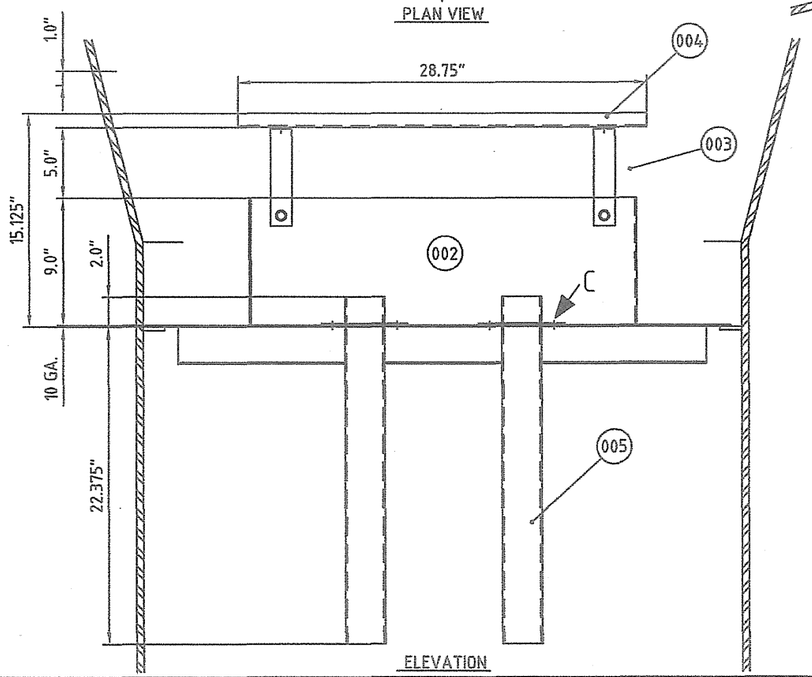


PLAN VIEW

RISER HAT AND SUPPORTS ARE NOT SHOWN IN THE PLAN VIEW FOR CLARITY.



ELEVATION

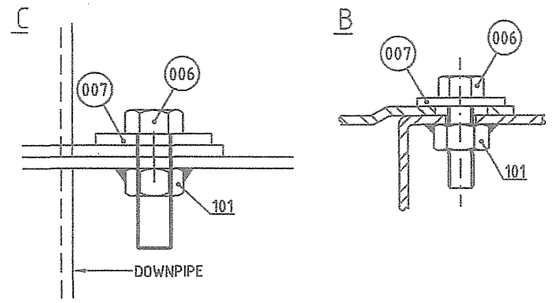


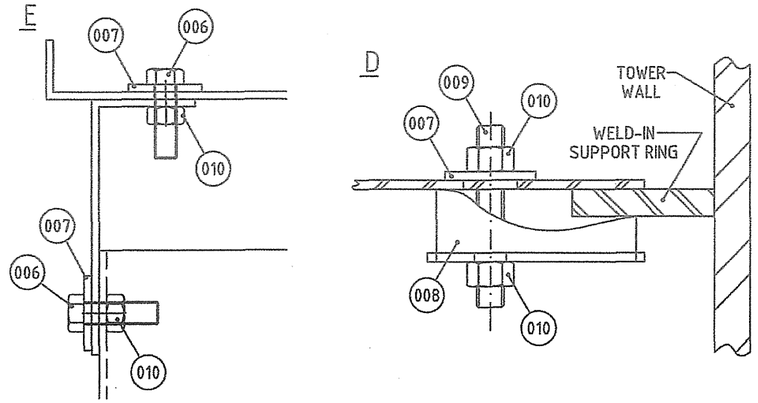
ELEVATION

item list							
item	qty.	spare	unit	drawing- or part-no.	description / remarks	material	wght. [lb.]
000	1	–	set		SKH COLLECTOR TRAY BED No.2	304L	153.5
001	2	–	pcs.		SKH COLLECTOR TRAY PANEL	304L	
002	1	–	pcs.		SKH COLLECTOR TRAY PANEL WITH RISER	304L	
003	4	–	pcs.		HAT SUPPORT	304L	
004	1	–	pcs.		RISER HAT	304L	
005	4	–	pcs.		DOWNPIPE WITH PLATE FLANGE	304L	
006	38	4	pcs.		HEX HEAD CAPSCREW – 3/8"-16 UNC x 1 1/4" LONG	304L	0.0485
007	54	5	pcs.		WASHER – 7/16" I.D. x 1 1/4" O.D.	304L	0.0331
008	16	2	pcs.		UNIVERSAL CLAMP – TWO WAY	304L	0.1900
009	16	2	pcs.		SQUARE STUD – 3/8"-16 x 2 1/2" LONG	304L	0.0610
010	40	4	pcs.		NUT – 3/8"-16 HEX	304L	0.0160
100	27	–	ft2		SHEET – 10 GA.	304L	5.670
101	30	–	pcs.		NUT – 3/8"-16 HEAVY HEX TACKWELDED	304L	0.0314

001 – 099: parts / 100 – 199: materials

NOTE: MATERIAL FOR ALL PARTS TO BE 10GA.(MK. 100) EXCEPT AS NOTED.





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RR 3/1/17
CURTIS KELLY, INC.

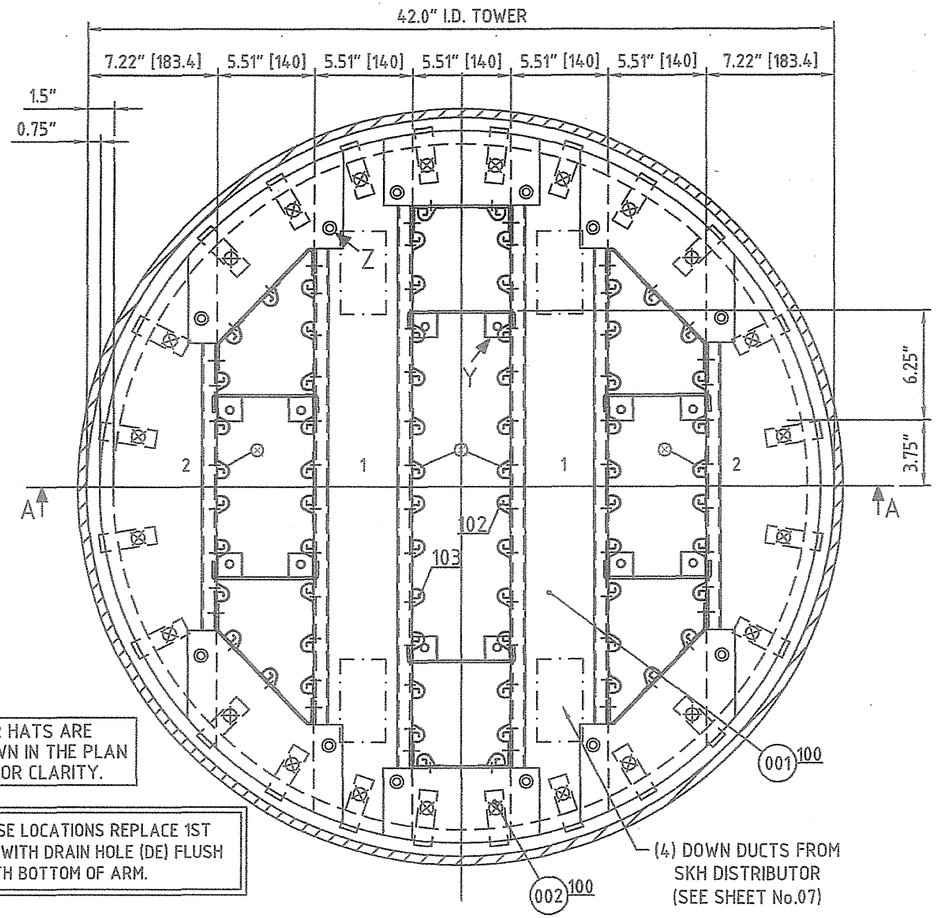
GENERAL NOTES
All parts shall pass through man ways:17.25" I.D.
All components are marked by SULZER.
The assembled part is checked after manufact.

state: CERTIFIED

rev.	revision remarks	issued by	date	checked	date	approved	date
1	CERTIFIED ISSUE	TSa	2/17/17	RBo	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BHc	1/6/17	RBo	1/9/17	DWi	1/9/17

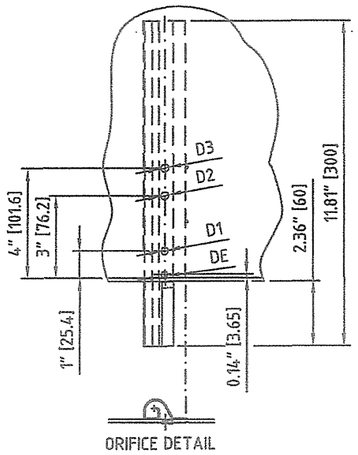
job no.: -210	SULZER project no.: 9033982-02	size: 11x17	scale: %
col.-I.D.: 42.0"	customer: UOP RUSSELL LLC.	customer p.o.: 4500753897	
col item: T-501	plant:	customer-dwg.:	
bed: No.2	area:	ACAD 2002	
SULZER	SKH COLLECTOR TRAY DEMETHANIZER TOWER (BED No.2)	drawing no.: 9033982-02	sheet no.: 07

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RISER HATS ARE NOT SHOWN IN THE PLAN VIEW FOR CLARITY.

⊗AT THESE LOCATIONS REPLACE 1ST STAGE HOLE WITH DRAIN HOLE (DE) FLUSH WITH BOTTOM OF ARM.

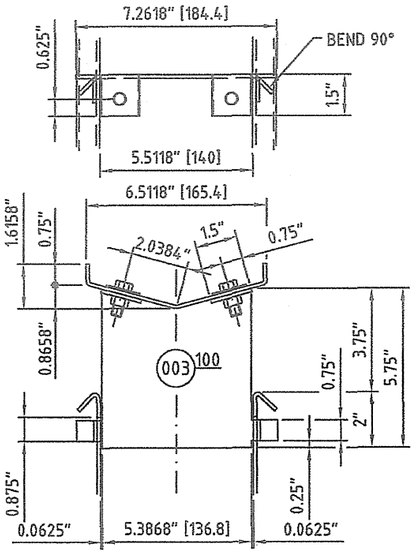


ORIFICE DETAIL

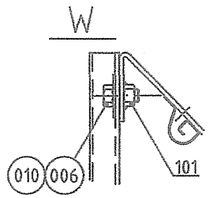
item list

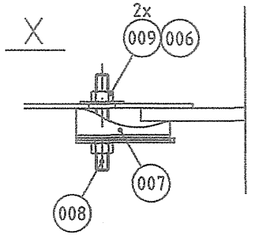
item	qty	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb]
000	1	–	set		VSIR DISTRIBUTOR	BED No.2	304L / 316L	187
001	4	–	pcs.		ARM CHANNELS	2 x No.1-2	304L / 316L	
002	6	–	pcs.		END PANELS	2 x No.3-5	304L / 316L	
003	6	–	pcs.		HAT BRACKET		304L	
004	3	–	pcs.		RISER HAT	1 x No.6 / 2 x No.7	304L	
005	24	3	pcs.		HEX HEAD CAPSCREW – 3/8"-16 x 1 1/4" LONG		304L	0.0485
006	108	11	pcs.		WASHER – 7/16" I.D. x 1 1/4" O.D.		304L	0.0331
007	24	3	pcs.		UNIVERSAL CLAMP – TWO WAY		304L	0.1900
008	24	3	pcs.		SQUARE STUD – 3/8"-16 x 2 1/2" LONG		304L	0.0610
009	60	6	pcs.		NUT – 3/8"-16 HEX		304L	0.0160
010	60	6	pcs.		HEX HEAD CAPSCREW – 3/8"-16 x 3/4" LONG		304L	0.0355
100	32	–	ft2		SHEET – 12 GA.		304L	4.427
101	72	–	pcs.		NUT – 3/8"-16 HEAVY HEX	TACKWELDED	304L	0.0314
102	34	–	pcs.		CURL TUBE – LEFT	L = 11.81" [300mm]	316L	0.5250
103	34	–	pcs.		CURL TUBE – RIGHT	L = 11.81" [300mm]	316L	0.5250

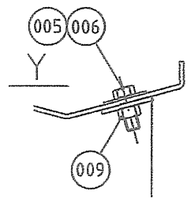
001 – 099: parts / 100 – 199: materials

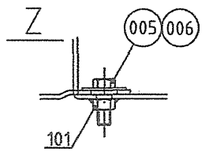


RISER HAT BRACKET MUST BE INSTALLED DURING RISER INSTALLATION.





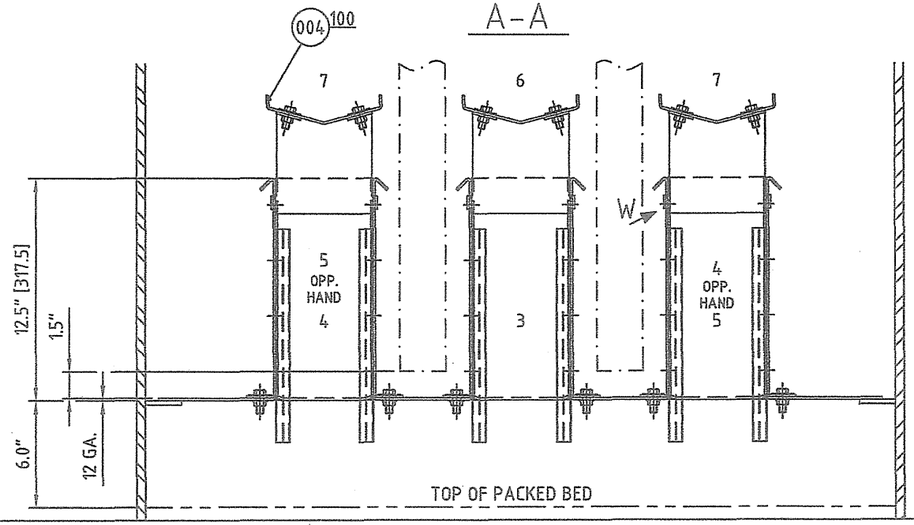




Distributor Data

I.D. column	42 / 1067 [in] / [mm]
I.D. manway	17.25 / 438 [in] / [mm]
Number of drip points	68 [–]
Distribution density	7.4 / 80 [1/ft2] / [1/m2]
Orifice size: D3	0.284 / 7.2 [in] / [mm]
Orifice size: D2	0.284 / 7.2 [in] / [mm]
Orifice size: D1	0.260 / 6.6 [in] / [mm]
Drain size: DE	0.236 / 6.0 [in] / [mm]

CASE	Flow [gpm] / [m3/h]	Load [gpm/ft^2] / [m3/m2h]	levels above orifice [in] / [mm]
Min.	26.8/6.1	2.78/6.80	1.65/42
Max.	161.5/36.7	16.79/41.04	9.33/237



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RR 2132 3/1
CURTIS KELLY, INC.

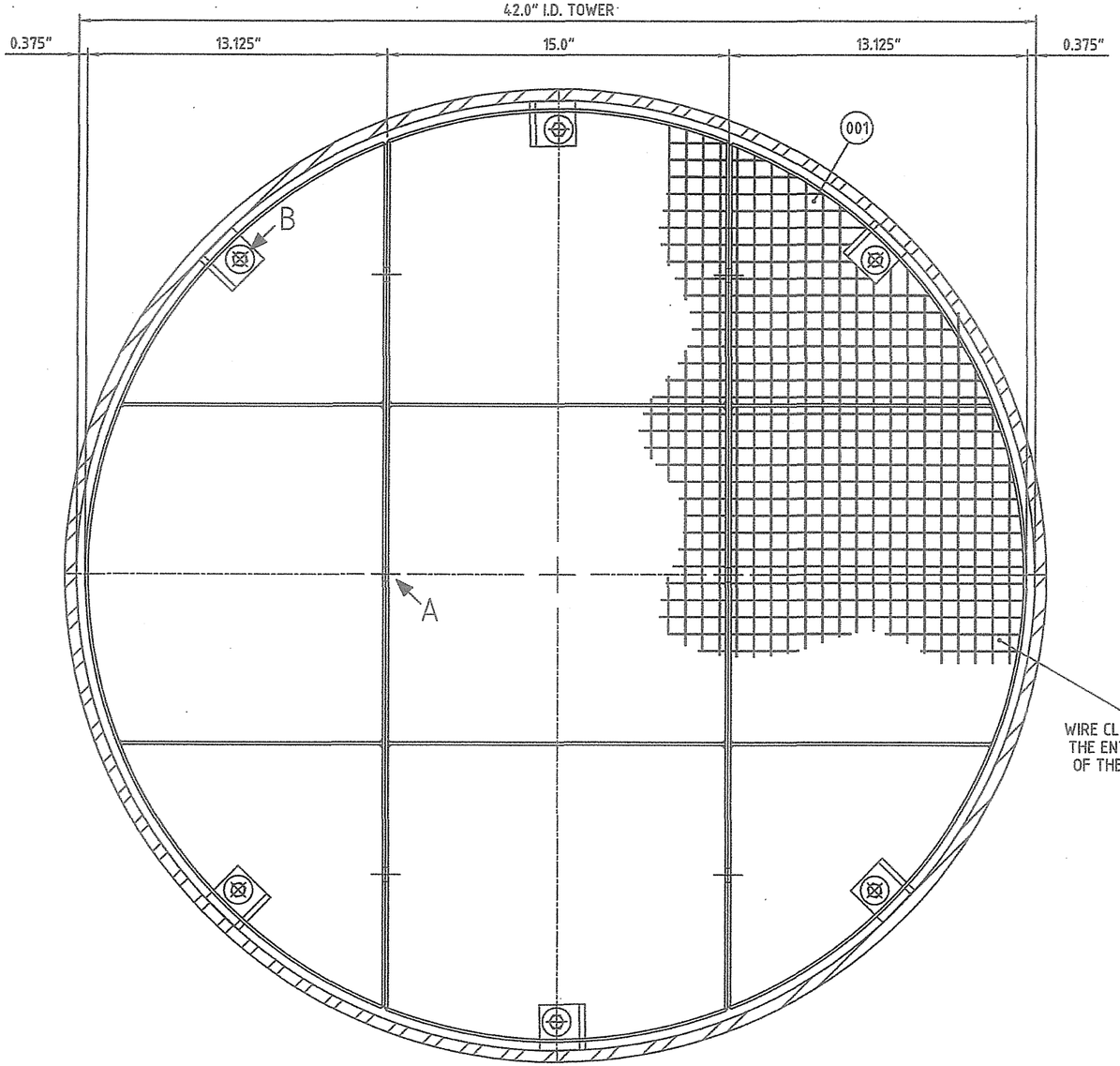
GENERAL NOTES
All parts shall pass through man ways:17.25" I.D.
All components are marked by SULZER.
The assembled part is checked after manufact.

State: CERTIFIED

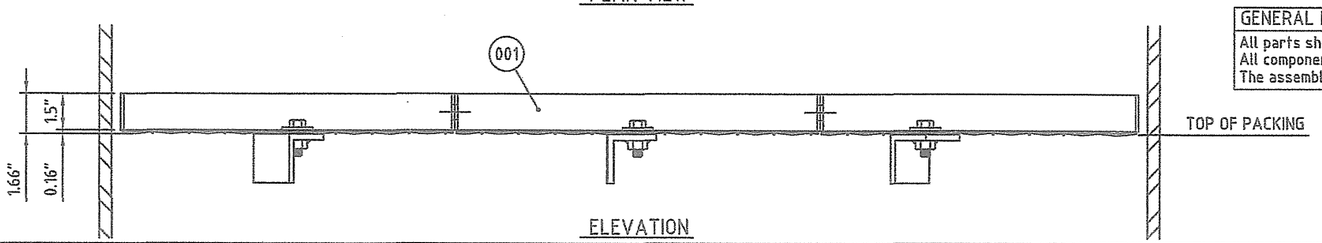
rev.	revision remarks	issued by	date	checked	date	approved	date
1	CERTIFIED ISSUE	TSa	2/17/17	RBo	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BMc	1/6/17	RBo	1/9/17	DWi	1/9/17

job no.: –208	SULZER project no.: 9033982-02	size: 11x17	scale: %
col ID: 42.0"	customer: UOP RUSSELL LLC.	customer p.o.: 4500753897	
col item: T-501	plant:	customer-dwg.:	
bed: No.2	area:	ACAD 2002	
SULZER	VSIR DISTRIBUTOR DEMETHANIZER TOWER (BED No.2)	drawing no.: 9033982-02	sheet no.: 08

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PLAN VIEW

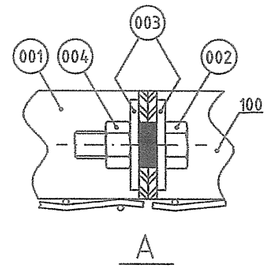


ELEVATION

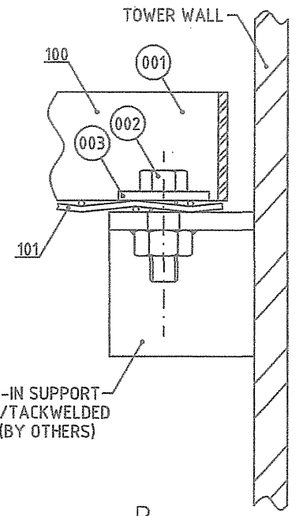
item list								
item	qty.	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb.]
000	1	–	set		RPB BED LIMITER	BEDS No.2, 3, & 4	304L / 316L	50
001	3	–	pcs.		RPB BED LIMITER PANEL		304L / 316L	
002	12	2	pcs.		HEX HEAD CAPSCREW - 3/8"-16 x 1 1/4" LONG		304L	0.0485
003	18	3	pcs.		WASHER - 7/16" I.D. x 1 1/4" O.D.		304L	0.0331
004	6	2	pcs.		NUT - 3/8"-16 HEX		304L	0.0160
100	6.95	–	ft2		SHEET - 12 GA.		304L	4.427
101	6	–	ft2		WIRE CLOTH- 0.75" x 0.75" x 0.080"ϕ		316L	0.5024

001 - 099: parts / 100 - 199: materials

NOTE: QUANTITIES SHOWN ABOVE ARE FOR 1 (ONE) RPB BED LIMITER.
A QUANTITY OF 3 (THREE) RPB BED LIMITERS AS SHOWN ON THIS SHEET
ARE REQUIRED. ONE EACH FOR BEDS No.2, No.3, AND No.4.



A



B

APPROVED FOR CONSTRUCTION
2132
RR 3/1/17
CURTIS KELLY, INC.

GENERAL NOTES

All parts shall pass through man ways:17.25" I.D.
All components are marked by SULZER.
The assembled part is checked after manufact.

rev.	revision remarks	issued by	date	checked	date	approved	date
1	CERTIFIED ISSUE	TSa	2/17/17	RBo	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BMc	1/6/17	RBo	1/9/17	DWi	1/9/17

job no.: -214	SULZER project no.: 9033982-02	size: 11x17	scale: %
col I.D.: 42.0"	customer: UOP RUSSELL LLC.	customer p.o.: 4500753897	
col item: T-501	plant:	customer-dwg.:	
bed: No.2, 3, & 4	area:	ACAD 2002	

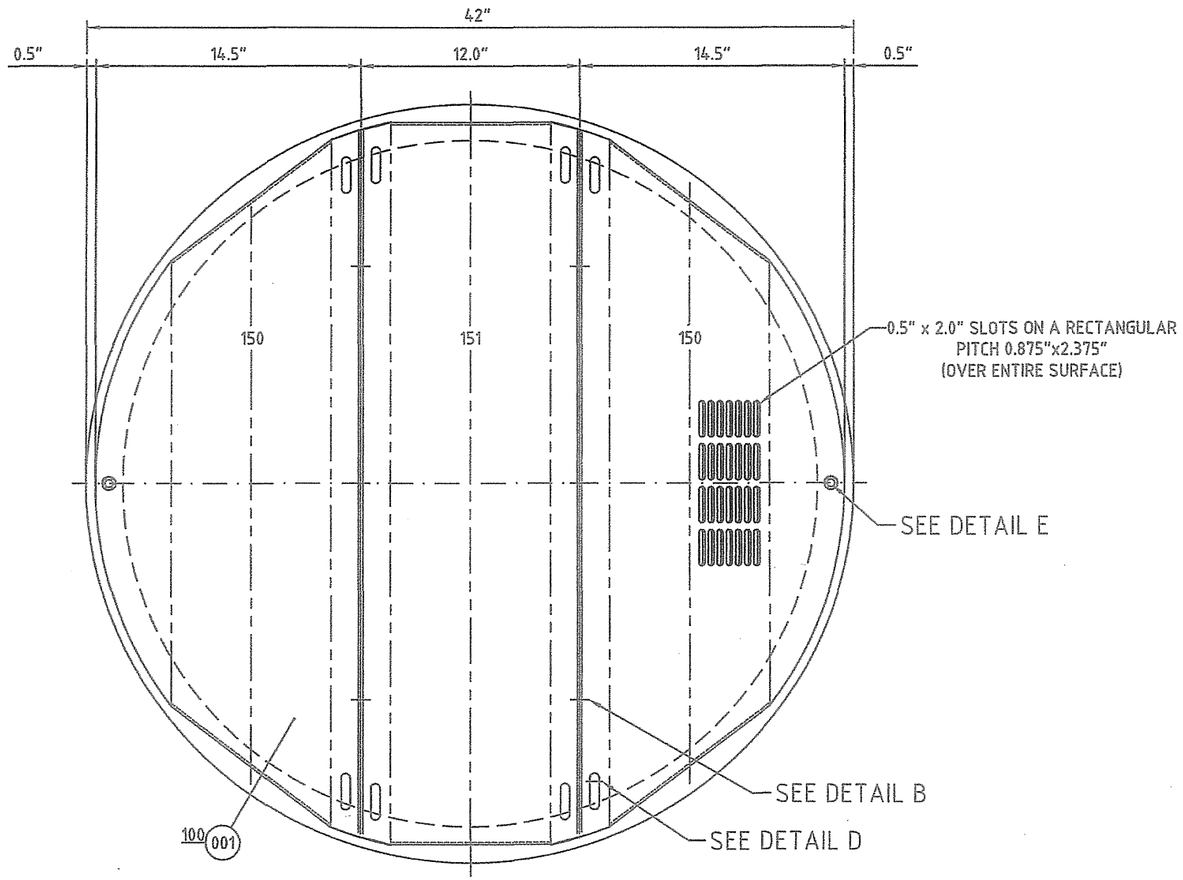
SULZER

RPB BED LIMITER
DEMETHANIZER TOWER (BEDS No.2, 3, & 4)

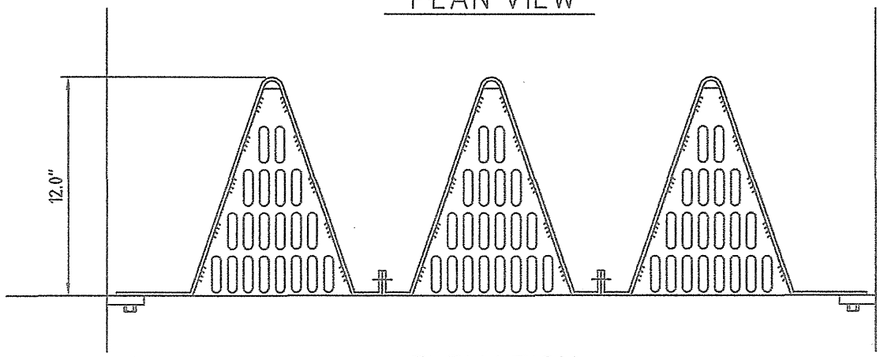
drawing no.: 9033982-02 sheet no.: 09

state: CERTIFIED

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PLAN VIEW

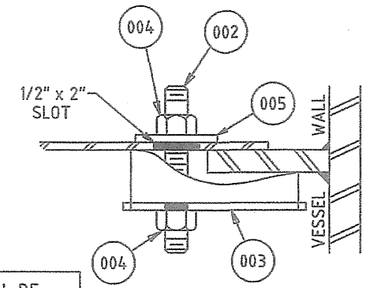


ELEVATION

item list								
item	qty.	spare	unit	drawing- or part-no.	description remarks	material	wght. [lb]
000	1	–	set		GIS Support Plate	304L	112.4
001	3	–	pcs.	150 (2) & 151 (1)	GIS Panel	304L	
002	8	2	pcs.		Square Stud - 3/8"-16 x 2.5" Long (All Thread)	304L	0.0733
003	8	2	pcs.		Clamp - Universal - Two Way	304L	0.1250
004	22	3	pcs.		Hex Nut - 3/8"-16	304L	0.0160
005	22	2	pcs.		Washer - 7/16" I.D. x 1 1/4" O.D.	304L	0.0331
006	8	1	pcs.		Hex Head Capscrew - 3/8"-16 x 1 1/2" Long	304L	0.0565
100	24.5	–	ft2		Sheet - 12 Ga. .	304L	4.4270

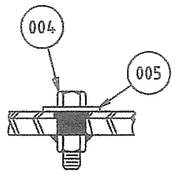
001 - 099: parts / 100 - 199: materials

NOTE: QUANTITIES SHOWN ABOVE ARE FOR 1 (ONE) GIS SUPPORT PLATE. A QUANTITY OF 3 (THREE) GIS SUPPORT PLATES AS SHOWN ON THIS SHEET ARE REQUIRED. ONE EACH FOR BEDS No.1, No.3, AND No.4.

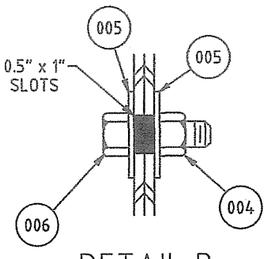


DETAIL D

NOTE: SUPPORT PLATE PANEL SHALL BE TACK-WELDED TO WELD-IN SUPPORT RING DURING INSTALLATION (TYP).



DETAIL E



DETAIL B

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2132
RR 3/1/17
CURTIS KELLY, INC.

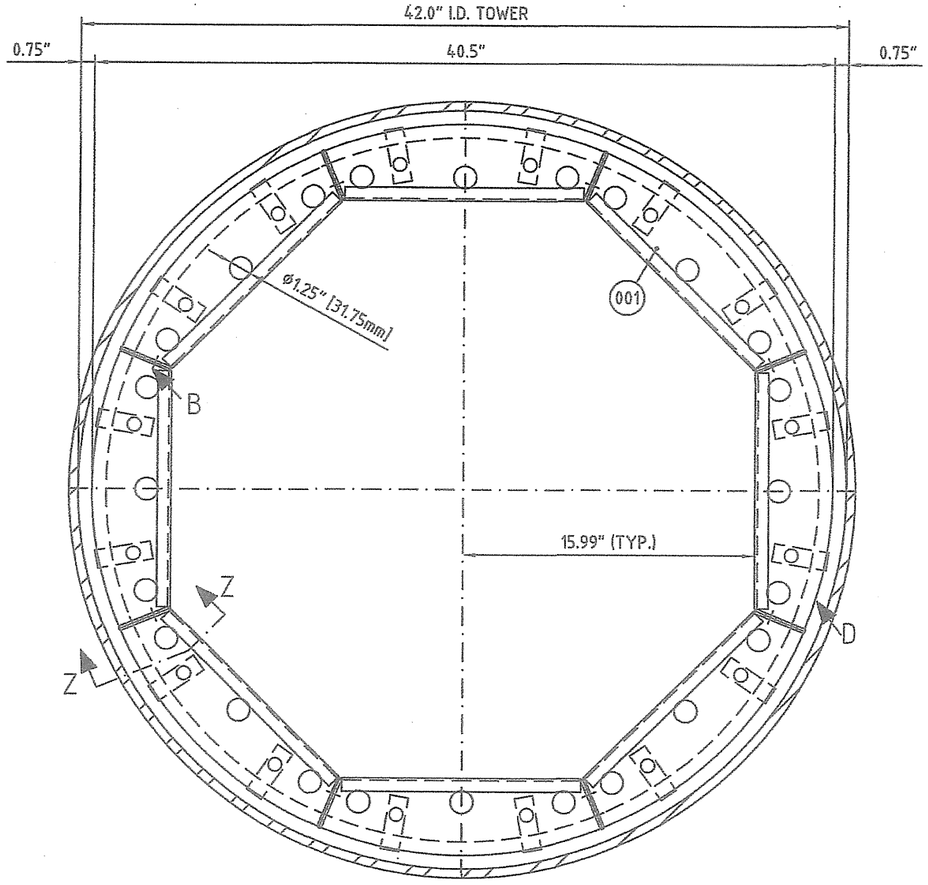
GENERAL NOTES
All parts shall pass through man ways47.25" I.D.
All components are marked by SULZER.
The assembled part is checked after manufact.

state: CERTIFIED

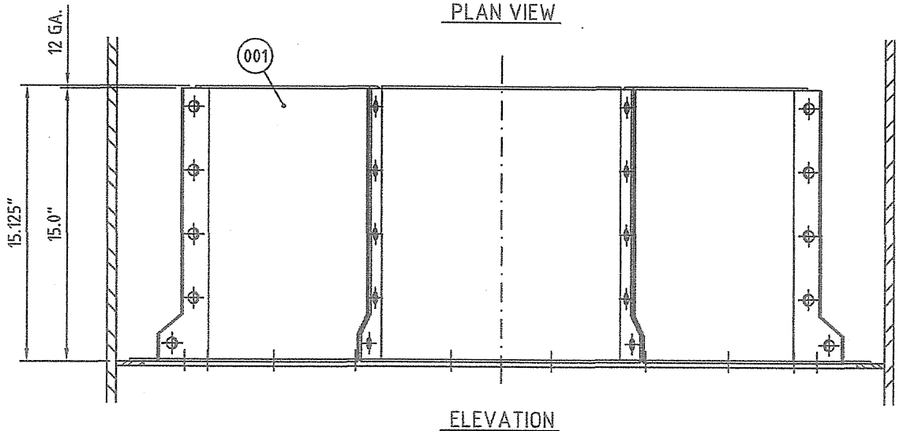
rev.	revison remarks	issued by	date	checked	date	approved	date
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0	ORIGINAL ISSUE	BHc	1/6/17	RBo	1/9/17	DWi	1/9/17

job no.: -213	SULZER project no.: 9033982-02	size: 11x17	scale: %
col I.D.: 42"	customer: UOP RUSSELL LLC.	customer p.o.: 4500753897	
col item:	plant:	customer-dwg.:	
bed: No.1,3 & 4	process:	ACAD 2002	
SULZER	GIS-SUPPORT PLATE DEMETHANIZER TOWER	drawing no.: 9033982-02	sheet no.: 10

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PLAN VIEW



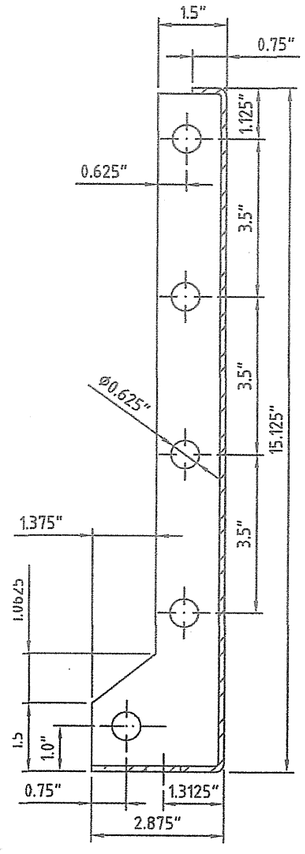
ELEVATION

APPROVED FOR CONSTRUCTION
2132
RR 3/1/17
CURTIS KELLY, INC.

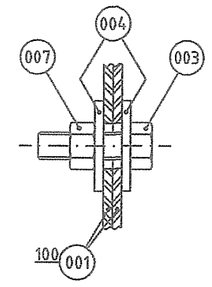
item list

item	qty.	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb.]
000	1	–	set		SKG GALLERY TRAY	BED No.3	304L	112.5
001	8	–	pcs.		SKG SEGMENT		304L	
003	40	4	pcs.		HEX HEAD CAPSCREW - 3/8"-16 UNC x 1 1/4" LONG		304L	0.0485
004	96	10	pcs.		WASHER - 7/16" I.D. x 1 1/4" O.D.		304L	0.0331
005	16	2	pcs.		UNIVERSAL CLAMP - TWO WAY		304L	0.1900
006	16	2	pcs.		SQUARE STUD - 3/8"-16 UNC x 2 1/2" LONG		304L	0.0610
007	72	7	pcs.		NUT - 3/8"-16 UNC HEX		304L	0.0160
100	23	–	ft2		SHEET - 12 GA.		304L	4.427

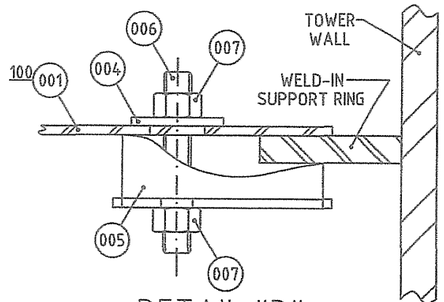
001 - 099: parts / 100 - 199: materials



SECTION "Z-Z"



DETAIL "B"



DETAIL "D"

Gallery Tray Data

DN Inlet Tube	3.0 / 76.2 [in] / [mm] W/Feed Baffle
Number of Inlet Pipes	1 [–]
Number of Orifices	24 [–]
Orifice size:	1.25 / 31.75 [in] / [mm]

Flow Rates:

	Flow [gpm] / [m3/h]	levels above orifice [in] / [mm]
min.	49.9 / 11.3	0.08 / 2
max.	319.4 / 72.5	4.5 / 114

GENERAL NOTES

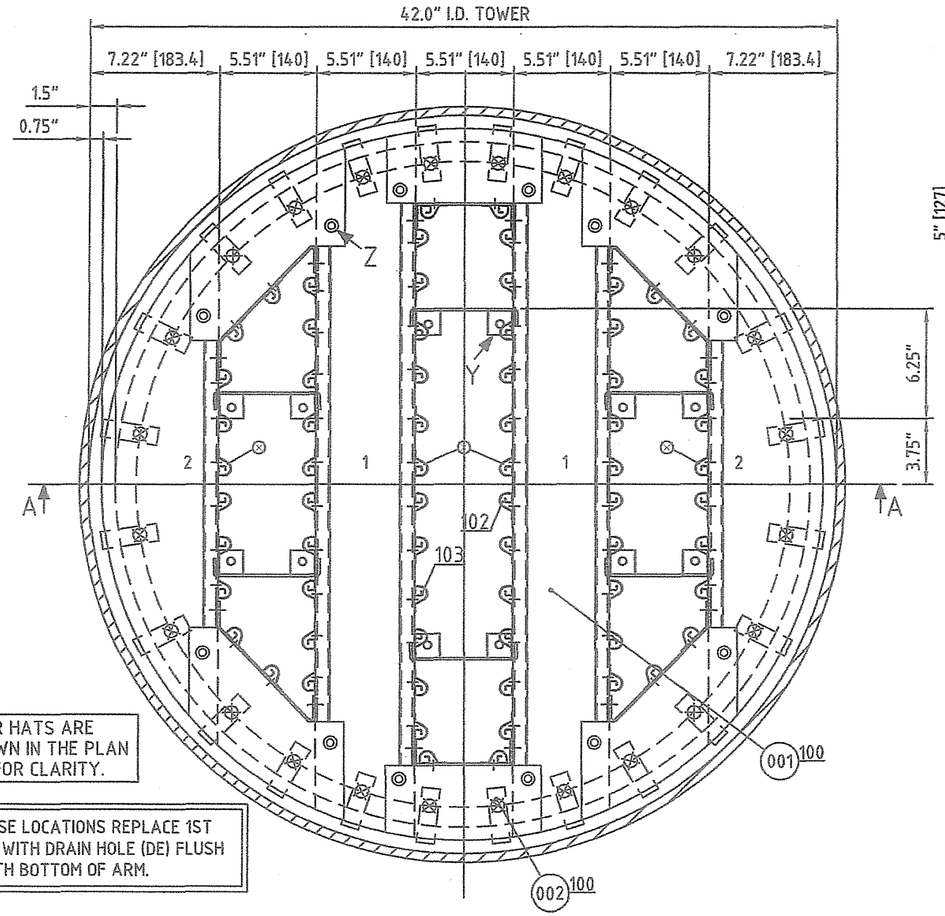
All parts shall pass through man ways:17.25" I.D.
All components are marked by SULZER.
The assembled part is checked after manufact.

state: CERTIFIED

rev.	revision remarks	issued by	date	checked	date	approved	date
1	CERTIFIED ISSUE	TSa	2/17/17	RBo	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BMc	1/6/17	RBo	1/9/17	DWi	1/9/17

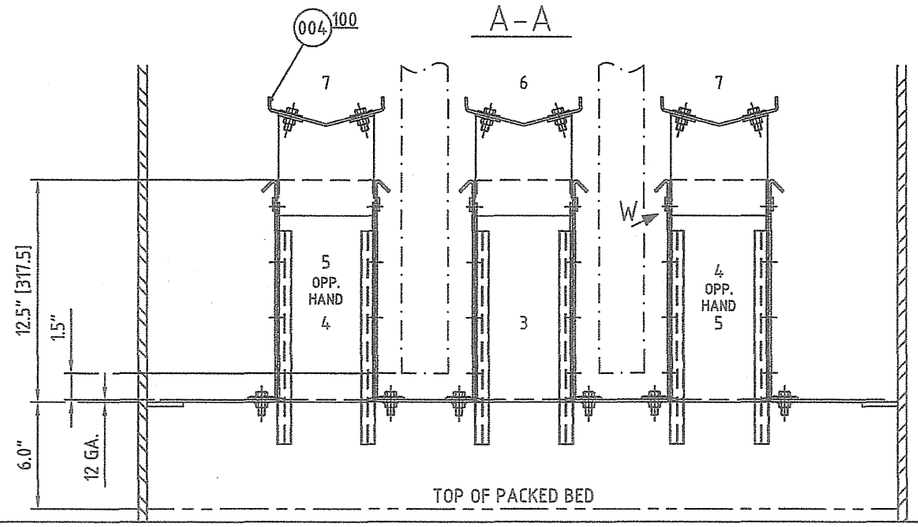
job no.: -211	SULZER project no.: 9033982-02	size: 11x17	scale: %
col.-I.D.: 42.0"	customer: UOP RUSSELL LLC.	customer p.o.: 4500753897	
col item: T-501	plant:	customer-dwg.:	
bed: No.3	area:	ACAD 2000	
SULZER	SKG GALLERY TRAY DEMETHANIZER TOWER (BED No.3)	drawing no.: 9033982-02	sheet no.: 11

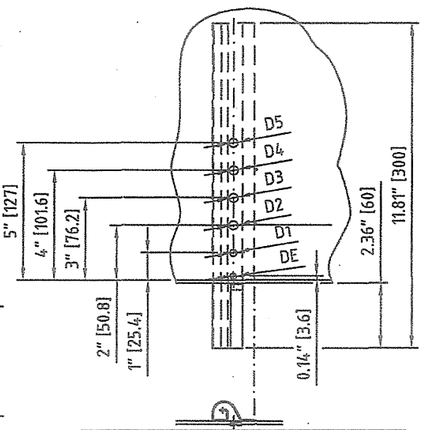
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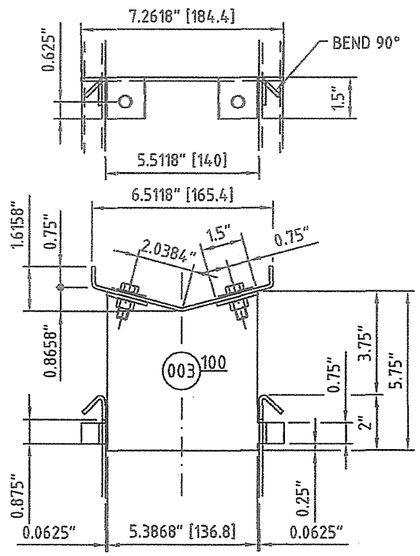
RISER HATS ARE NOT SHOWN IN THE PLAN VIEW FOR CLARITY.

⊗ AT THESE LOCATIONS REPLACE 1ST STAGE HOLE WITH DRAIN HOLE (DE) FLUSH WITH BOTTOM OF ARM.





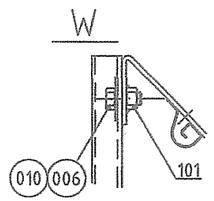
APPROVED FOR CONSTRUCTION
2132
RR 3/1/17
CURTIS KELLY, INC.

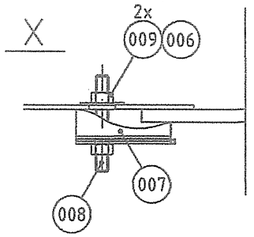


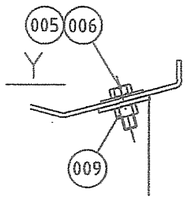
RISER HAT BRACKET MUST BE INSTALLED DURING RISER INSTALLATION.

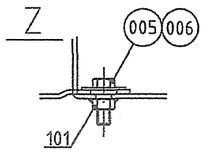
item list								
item	qty	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb]
000	1	–	set		VSIR DISTRIBUTOR	BED No.3	304L / 316L	187
001	4	–	pcs.		ARM CHANNELS	2 x No.1-2	304L / 316L	
002	6	–	pcs.		END PANELS	2 x No.3-5	304L / 316L	
003	6	–	pcs.		HAT BRACKET		304L	
004	3	–	pcs.		RISER HAT	1 x No.6 / 2 x No.7	304L	
005	24	3	pcs.		HEX HEAD CAPSCREW - 3/8"-16 x 1 1/4" LONG		304L	0.0485
006	108	11	pcs.		WASHER - 7/16" I.D. x 1 1/4" O.D.		304L	0.0331
007	24	3	pcs.		UNIVERSAL CLAMP - TWO WAY		304L	0.1900
008	24	3	pcs.		SQUARE STUD - 3/8"-16 x 2 1/2" LONG		304L	0.0610
009	60	6	pcs.		NUT - 3/8"-16 HEX		304L	0.0160
010	60	6	pcs.		HEX HEAD CAPSCREW - 3/8"-16 x 3/4" LONG		304L	0.0355
100	32	–	ft2		SHEET - 12 GA.		304L	4.427
101	72	–	pcs.		NUT - 3/8"-16 HEAVY HEX	TACKWELDED	304L	0.0314
102	34	–	pcs.		CURL TUBE - LEFT	L = 11.81" [300mm]	316L	0.5250
103	34	–	pcs.		CURL TUBE - RIGHT	L = 11.81" [300mm]	316L	0.5250

001 – 099: parts / 100 – 199: materials









Distributor Data

I.D. column	42 / 1067 [in] / [mm]
I.D. manway	17.25 / 438 [in] / [mm]
Number of drip points	68 [–]
Distribution density	7.4 / 80 [1/ft2] / [1/m2]
Orifice size: D5	0.3145 / 8 [in] / [mm]
Orifice size: D4	0.3145 / 8 [in] / [mm]
Orifice size: D3	0.3145 / 8 [in] / [mm]
Orifice size: D2	0.3145 / 8 [in] / [mm]
Orifice size: D1	0.252 / 6.4 [in] / [mm]
Drain size: DE	0.228 / 5.8 [in] / [mm]

CASE	Flow [gpm] / [m3/h]	Load [gpm/ft^2] / [m3/m2h]	levels above orifice [in] / [mm]
Min.	49.9 / 11.3	5.19 / 12.68	1.65 / 42
Max.	319.4 / 72.5	33.19 / 81.15	9.45 / 240

GENERAL NOTES

All parts shall pass through man ways:17.25" I.D.
All components are marked by SULZER.
The assembled part is checked after manufact.

state: CERTIFIED

rev.	revision remarks	issued by	date	checked	date	approved	date
1	CERTIFIED ISSUE	TSa	2/17/17	RBo	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BMc	1/6/17	RBo	1/9/17	DWi	1/9/17

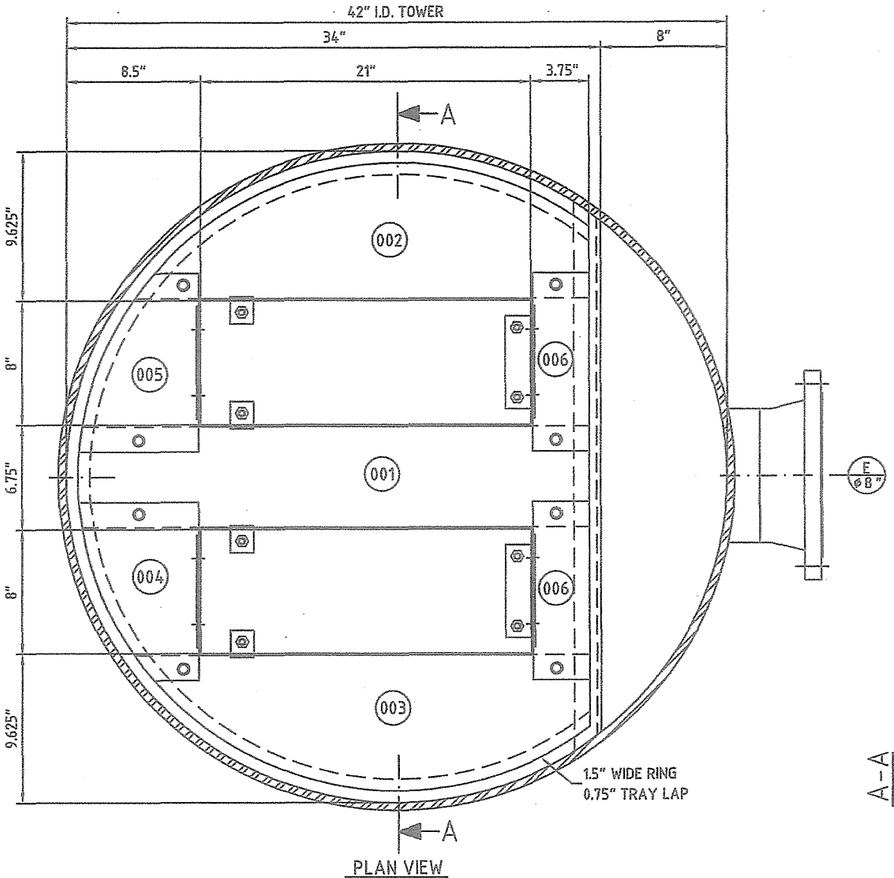
job no.: -221	SULZER project no.: 9033982-02	size: 11x17	scale: %
col ID: 42.0"	customer: UOP RUSSELL LLC.	customer p.o.:	4500753897
col item: T-501	plant:	customer-dwg.:	
bed: No.3	area:	ACAD 2000	

SULZER

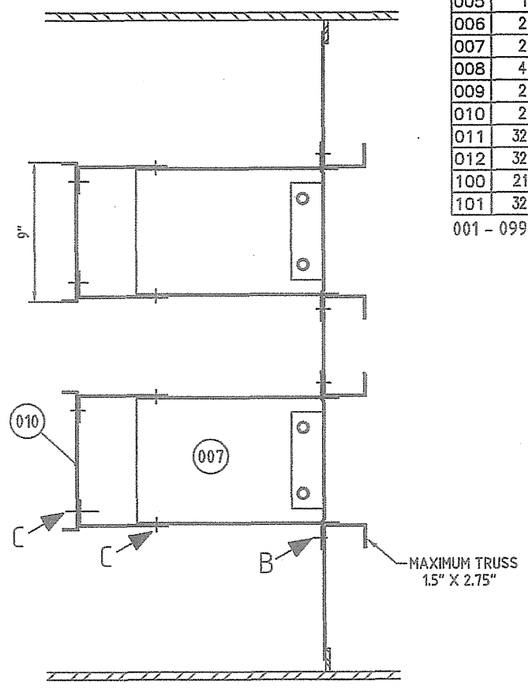
VSIR DISTRIBUTOR
DEMETHANIZER TOWER (BED No.3)

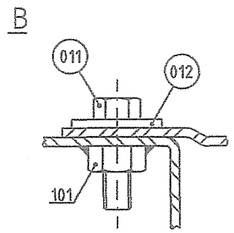
drawing no.: 9033982-02 sheet no.: 12

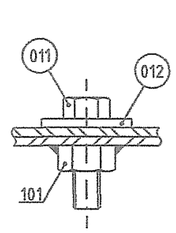
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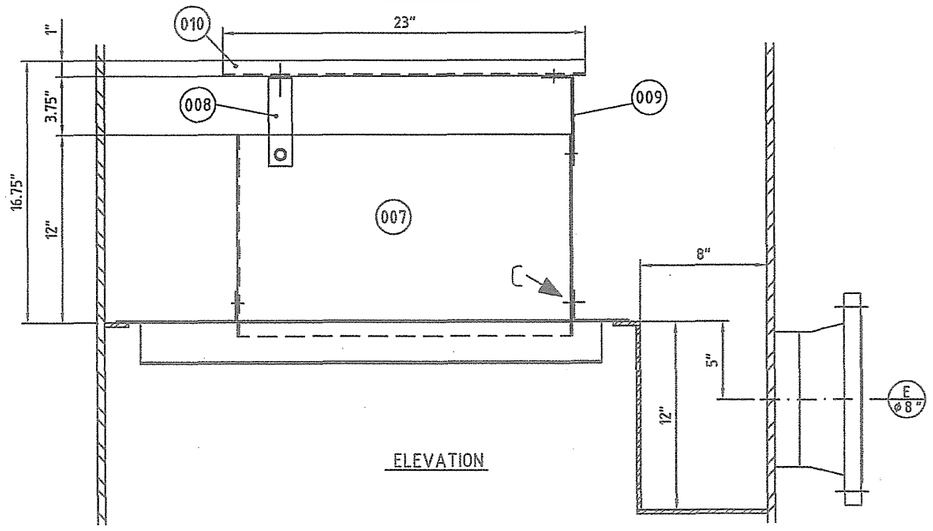


PLAN VIEW









ELEVATION

RISER HATS ARE NOT SHOWN IN THE PLAN VIEW FOR CLARITY.

NOTE TO TRAY INSTALLER
CHIMNEY TRAY FLOOR, RISER & DOWNCOMER TO BE COMPLETELY SEAL WELDED DOWN ALL SEAMS, AT ALL JOINTS & BOLTING TO PROVIDE A LIQUID TIGHT TRAY.

item list

item	qty.	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb.]
000	1	–	set		SKHW COLLECTOR TRAY	BED No.3	304L	120
001	1	–	pcs.		SKHW COLLECTOR TRAY PANEL		304L	
002	1	–	pcs.		SKHW COLLECTOR TRAY PANEL		304L	
003	1	–	pcs.		SKHW COLLECTOR TRAY PANEL		304L	
004	1	–	pcs.		SKHW COLLECTOR TRAY PANEL		304L	
005	1	–	pcs.		SKHW COLLECTOR TRAY PANEL		304L	
006	2	–	pcs.		SKHW COLLECTOR TRAY PANEL		304L	
007	2	–	pcs.		RISER		304L	
008	4	–	pcs.		HAT SUPPORT		304L	
009	2	–	pcs.		HAT SUPPORT		304L	
010	2	–	pcs.		RISER HAT		304L	
011	32	3	pcs.		HEX HEAD CAPSCREW – 3/8"-16 x 1 1/4" LONG		304L	0.0485
012	32	3	pcs.		WASHER – 7/16" I.D. x 1 1/4" O.D.		304L	0.0331
100	21	–	ft2		SHEET – 10 GA.		304L	5.67
101	32	–	pcs.		NUT – 3/8"-16 HEAVY HEX	TACKWELDED	304L	0.0314

001 – 099: parts / 100 – 199: materials

NOTE: MATERIAL FOR ALL PARTS TO BE 10GA.(MK. 100) EXCEPT AS NOTED.

APPROVED FOR CONSTRUCTION
2132
RR 3/1/17
CURTIS KELLY, INC.

GENERAL NOTES
All parts shall pass through man ways:17.25" I.D.
All components are marked by SULZER.
The assembled part is checked after manufact.

state: CERTIFIED

rev.	revision remarks	issued by	date	checked	date	approved	date
1	CERTIFIED ISSUE	TSa	2/17/17	RBo	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BMc	1/6/17	RBo	1/9/17	DWi	1/9/17

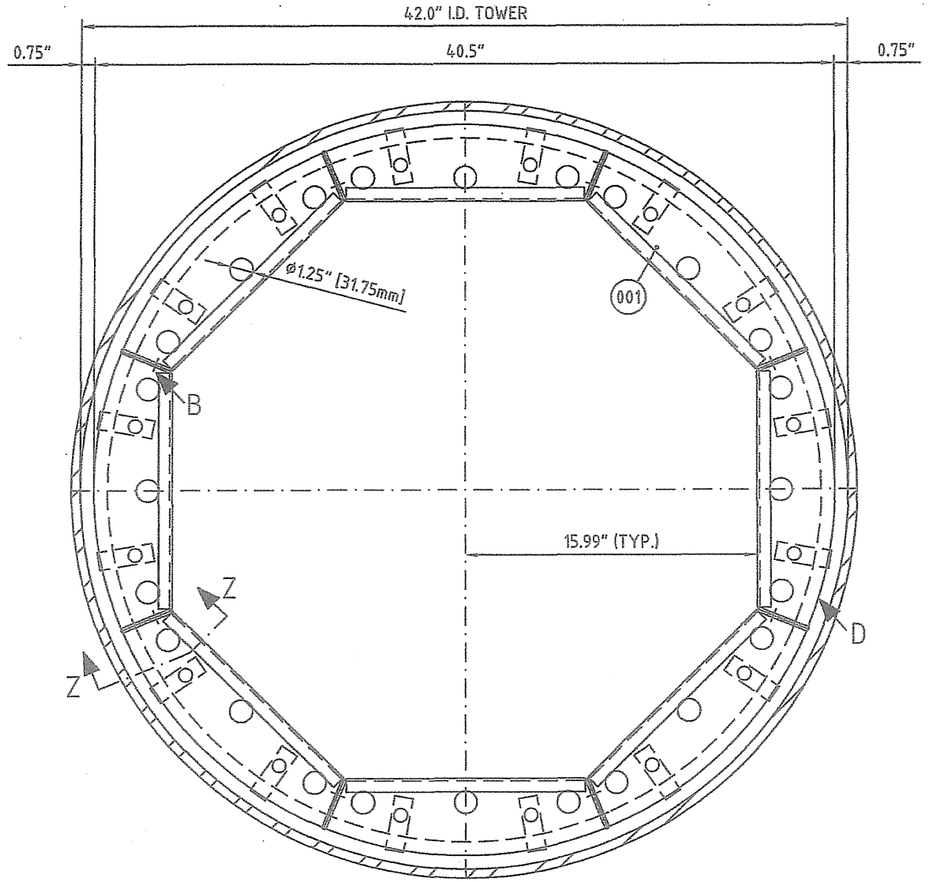
job no.: -212	SULZER project no.: 9033982-02	size: 11x17	scale: %
col.-I.D.: 42.0"	customer: UOP RUSSELL LLC.	customer p.o.: 4500753897	
col item: T-501	plant:	customer-dwg.:	
bed: No.3	area:	ACAD 2000	

SULZER

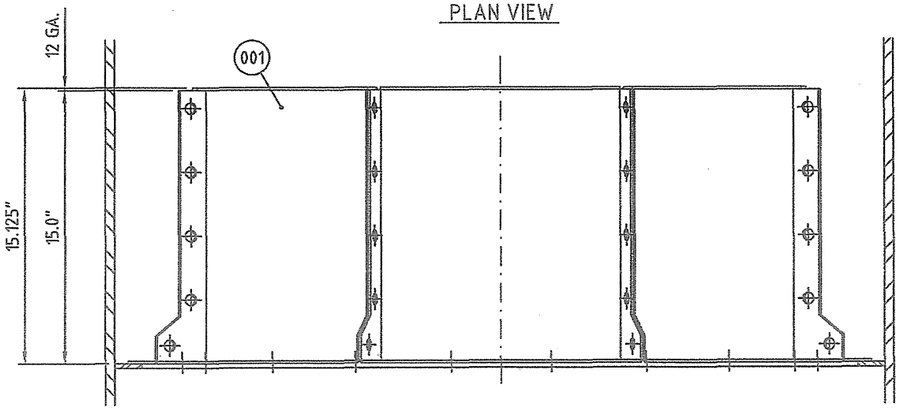
SKHW COLLECTOR TRAY
DEMETHANIZER TOWER (BED No.3)

drawing no.: 9033982-02 sheet no.: 13

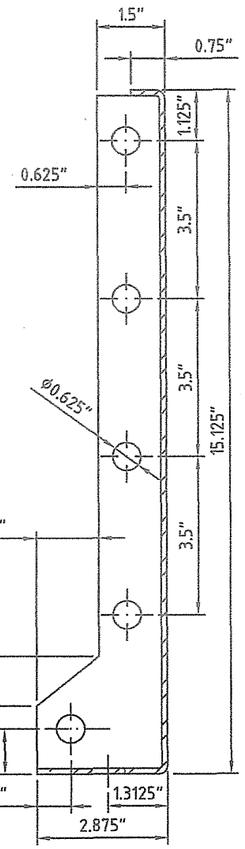
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PLAN VIEW



ELEVATION



SECTION "Z-Z"

item list								
item	qty.	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb.]
000	1	–	set		SKG GALLERY TRAY	BED No.4	304L	112.5
001	8	–	pcs.		SKG SEGMENT		304L	
003	40	4	pcs.		HEX HEAD CAPSCREW - 3/8"-16 UNC x 1 1/4" LONG		304L	0.0485
004	96	10	pcs.		WASHER - 7/16" I.D. x 1 1/4" O.D.		304L	0.0331
005	16	2	pcs.		UNIVERSAL CLAMP - TWO WAY		304L	0.1900
006	16	2	pcs.		SQUARE STUD - 3/8"-16 UNC x 2 1/2" LONG		304L	0.0610
007	72	7	pcs.		NUT - 3/8"-16 UNC HEX		304L	0.0160
100	23	–	ft2		SHEET - 12 GA.		304L	4.427

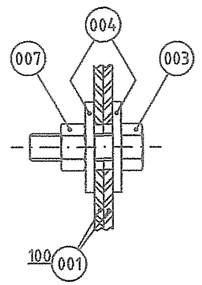
001 - 099: parts / 100 - 199: materials

Gallery Tray Data

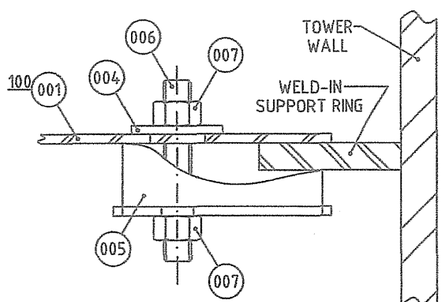
DN Inlet Tube	8.0 / 203.2 [in] / [mm] W/Feed Baffle
Number of Inlet Pipes	1 [-]
Number of Orifices	24 [-]
Orifice size:	1.25 / 31.75 [in] / [mm]

Flow Rates:

	Flow [gpm] / [m3/h]	levels above orifice [in] / [mm]
min.	46.2 / 10.5	0.07 / 2
max.	308.6 / 70.1	4.2 / 107



DETAIL "B"



DETAIL "D"

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2132
RR 3/1/17
CURTIS KELLY, INC.

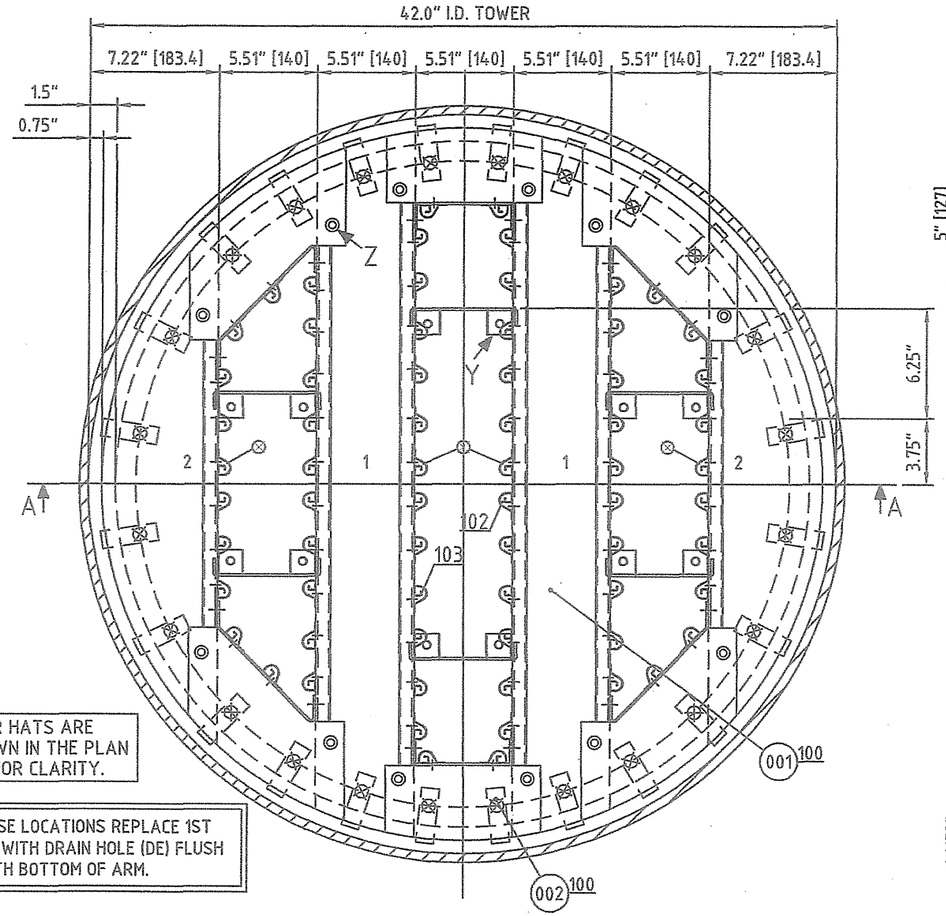
GENERAL NOTES
All parts shall pass through man ways:17.25" I.D.
All components are marked by SULZER.
The assembled part is checked after manufact.

state: CERTIFIED

rev.	revision remarks	issued by	date	checked	date	approved	date
1	CERTIFIED ISSUE	TSa	2/17/17	RBo	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BMc	1/6/17	RBo	1/9/17	DWi	1/9/17

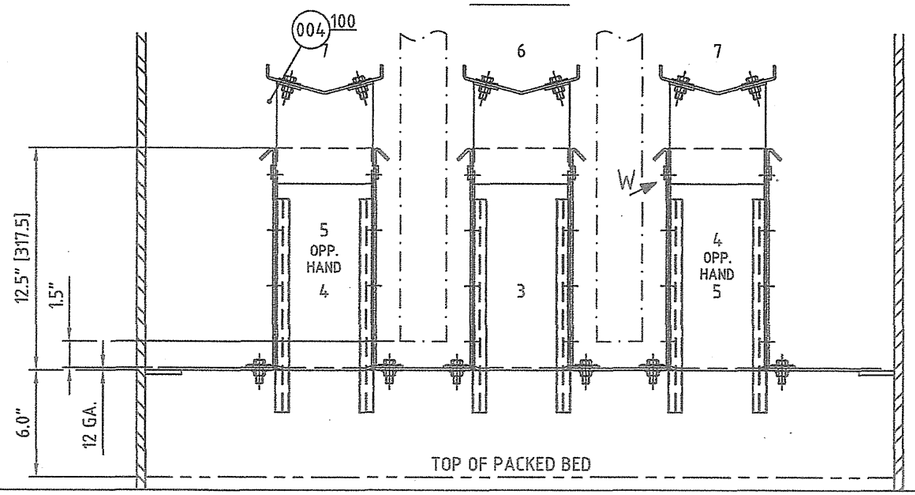
job no.: -211	SULZER project no.: 9033982-02	size: 11x17	scale: %
col.-I.D.: 42.0"	customer: UOP RUSSELL LLC.	customer p.o.: 4500753897	
col item: T-501	plant:	customer-dwg.:	
bed: No.4	area:	ACAD 2000	
SULZER	SKG GALLERY TRAY DEMETHANIZER TOWER (BED No.4)	drawing no.: 9033982-02	sheet no.: 14

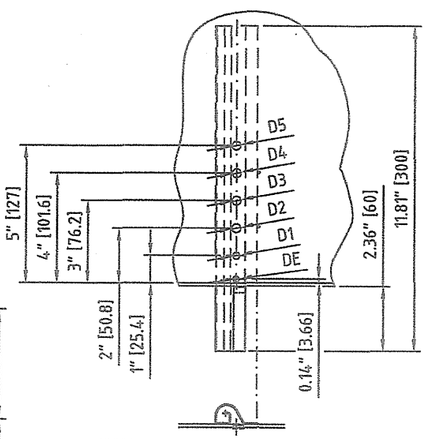
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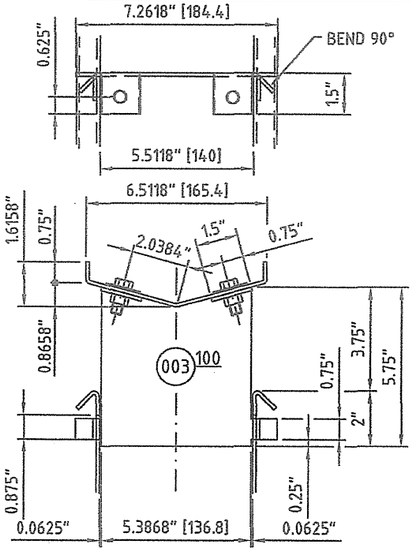


RISER HATS ARE NOT SHOWN IN THE PLAN VIEW FOR CLARITY.

⊗ AT THESE LOCATIONS REPLACE 1ST STAGE HOLE WITH DRAIN HOLE (DE) FLUSH WITH BOTTOM OF ARM.

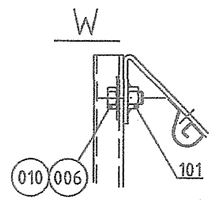


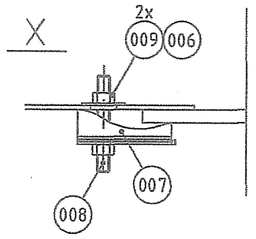


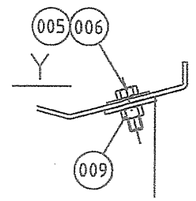


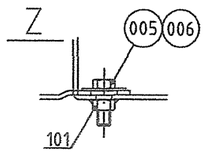
RISER HAT BRACKET MUST BE INSTALLED DURING RISER INSTALLATION.

APPROVED FOR CONSTRUCTION
2132
RR 3/1/17
CURTIS KELLY, INC.









Item list

item	qty	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb]
000	1	–	set		VSIR DISTRIBUTOR	BED No.4	304L / 316L	187
001	4	–	pcs.		ARM CHANNELS	2 x No.1-2	304L / 316L	
002	6	–	pcs.		END PANELS	2 x No.3-5	304L / 316L	
003	6	–	pcs.		HAT BRACKET		304L	
004	3	–	pcs.		RISER HAT	1 x No.6 / 2 x No.7	304L	
005	24	3	pcs.		HEX HEAD CAPSCREW – 3/8"-16 x 1 1/4" LONG		304L	0.0485
006	108	11	pcs.		WASHER – 7/16" I.D. x 1 1/4" O.D.		304L	0.0331
007	24	3	pcs.		UNIVERSAL CLAMP – TWO WAY		304L	0.1900
008	24	3	pcs.		SQUARE STUD – 3/8"-16 x 2 1/2" LONG		304L	0.0610
009	60	6	pcs.		NUT – 3/8"-16 HEX		304L	0.0160
010	60	6	pcs.		HEX HEAD CAPSCREW – 3/8"-16 x 3/4" LONG		304L	0.0355
100	31	–	ft2		SHEET – 12 GA.		304L	4.427
101	72	–	pcs.		NUT – 3/8"-16 HEAVY HEX	TACKWELDED	304L	0.0314
102	34	–	pcs.		CURL TUBE – LEFT	L = 11.81" [300mm]	316L	0.5250
103	34	–	pcs.		CURL TUBE – RIGHT	L = 11.81" [300mm]	316L	0.5250

001 – 099: parts / 100 – 199: materials

Distributor Data

I.D. column	42 / 1067 [in] / [mm]
I.D. manway	17.25 / 438 [in] / [mm]
Number of drip points	68 [–]
Distribution density	7.4 / 80 [1/ft2] / [1/m2]
Orifice size: D5	0.3145 / 8 [in] / [mm]
Orifice size: D4	0.3145 / 8 [in] / [mm]
Orifice size: D3	0.3145 / 8 [in] / [mm]
Orifice size: D2	0.3145 / 8 [in] / [mm]
Orifice size: D1	0.252 / 6.4 [in] / [mm]
Drain size: DE	0.228 / 5.8 [in] / [mm]

CASE	Flow [gpm] / [m3/h]	Load [gpm/ft^2] / [m3/m2h]	levels above orifice [in] / [mm]
Min.	46.2 / 10.5	4.80 / 11.73	1.54 / 39
Max.	308.6 / 70.1	32.08 / 78.43	8.98 / 228

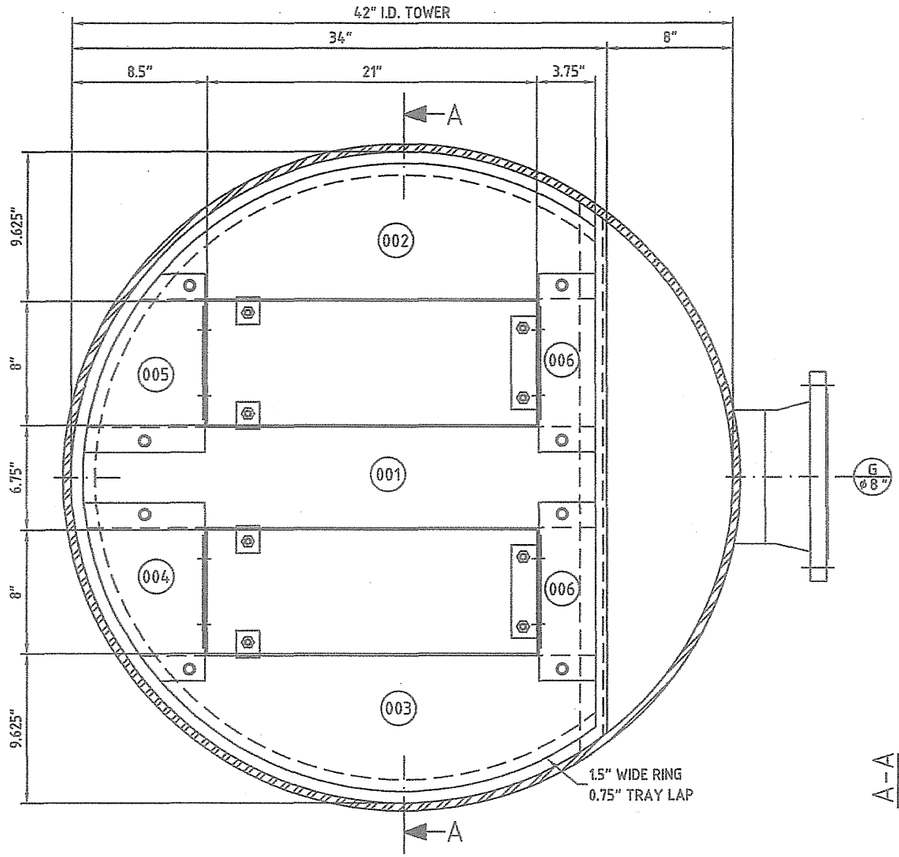
GENERAL NOTES
All parts shall pass through man ways:17.25" I.D.
All components are marked by SULZER.
The assembled part is checked after manufact.

state: CERTIFIED

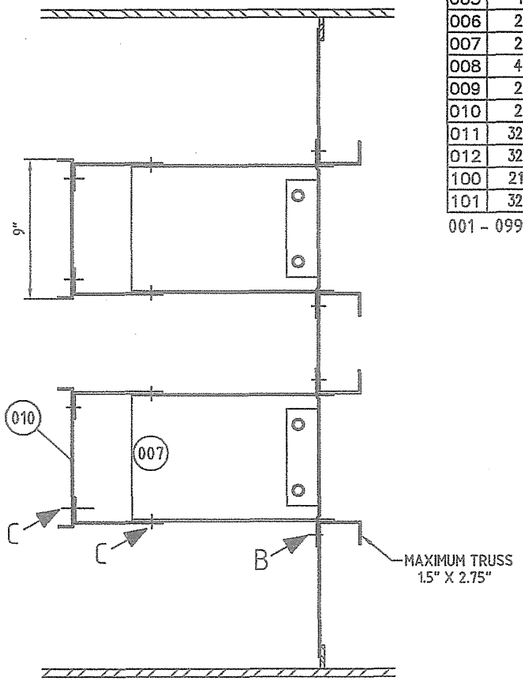
rev.	revision remarks	issued by	date	checked	date	approved	date
1	CERTIFIED ISSUE	TSa	2/17/17	RBo	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BMc	1/6/17	RBo	1/9/17	DWi	1/9/17

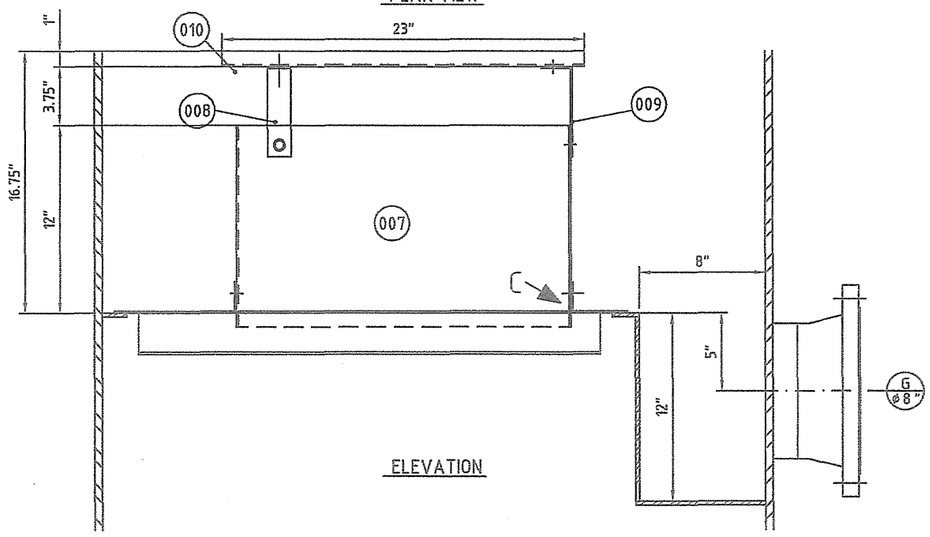
job no.: -222	SULZER project no.: 9033982-02	size: 11x17	scale: %
col ID: 42.0"	customer: UOP RUSSELL LLC.	customer p.o.: 4500753897	
col item: T-501	plant:	customer-dwg.:	
bed: No.4	area:	ACAD 2000	
SULZER	VSIR DISTRIBUTOR DEMETHANIZER TOWER (BED No.4)	drawing no.: 9033982-02	sheet no.: 15

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PLAN VIEW

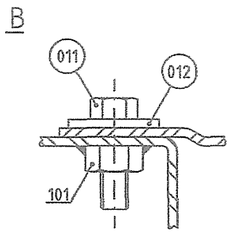




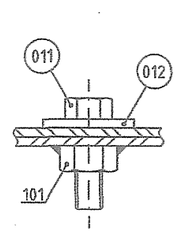
ELEVATION

RISER HATS ARE NOT SHOWN IN THE PLAN VIEW FOR CLARITY.

B



C



item list

item	qty.	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb.]
000	1	–	set		SKHW COLLECTOR TRAY	BED No.4	304L	120
001	1	–	pcs.		SKHW COLLECTOR TRAY PANEL		304L	
002	1	–	pcs.		SKHW COLLECTOR TRAY PANEL		304L	
003	1	–	pcs.		SKHW COLLECTOR TRAY PANEL		304L	
004	1	–	pcs.		SKHW COLLECTOR TRAY PANEL		304L	
005	1	–	pcs.		SKHW COLLECTOR TRAY PANEL		304L	
006	2	–	pcs.		SKHW COLLECTOR TRAY PANEL		304L	
007	2	–	pcs.		RISER		304L	
008	4	–	pcs.		HAT SUPPORT		304L	
009	2	–	pcs.		HAT SUPPORT		304L	
010	2	–	pcs.		RISER HAT		304L	
011	32	3	pcs.		HEX HEAD CAPSCREW - 3/8"-16 x 1 1/4" LONG		304L	0.0485
012	32	3	pcs.		WASHER - 7/16" I.D. x 1 1/4" O.D.		304L	0.0331
100	21	–	ft2		SHEET - 10 GA.		304L	5.67
101	32	–	pcs.		NUT - 3/8"-16 HEAVY HEX	TACKWELDED	304L	0.0314

001 - 099: parts / 100 - 199: materials

NOTE: MATERIAL FOR ALL PARTS TO BE 10GA.(MK. 100) EXCEPT AS NOTED.

APPROVED FOR CONSTRUCTION
2132
RR 3/1/17
CURTIS KELLY, INC.

NOTE TO TRAY INSTALLER
CHIMNEY TRAY FLOOR, RISER & DOWNCOMER TO BE COMPLETELY SEAL WELDED DOWN ALL SEAMS, AT ALL JOINTS & BOLTING TO PROVIDE A LIQUID TIGHT TRAY.

GENERAL NOTES
All parts shall pass through man ways:17.25" I.D.
All components are marked by SULZER.
The assembled part is checked after manufact.

state: CERTIFIED

rev.	revision remarks	issued by	date	checked	date	approved	date
1	CERTIFIED ISSUE	TSa	2/17/17	RBo	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BMc	1/6/17	RBo	1/9/17	DWi	1/9/17

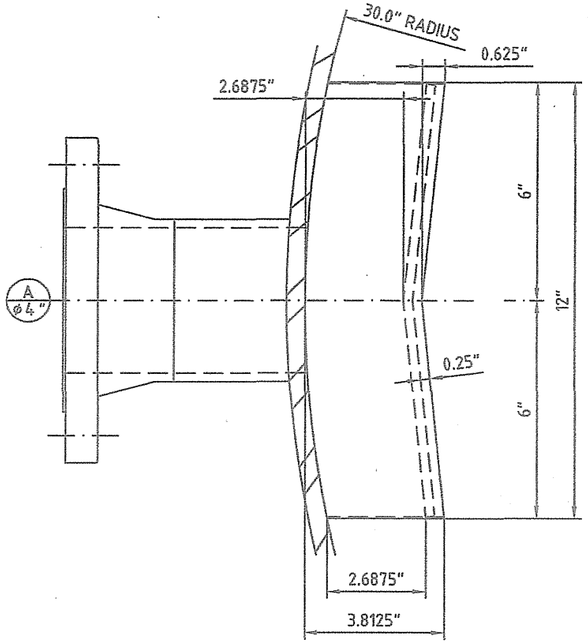
job no.: -212	SULZER project no.: 9033982-02	size: 11x17	scale: %
col.-I.D.: 42.0"	customer: UOP RUSSELL LLC.	customer p.o.: 4500753897	
col item: T-501	plant:	customer-dwg.:	
bed: No.4	area:	ACAD 2000	

SULZER

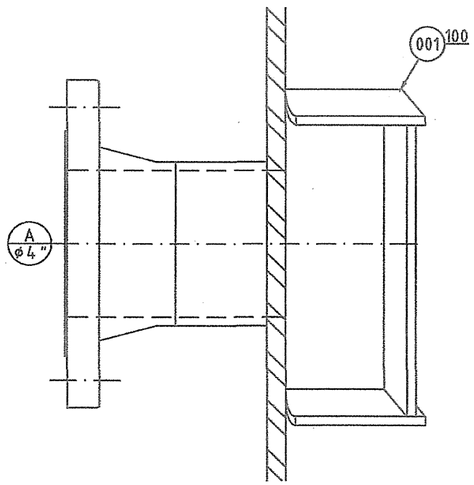
SKHW COLLECTOR TRAY
DEMETHANIZER TOWER (BED No.4)

drawing no.: 9033982-02 sheet no.: 16

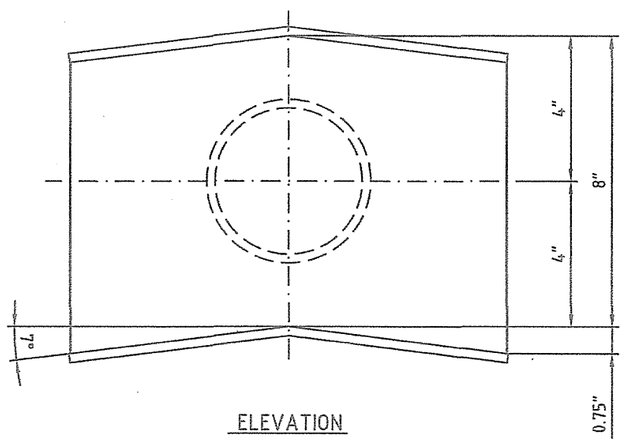
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PLAN VIEW



ELEVATION



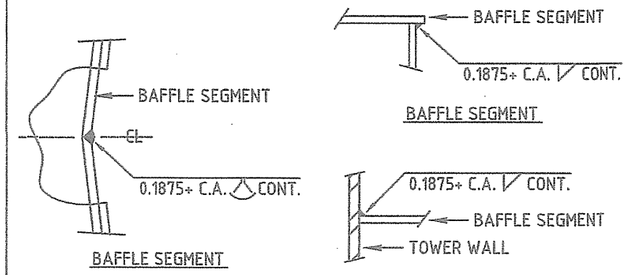
ELEVATION

item list								
item	qty.	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb.]
000	1	–	set		WELD-IN BAFFLE FOR NOZZLE "A"	BED No.1	304L	16.7
001	1	–	pce.		BAFFLE		304L	
100	1.5	–	ft2		PLATE - 1/4" THICK		304L	11.16

001 - 099: parts / 100 - 199: materials

RECOMMENDED WELDING DETAILS

WELD SIZE AS SPECIFIED DOES NOT CONSTITUTE
LIABILITY IN REGARDS TO CONFLICTION WITH VESSEL
FABRICATOR OR CUSTOMER PROCEDURES



SHOP NOTES:

1. MAXIMUM HORIZONTAL LEVEL DEVIATIONS: ±0.1875"
2. ALL WELD IN MATERIAL: 0.25" THICK 304L

APPROVED FOR CONSTRUCTION
2132
RR 3/1/17
CURTIS KELLY, INC.

GENERAL NOTES

All parts shall pass through man ways:17.25" I.D.
All components are marked by SULZER.
The assembled part is checked after manufact.

state: CERTIFIED

rev.	revision remarks	issued by	date	checked	date	approved	date
1	CERTIFIED ISSUE	TSa	2/17/17	RBo	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BMc	1/6/17	RBo	1/9/17	DWi	1/9/17

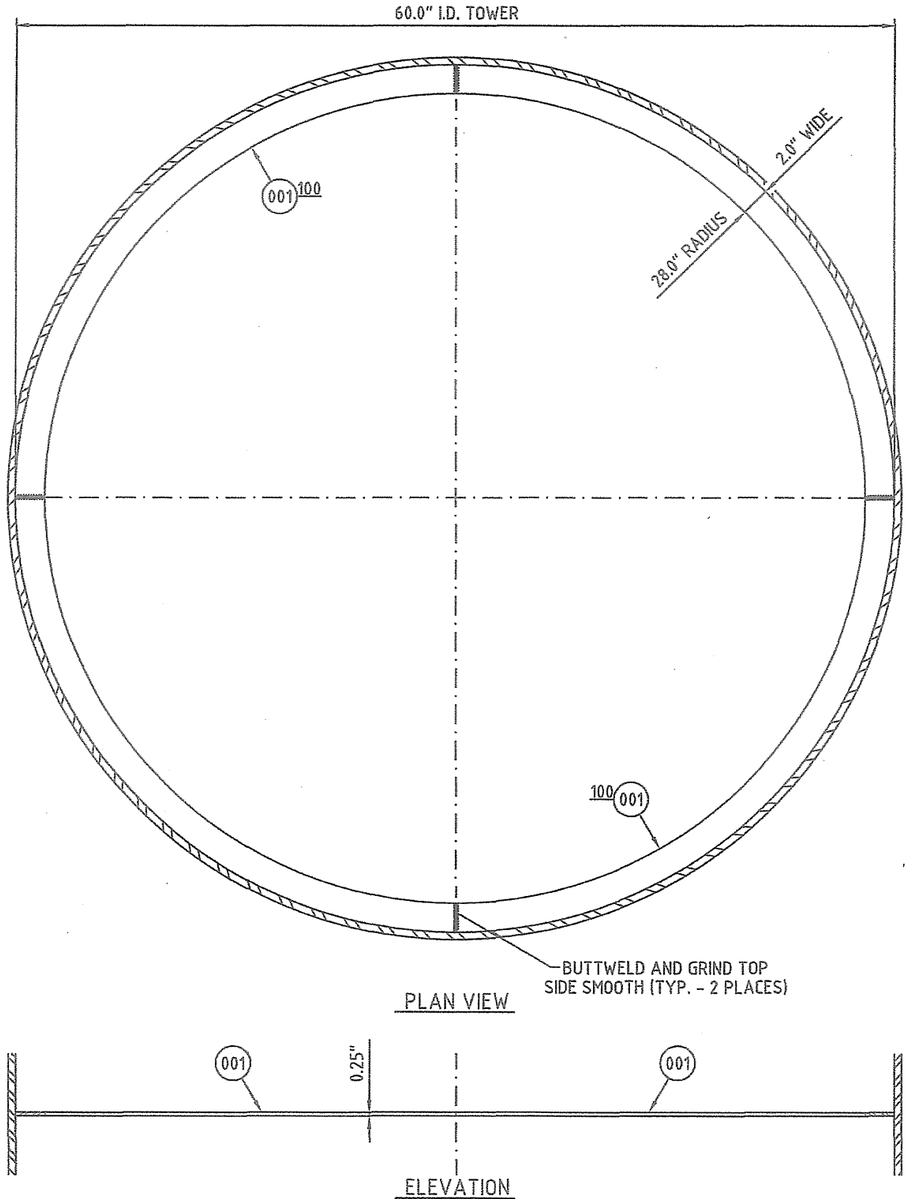
job no.: -215	SULZER project no.: 9033982-02	size: 11x17	scale: %
col.-I.D.: 60.0"	customer: UOP RUSSELL LLC.	customer p.o.: 4500753897	
col item: T-501	plant:	customer-dwg.:	
bed: No.1	area:	ACAD 2000	

SULZER

WELD-IN BAFFLE FOR NOZZLE "A"
DEMETHANIZER TOWER (BED No.1)

drawing no.: 9033982-02 sheet no.: 17

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PLAN VIEW

ELEVATION

item list

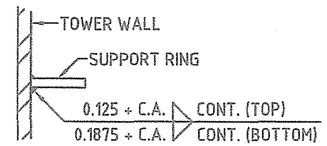
item	qty.	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb.]
000	1	–	set		WELD-INS FOR SKG, VSIR, & GIS	BED No.1	304L	29
001	4	–	pcs.		SUPPORT RING SEGMENT		304L	
100	2.54	–	ft2		PLATE - 1/4" THICK		304L	11.16

001 - 099: parts / 100 - 199: materials

NOTE: QUANTITIES SHOWN ABOVE ARE FOR 1 (ONE) SUPPORT RING.
A QUANTITY OF 3 (THREE) SUPPORT RINGS AS SHOWN ON THIS SHEET
ARE REQUIRED. ONE EACH FOR THE BED No.1 SKG GALLERY TRAY,
VSIR DISTRIBUTOR, AND GIS SUPPORT PLATE.

RECOMMENDED WELDING DETAILS

WELD SIZE AS SPECIFIED DOES NOT CONSTITUTE
LIABILITY IN REGARDS TO CONFLICTION WITH VESSEL
FABRICATOR OR CUSTOMER PROCEDURES



SUPPORT RING - TOWER

SHOP NOTES:

1. MAXIMUM HORIZONTAL LEVEL DEVIATIONS: ±0.125"
2. ALL WELD IN MATERIAL: 0.25" THICK 304L

APPROVED FOR CONSTRUCTION
2132
RR 3/1/17
CURTIS KELLY, INC.

GENERAL NOTES

All parts shall pass through man ways:17.25" I.D.
All components are marked by SULZER.
The assembled part is checked after manufact.

state: CERTIFIED

rev.	revision remarks	issued by	date	checked	date	approved	date
1	CERTIFIED ISSUE	TSa	2/17/17	RBo	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BMc	1/6/17	RBo	1/9/17	DWi	1/9/17

job no.: -217	SULZER project no.: 9033982-02	size: 11x17	scale: %
col.-I.D.: 60.0"	customer: UOP RUSSELL LLC.	customer p.o.: 4500753897	
col item: T-501	plant:	customer-dwg.:	
bed: No.1	area:	ACAD 2000	

SULZER

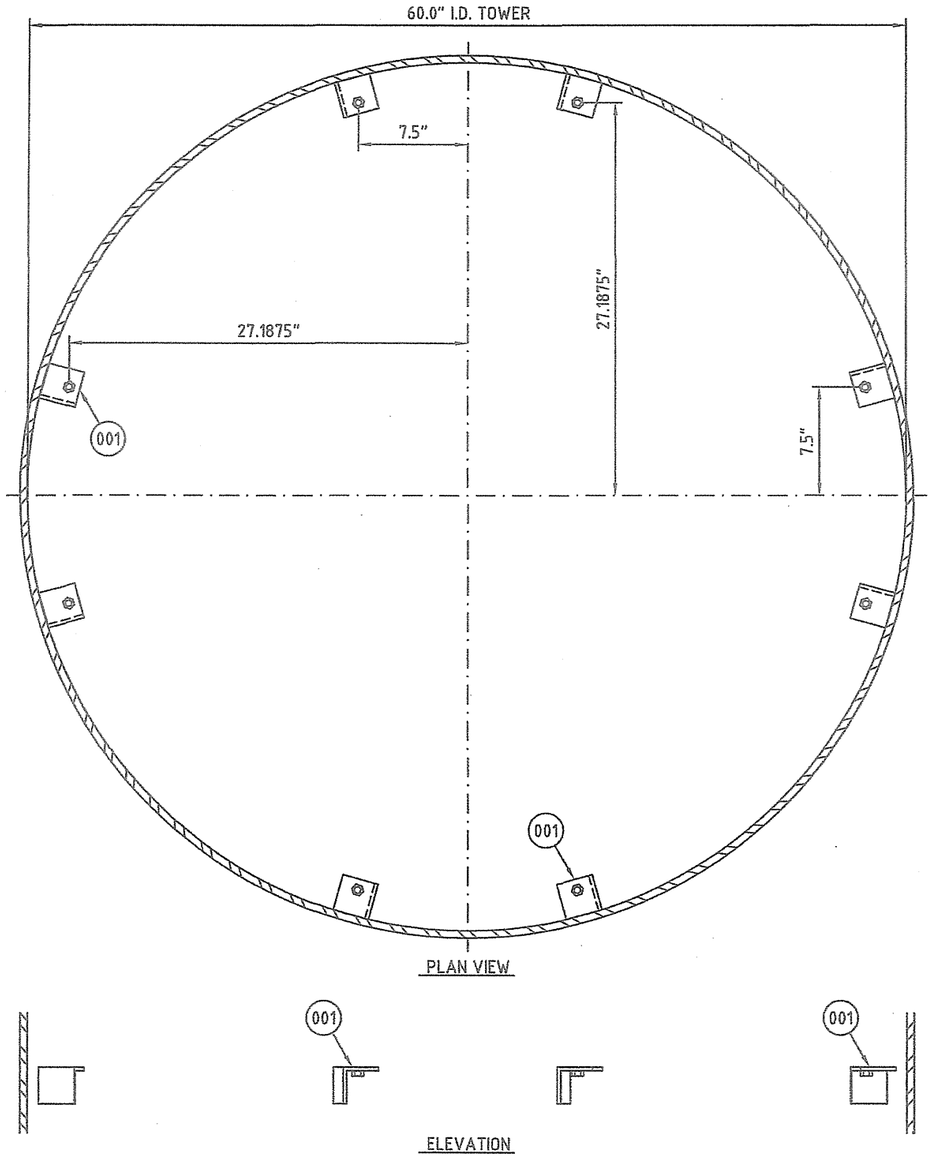
WELD-INS FOR SKG, VSIR, AND GIS
DEMETHANIZER TOWER (BED No.1)

drawing no.: 9033982-02 sheet no.: 18

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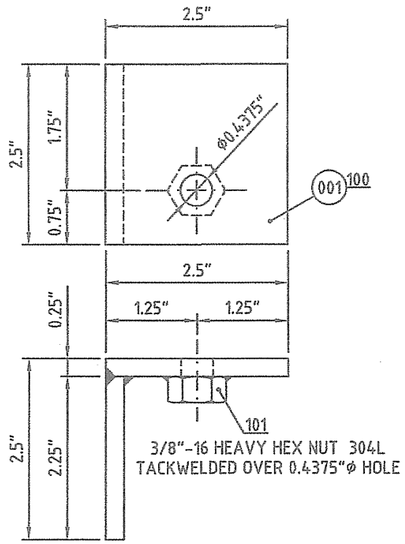
item list								
item	qty.	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb.]
000	1	–	set		WELD-INS FOR RPB BED LIMITER	BED No.1	304L	8
001	8	–	pcs.		SUPPORT CLIP		304L	
100	0.66	–	ft2		PLATE - 1/4" THICK		304L	11.16
101	8	–	pcs.		HEAVY HEX NUT - 3/8"-16 - TACKWELDED		304L	0.0314

001 - 099: parts / 100 - 199: materials



PLAN VIEW

ELEVATION

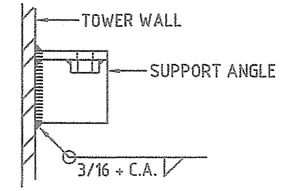


3/8"-16 HEAVY HEX NUT 304L
TACKWELDED OVER 0.4375"ø HOLE

SUPPORT CLIP DETAIL
(8 - REQUIRED)

RECOMMENDED WELDING DETAILS

WELD SIZE AS SPECIFIED DOES NOT CONSTITUTE LIABILITY IN REGARDS TO CONFLICTION WITH VESSEL FABRICATOR OR CUSTOMER PROCEDURES



BEAM CLIP - TOWER

SHOP NOTES:

1. MAXIMUM HORIZONTAL LEVEL DEVIATIONS: ±0.1875"
2. ALL WELD IN MATERIAL: 0.25" THICK 304L

APPROVED FOR CONSTRUCTION
2132
RR 3/1/17
CURTIS KELLY, INC.

GENERAL NOTES

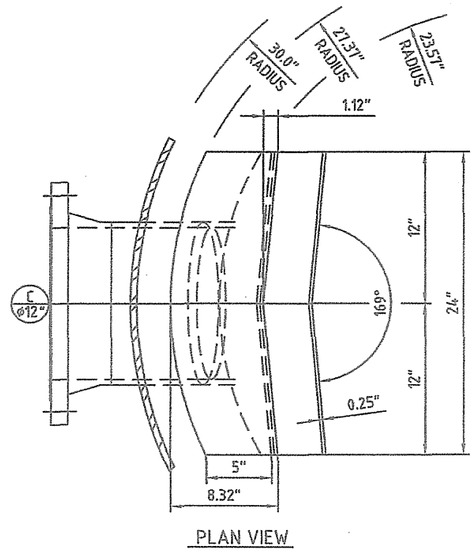
All parts shall pass through man ways:17.25" I.D.
All components are marked by SULZER.
The assembled part is checked after manufact.

state: CERTIFIED

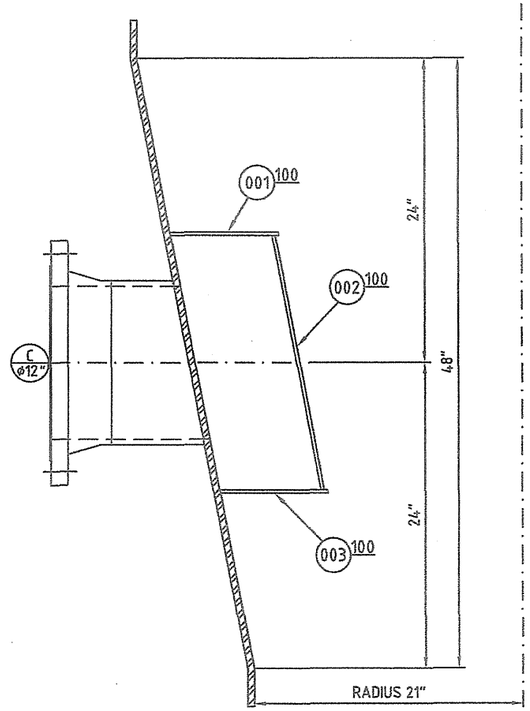
rev.	revision remarks	issued by	date	checked	date	approved	date
1	CERTIFIED ISSUE	TSa	2/17/17	RBo	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BMc	1/6/17	RBo	1/9/17	DWi	1/9/17

job no.: -220	SULZER project no.: 9033982-02	size: 11x17	scale: %
col.-I.D.: 60.0"	customer: UOP RUSSELL LLC.	customer p.o.: 4500753897	
col item: T-501	plant:	customer-dwg.:	
bed: No.1	area:	ACAD 2000	
SULZER	WELD-INS FOR RPB BED LIMITER DEMETHANIZER TOWER (BED No.1)	drawing no.: 9033982-02	sheet no.: 19

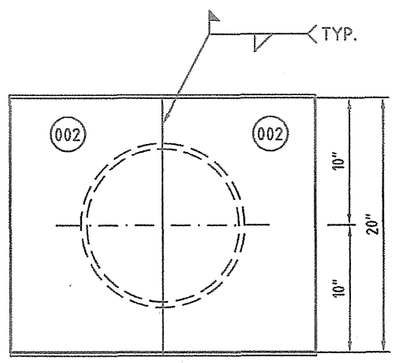
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PLAN VIEW



ELEVATION



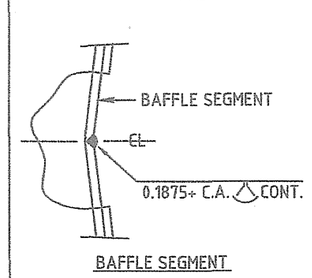
ELEVATION

item list								
item	qty.	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb.]
000	1	–	set		WELD-IN BAFFLE FOR NOZZLE "C"	BED No.2	304L	52
001	1	–	pce.		BAFFLE		304L	
002	2	–	pce.		BAFFLE		304L	
003	1	–	pce.		BAFFLE		304L	
100	4.7	–	ft2		PLATE - 1/4" THICK		304L	11.16

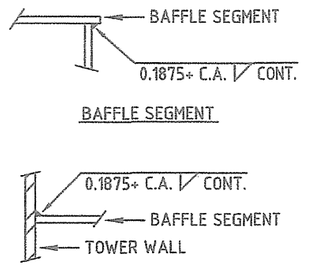
001 - 099: parts / 100 - 199: materials

RECOMMENDED WELDING DETAILS

WELD SIZE AS SPECIFIED DOES NOT CONSTITUTE
LIABILITY IN REGARDS TO CONFLICTION WITH VESSEL
FABRICATOR OR CUSTOMER PROCEDURES



BAFFLE SEGMENT



BAFFLE SEGMENT

BAFFLE SEGMENT/ TOWER WALL

SHOP NOTES:

1. MAXIMUM HORIZONTAL LEVEL DEVIATIONS: ±0.1875"
2. ALL WELD IN MATERIAL: 0.25" THICK 304L

APPROVED FOR CONSTRUCTION
2132
RR 3/1/17
CURTIS KELLY, INC.

GENERAL NOTES

All parts shall pass through man ways:17.25" i.D.
All components are marked by SULZER.
The assembled part is checked after manufact.

state: CERTIFIED

rev.	revision remarks	issued by	date	checked	date	approved	date
1	CERTIFIED ISSUE	TSa	2/17/17	RBo	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BMc	1/6/17	RBo	1/9/17	DWi	1/9/17

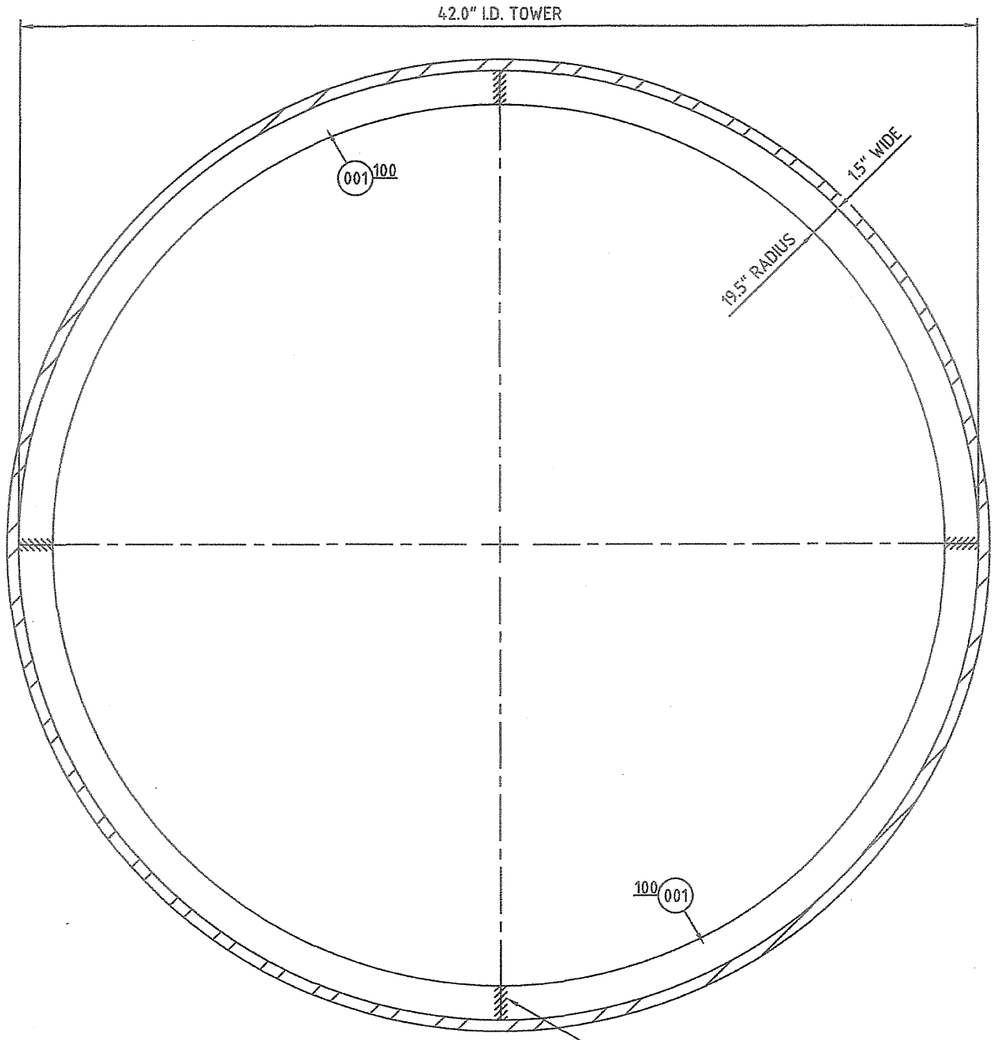
job no.: -215	SULZER project no.: 9033982-02	size: 11x17	scale: %
col.-I.D.: 42.0"	customer: UOP RUSSELL LLC.	customer p.o.: 4500753897	
col item: T-501	plant:	customer-dwg.:	
bed: No.2	area:	ACAD 2000	

SULZER

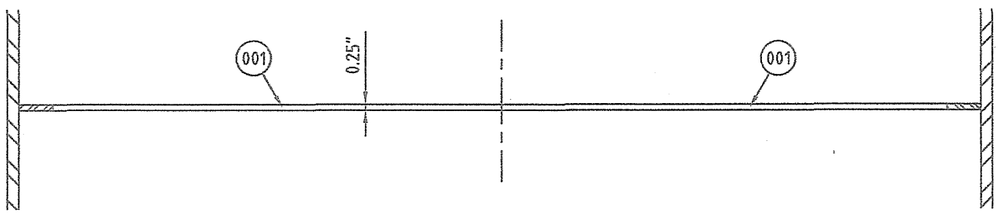
WELD-IN BAFFLE FOR NOZZLE "C"
DEMETHANIZER TOWER (BED No.2)

drawing no.: 9033982-02 sheet no.: 20

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PLAN VIEW



ELEVATION

Item list

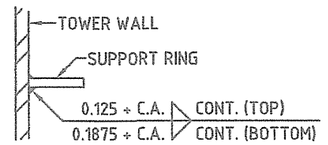
item	qty.	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb.]
000	1	–	set		WELD-INS FOR SKH, VSIR, EMS, & SKG	BEDS No.2,3,&4	304L	15.6
001	4	–	pcs.		SUPPORT RING SEGMENT		304L	
100	1.4	–	ft2		PLATE - 1/4" THICK		304L	11.16

001 - 099: parts / 100 - 199: materials

NOTE: QUANTITIES SHOWN ABOVE ARE FOR 1 (ONE) SUPPORT RING. A QUANTITY OF 9 (NINE) SUPPORT RINGS AS SHOWN ON THIS SHEET ARE REQUIRED. ONE EACH FOR THE BED No.2 SKH COLLECTOR TRAY, VSIR DISTRIBUTOR, AND GIS SUPPORT PLATE; BED No.3 SKG GALLERY TRAY, VSIR DISTRIBUTOR, AND GIS SUPPORT PLATE; AND BED No.4 SKG GALLERY TRAY, VSIR DISTRIBUTOR, AND GIS SUPPORT PLATE.

RECOMMENDED WELDING DETAILS

WELD SIZE AS SPECIFIED DOES NOT CONSTITUTE LIABILITY IN REGARDS TO CONFLICTION WITH VESSEL FABRICATOR OR CUSTOMER PROCEDURES



SUPPORT RING - TOWER

SHOP NOTES:

1. MAXIMUM HORIZONTAL LEVEL DEVIATIONS: ±0.125"
2. ALL WELD IN MATERIAL: 0.25" THICK 304L

APPROVED FOR CONSTRUCTION
2132
RR 3/1/17
CURTIS KELLY, INC.

GENERAL NOTES

All parts shall pass through man ways:17.25" I.D.
All components are marked by SULZER.
The assembled part is checked after manufact.

state: CERTIFIED

rev.	revision remarks	issued by	date	checked	date	approved	date
1	CERTIFIED ISSUE	TSa	2/17/17	RBo	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BMc	1/6/17	RBo	1/9/17	DWi	1/9/17

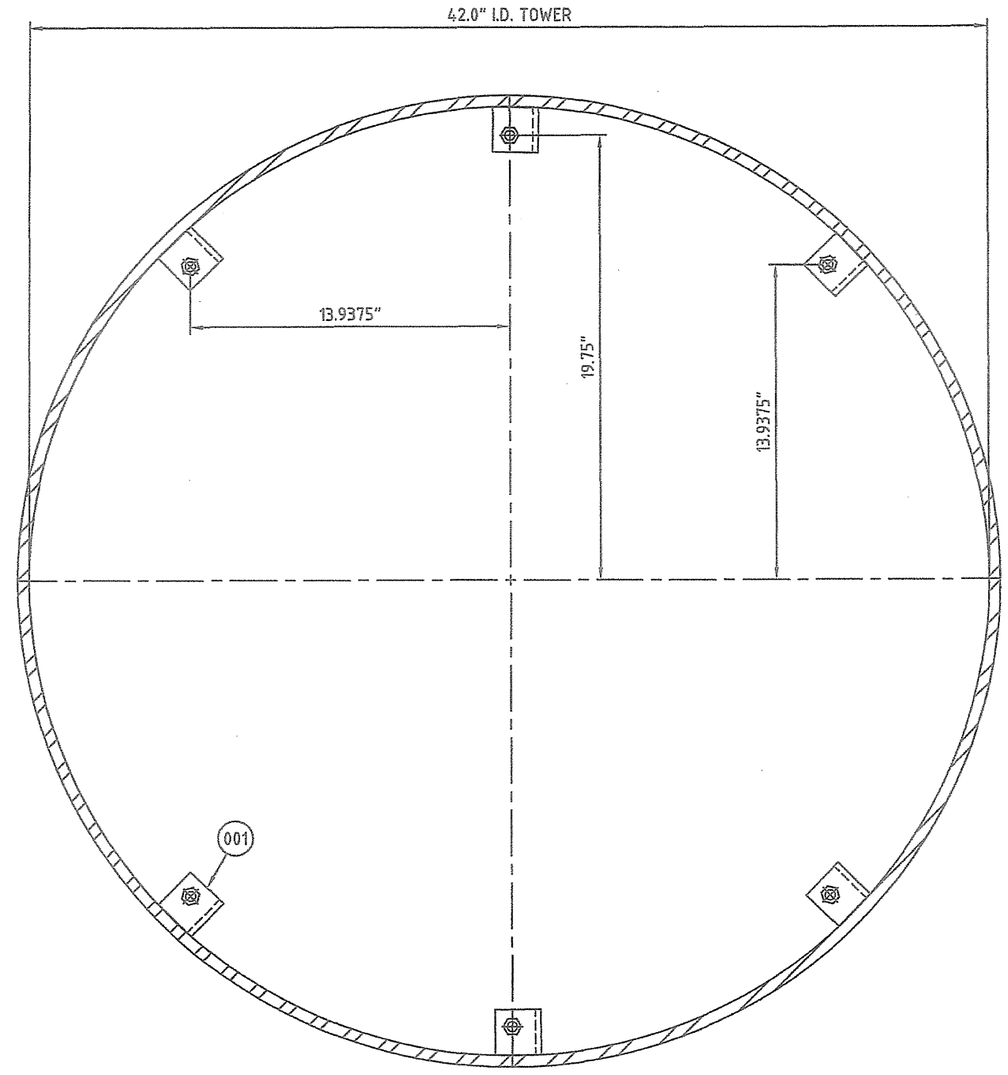
job no.: -218	SULZER project no.: 9033982-02	size: 11x17	scale: %
col.-I.D.: 42.0"	customer: UOP RUSSELL LLC.	customer p.o.: 4500753897	
col item: T-501	plant:	customer-dwg.:	
bed: No.2, 3, & 4	area:	ACAD 2000	

SULZER

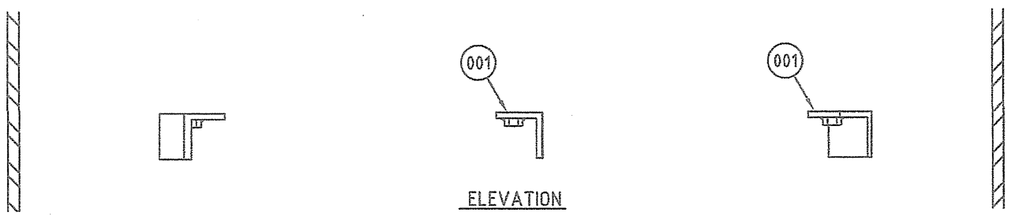
WELD-INS FOR SKH, VSIR, GIS, AND SKG
DEMETHANIZER TOWER (BEDS No.2, 3, & 4)

drawing no.: 9033982-02 sheet no.: 21

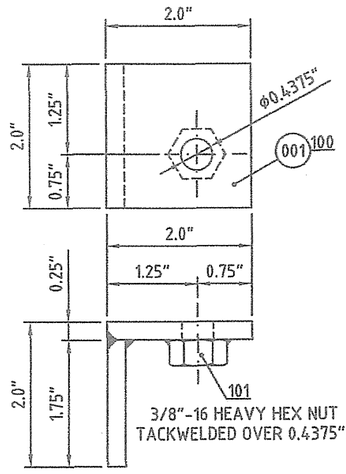
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PLAN VIEW



ELEVATION



SUPPORT CLIP DETAIL
(6 - REQUIRED)

item list

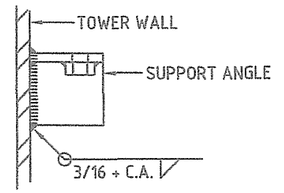
item	qty.	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb.]
000	1	–	set		WELD-INS FOR RPB BED LIMITER	BEDS No.2, 3, & 4	304L	4
001	6	–	pcs.		SUPPORT CLIP		304L	
100	0.32	–	ft2		PLATE - 1/4" THICK		304L	11.16
101	6	–	pcs.		HEAVY HEX NUT - 3/8"-16 - TACKWELDED		304L	0.0314

001 - 099: parts / 100 - 199: materials

NOTE: QUANTITIES SHOWN ABOVE ARE FOR 1 (ONE) SET OF SUPPORT CLIPS. A QUANTITY OF 3 (THREE) SETS OF SUPPORT CLIPS AS SHOWN ON THIS SHEET ARE REQUIRED. ONE EACH FOR THE BED No.2 RPB BED LIMITER, BED No.3 RPB BED LIMITER, AND BED No.4 RPB BED LIMITER.

RECOMMENDED WELDING DETAILS

WELD SIZE AS SPECIFIED DOES NOT CONSTITUTE LIABILITY IN REGARDS TO CONFLICTION WITH VESSEL FABRICATOR OR CUSTOMER PROCEDURES



BEAM CLIP - TOWER

SHOP NOTES:

1. MAXIMUM HORIZONTAL LEVEL DEVIATIONS: ±0.1875"
2. ALL WELD IN MATERIAL: 0.25" THICK 304L

APPROVED FOR CONSTRUCTION
2132
RR 3/1/17
CURTIS KELLY, INC.

GENERAL NOTES

All parts shall pass through man ways:17.25" I.D.
All components are marked by SULZER.
The assembled part is checked after manufact.

state: CERTIFIED

rev.	revision remarks	issued by	date	checked	date	approved	date
1	CERTIFIED ISSUE	TSa	2/17/17	RBo	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BMc	1/6/17	RBo	1/9/17	DWi	1/9/17

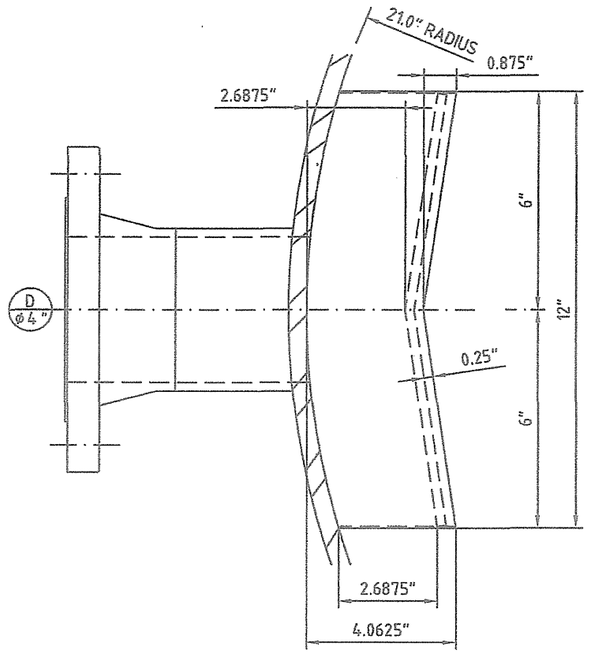
job no.: -220	SULZER project no.: 9033982-02	size: 11x17	scale: %
col.-I.D.: 42.0"	customer: UOP RUSSELL LLC.	customer p.o.: 4500753897	
col item: T-501	plant:	customer-dwg.:	
bed: No.2, 3, & 4	area:	ACAD 2000	

SULZER

WELD-INS FOR RPB BED LIMITER
DEMETHANIZER TOWER (BEDS No.2, 3, & 4)

drawing no.: 9033982-02 sheet no.: 22

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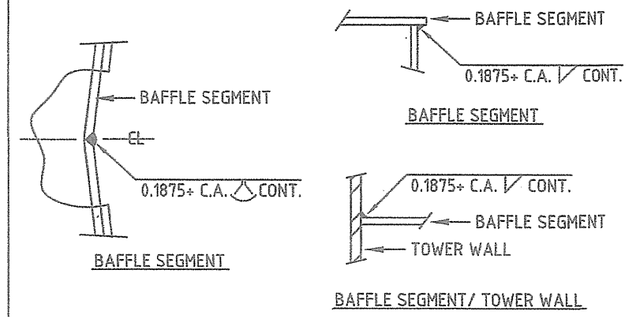
PLAN VIEW

item list								
item	qty.	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb.]
000	1	–	set		WELD-IN BAFFLE FOR NOZZLE "D"	BED No.3	304L	16.7
001	1	–	pce.		BAFFLE		304L	
100	1.5	–	ft2		PLATE - 1/4" THICK		304L	11.16

001 - 099: parts / 100 - 199: materials

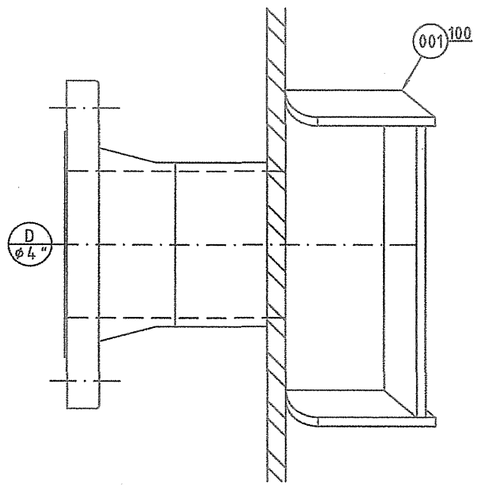
RECOMMENDED WELDING DETAILS

WELD SIZE AS SPECIFIED DOES NOT CONSTITUTE
LIABILITY IN REGARDS TO CONFLICTION WITH VESSEL
FABRICATOR OR CUSTOMER PROCEDURES

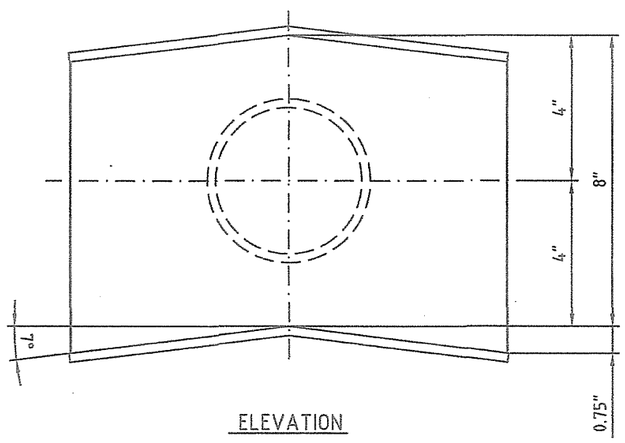


SHOP NOTES:

1. MAXIMUM HORIZONTAL LEVEL DEVIATIONS: ±0.1875"
2. ALL WELD IN MATERIAL: 0.25" THICK 304L



ELEVATION



ELEVATION

APPROVED FOR CONSTRUCTION
2132
RR 3/1/17
CURTIS KELLY, INC.

GENERAL NOTES
All parts shall pass through man ways:17.25" I.D.
All components are marked by SULZER.
The assembled part is checked after manufact.

state: CERTIFIED

rev.	revision remarks	issued by	date	checked	date	approved	date
1	CERTIFIED ISSUE	TSa	2/17/17	RBo	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BHc	1/6/17	RBo	1/9/17	DWi	1/9/17

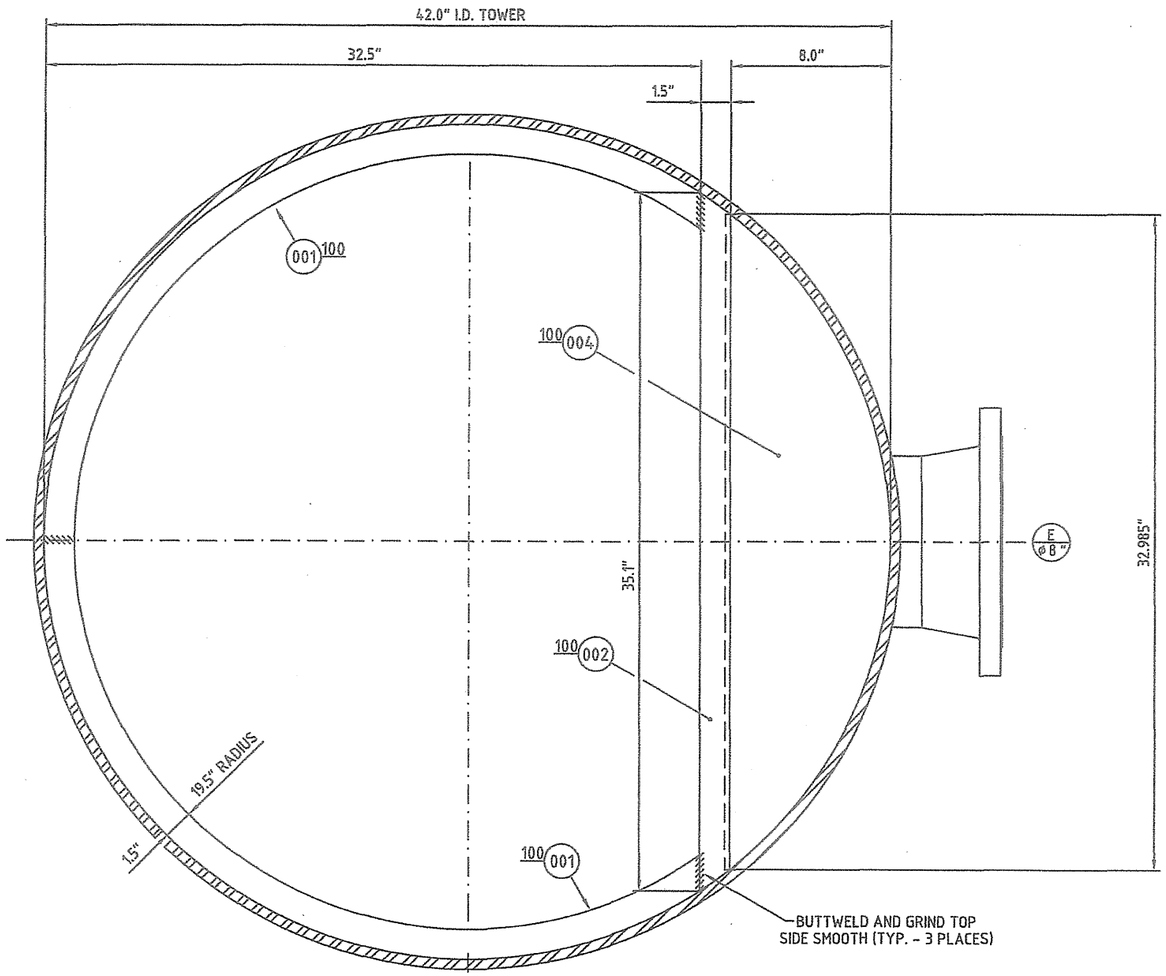
job no.: -215	SULZER project no.: 9033982-02	size: 11x17	scale: %
col.-I.D.: 42.0"	customer: UOP RUSSELL LLC.	customer p.o.: 4500753897	
col item: T-501	plant:	customer-dwg.:	
bed: No.3	area:	ACAD 2000	

SULZER

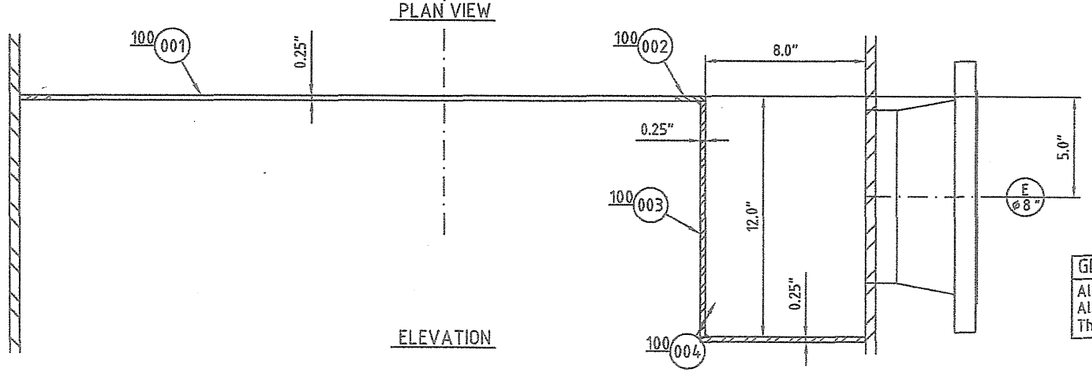
WELD-IN BAFFLE FOR NOZZLE "D"
DEMETHANIZER TOWER (BED No.3)

drawing no.: 9033982-02 sheet no.: 23

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PLAN VIEW



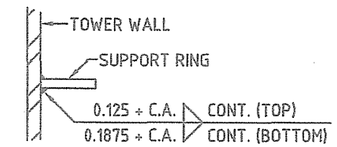
ELEVATION

item list								
item	qty.	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb.]
000	1	–	set		WELD-INS FOR SKH, VSIR, EMS, & SKG	BED No.3	304L	60
001	2	–	pcs.		SUPPORT RING SEGMENT		304L	
002	1	–	pce.		SUPPORT LEDGE		304L	
003	1	–	pce.		SUMP WALL		304L	
004	1	–	pce.		SUMP FLOOR		304L	
100	5.4	–	ft2		PLATE - 1/4" THICK		304L	11.16

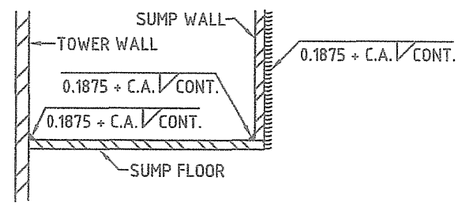
001 - 099: parts / 100 - 199: materials

RECOMMENDED WELDING DETAILS

WELD SIZE AS SPECIFIED DOES NOT CONSTITUTE LIABILITY IN REGARDS TO CONFLICTION WITH VESSEL FABRICATOR OR CUSTOMER PROCEDURES



SUPPORT RING - TOWER



SUMP FLOOR / SUMP WALL - TOWER

SHOP NOTES:

1. MAXIMUM HORIZONTAL LEVEL DEVIATIONS: ±0.125"
2. ALL WELD IN MATERIAL: 0.25" THICK 304L

APPROVED FOR CONSTRUCTION
2132
RR 3/1/17
CURTIS KELLY, INC.

GENERAL NOTES

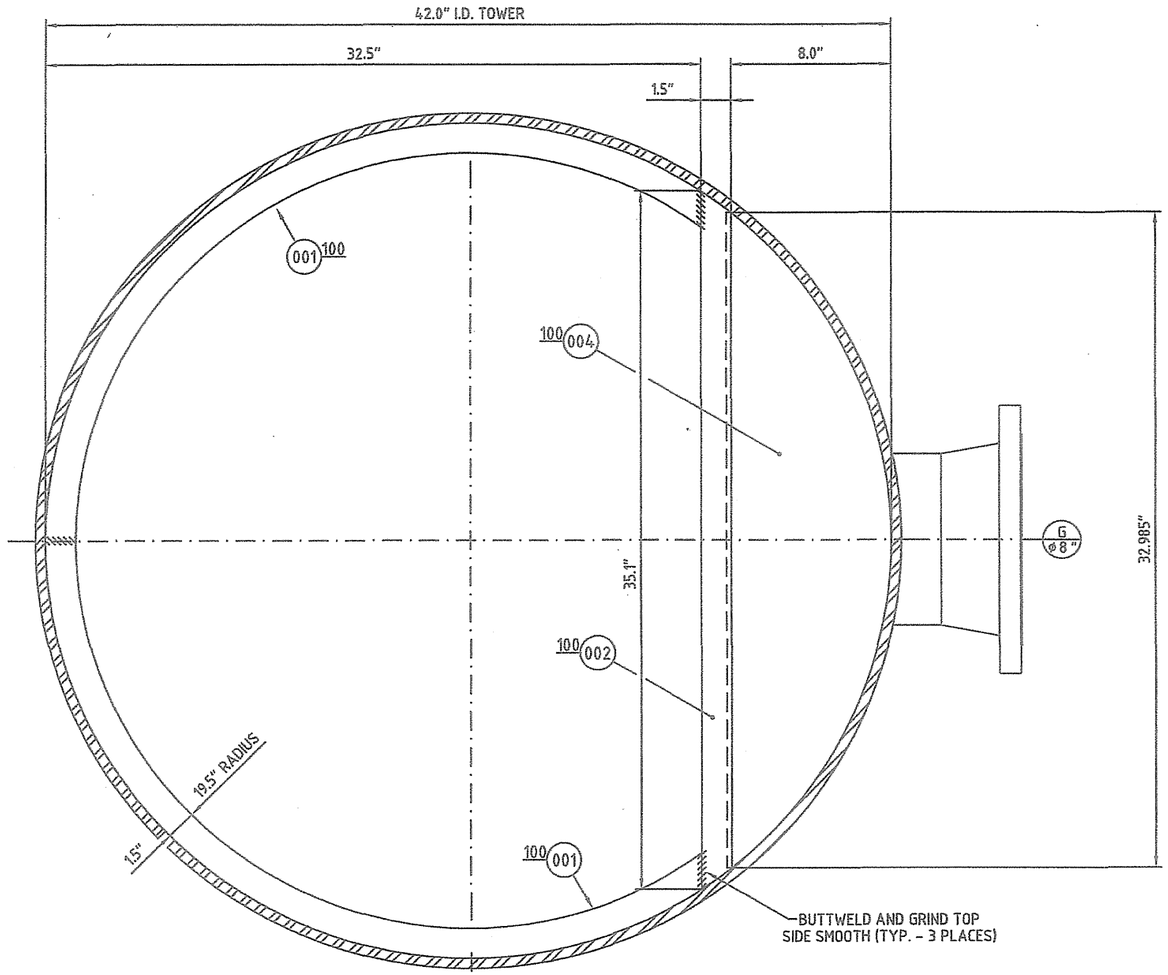
All parts shall pass through man ways:17.25" I.D.
All components are marked by SULZER.
The assembled part is checked after manufact.

state: CERTIFIED

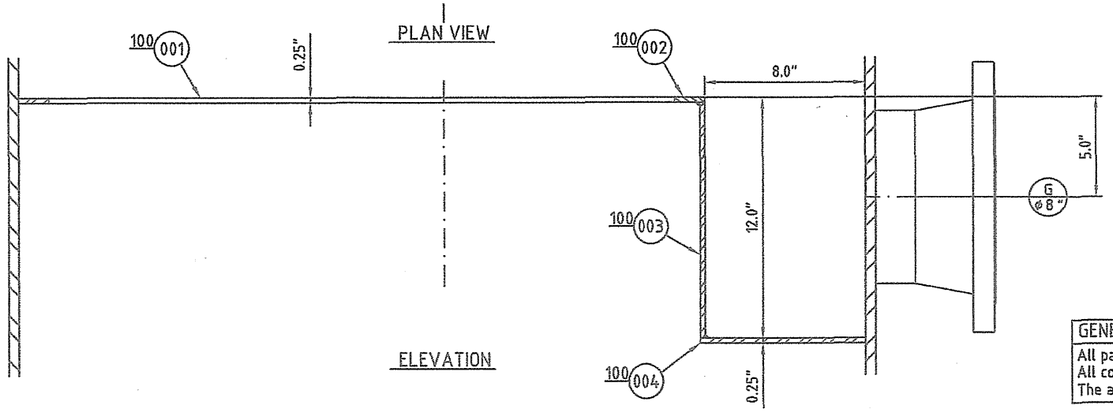
rev.	revision remarks	issued by	date	checked	date	approved	date
1	CERTIFIED ISSUE	TSa	2/17/17	RBo	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BMc	1/6/17	RBo	1/9/17	DWi	1/9/17

job no.: -219x	SULZER project no.: 9033982-02	size: 11x17	scale: %
col.-I.D.: 42.0"	customer: UOP RUSSELL LLC.	customer p.o.: 4500753897	
col item: T-501	plant:	customer-dwg.:	
bed: No.3	area:	ACAD 2000	
SULZER	WELD-INS FOR SKHW COLLECTOR TRAY DEMETHANIZER TOWER (BED No.3)	drawing no.: 9033982-02	sheet no.: 24

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PLAN VIEW



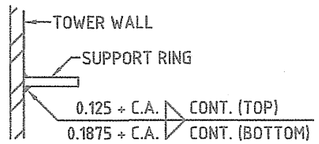
ELEVATION

item list								
item	qty.	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb.]
000	1	–	set		WELD-INS FOR SKH, VSIR, EMS, & SKG	BED No.4	304L	60
001	2	–	pcs.		SUPPORT RING SEGMENT		304L	
002	1	–	pce.		SUPPORT LEDGE		304L	
003	1	–	pce.		SUMP WALL		304L	
004	1	–	pce.		SUMP FLOOR		304L	
100	5.4	–	ft2		PLATE - 1/4" THICK		304L	11.16

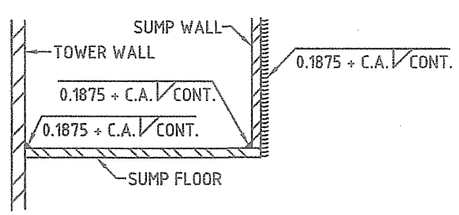
001 - 099: parts / 100 - 199: materials

RECOMMENDED WELDING DETAILS

WELD SIZE AS SPECIFIED DOES NOT CONSTITUTE LIABILITY IN REGARDS TO CONFLICTION WITH VESSEL FABRICATOR OR CUSTOMER PROCEDURES



SUPPORT RING - TOWER



SUMP FLOOR / SUMP WALL - TOWER

SHOP NOTES:

1. MAXIMUM HORIZONTAL LEVEL DEVIATIONS: ±0.125"
2. ALL WELD IN MATERIAL: 0.25" THICK 304L

APPROVED FOR CONSTRUCTION
2132
RR 3/1/17
CURTIS KELLY, INC.

GENERAL NOTES

All parts shall pass through man ways:17.25" I.D.
All components are marked by SULZER.
The assembled part is checked after manufact.

state: CERTIFIED

rev.	revision remarks	issued by	date	checked	date	approved	date
1	CERTIFEID ISSUE	TSa	2/17/17	RBo	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BMc	1/6/17	RBo	1/9/17	DWi	1/9/17

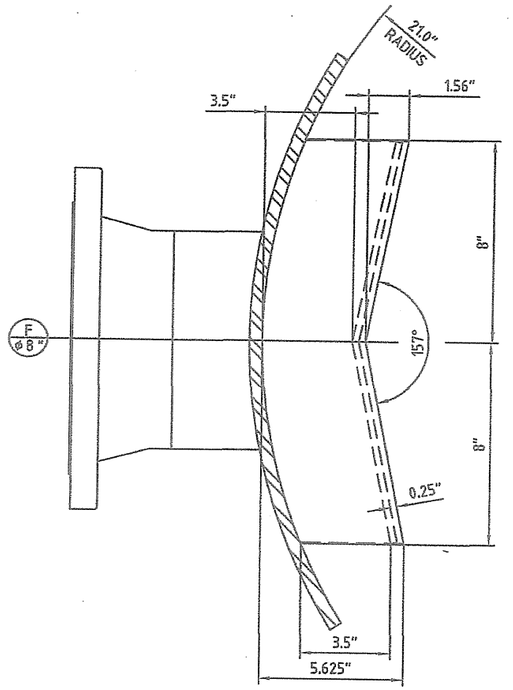
job no.: -219	SULZER project no.: 9033982-02	size: 11x17	scale: %
col.-I.D.: 42.0"	customer: UOP RUSSELL LLC.	customer p.o.: 4500753897	
col item: T-501	plant:	customer-dwg.:	
bed: No.4	area:	ACAD 2000	

SULZER

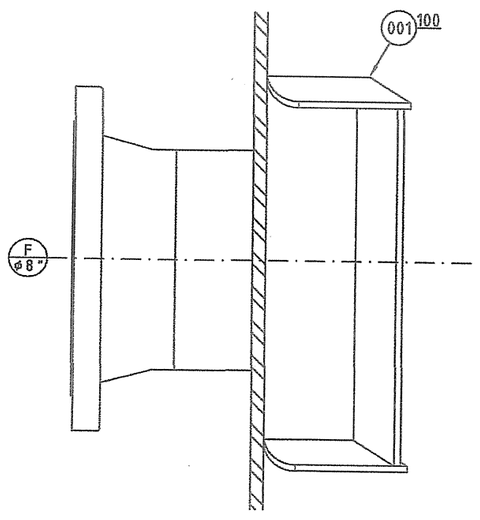
WELD-INS FOR SKHW COLLECTOR TRAY
DEMETHANIZER TOWER (BEDS No. 4)

drawing no.: 9033982-02 sheet no.: 24A

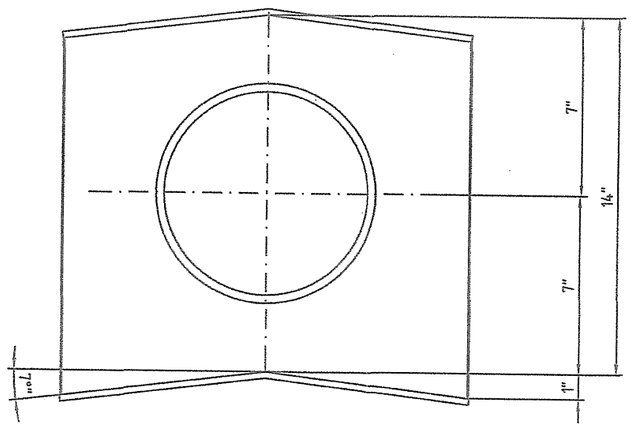
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PLAN VIEW



ELEVATION



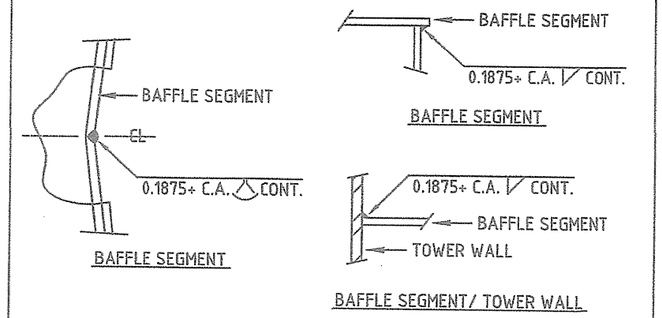
ELEVATION

item list								
item	qty.	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb.]
000	1	–	set		WELD-IN BAFFLE FOR NOZZLE "F"	BED No.4	304L	32
001	1	–	pce.		BAFFLE		304L	
100	2.9	–	ft2		PLATE - 1/4" THICK		304L	11.16

001 - 099: parts / 100 - 199: materials

RECOMMENDED WELDING DETAILS

WELD SIZE AS SPECIFIED DOES NOT CONSTITUTE
LIABILITY IN REGARDS TO CONFLICTION WITH VESSEL
FABRICATOR OR CUSTOMER PROCEDURES



SHOP NOTES:

1. MAXIMUM HORIZONTAL LEVEL DEVIATIONS: ±0.1875"
2. ALL WELD IN MATERIAL: 0.25" THICK 304L

GENERAL NOTES
All parts shall pass through man ways: 17.25" I.D. All components are marked by SULZER. The assembled part is checked after manufact.

state: CERTIFIED

APPROVED FOR CONSTRUCTION
2132
RR 3/1/17
CURTIS KELLY, INC.

rev.	revision remarks	issued by	date	checked	date	approved	date
1	CERTIFIED ISSUE	TSa	2/17/17	RBo	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BMc	1/6/17	RBo	1/9/17	DWi	1/9/17

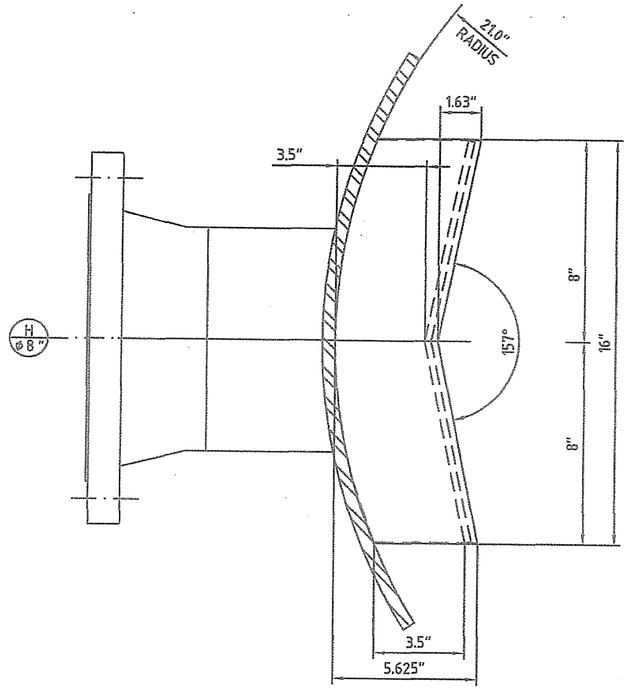
job no.: -215	SULZER project no.: 9033982-02	size: 11x17	scale: %
col.-I.D.: 42.0"	customer: UOP RUSSELL LLC.	customer p.o.: 4500753897	
col item: T-501	plant:	customer-dwg.:	
bed: No.4	area:	ACAD 2000	

SULZER

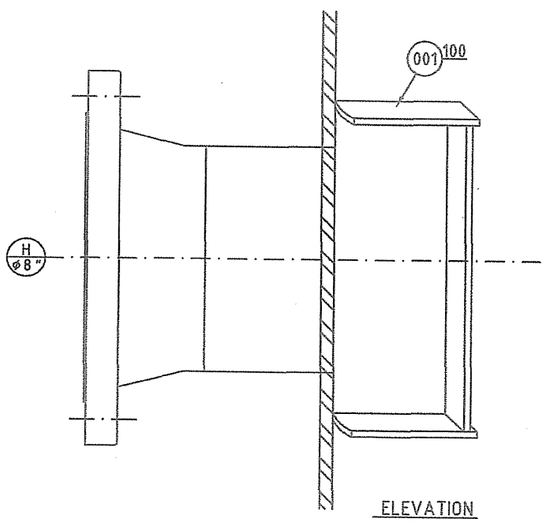
WELD-IN BAFFLE FOR NOZZLE "F"
DEMETHANIZER TOWER (BED No.4)

drawing no.: 9033982-02
sheet no.: 25

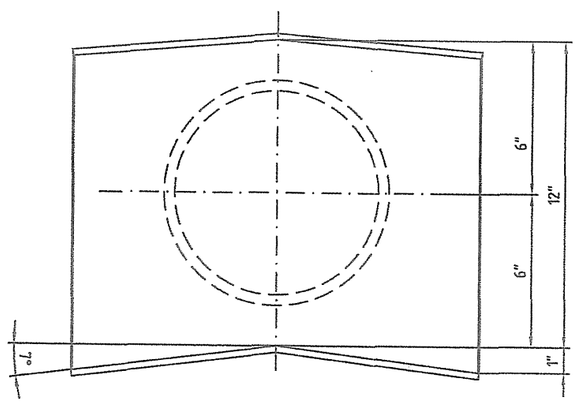
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PLAN VIEW



ELEVATION



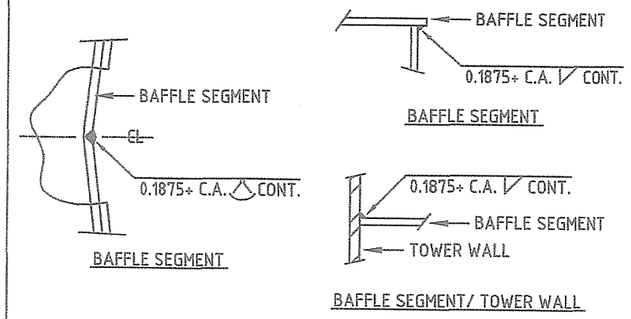
ELEVATION

item list								
item	qty.	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb.]
000	1	–	set		WELD-IN BAFFLE FOR NOZZLE "H"	BED No.4	304L	15.6
001	1	–	pce.		BAFFLE		304L	
100	1.4	–	ft2		PLATE - 1/4" THICK		304L	11.16

001 - 099: parts / 100 - 199: materials

RECOMMENDED WELDING DETAILS

WELD SIZE AS SPECIFIED DOES NOT CONSTITUTE
LIABILITY IN REGARDS TO CONFLICTION WITH VESSEL
FABRICATOR OR CUSTOMER PROCEDURES



SHOP NOTES:

1. MAXIMUM HORIZONTAL LEVEL DEVIATIONS: ±0.1875"
2. ALL WELD IN MATERIAL: 0.25" THICK 304L

APPROVED FOR CONSTRUCTION
RR 2132
3/1/17
CURTIS KELLY, INC.

GENERAL NOTES

All parts shall pass through man ways: 17.25" I.D.
All components are marked by SULZER.
The assembled part is checked after manufact.

state: CERTIFIED

rev.	revision remarks	issued by	date	checked	date	approved	date
1	CERTIFIED ISSUE	TSa	2/17/17	RBo	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BMc	1/6/17	RBo	1/9/17	DWi	1/9/17

job no.: -215	SULZER project no.: 9033982-02	size: 11x17	scale: %
col.-I.D.: 42.0"	customer: UOP RUSSELL LLC.	customer p.o.: 4500753897	
col item: T-501	plant:	customer-dwg.:	
bed: No.4	area:	ACAD 2000	

SULZER

WELD-IN BAFFLE FOR NOZZLE "H"
DEMETHANIZER TOWER (BED No.4)

drawing no.: 9033982-02 sheet no.: 26

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