API Heat Transfer

Member Of:

Basco/Whitlock Shell and Tube Heat Exchanger

							JOB NO.	**CB-18580/1**			
CUSTOMER	**Cameron**						REFERENCE NO.				
ADDRESS							PROPOSAL NO.				
PLANT LOCATION							DATE	**10/ 9/2013**			
SERVICE OF UNIT	**Oil Cooler**						ITEM NO.	**101**			
SIZE	**10072-4"-4P**			TYPE	**500(BEM)**		(HORIZ.) (VERT.)	CONNECTED IN			
SQ.M SURFACE	(GROSS) (EFF.)	**18.822**		SHELLS/UNIT	**ONE**		SQ.M SURF/SHELL	(GROSS) (EFF.)	**18.822**		

PERFORMANCE OF ONE UNIT

		SHELL SIDE	TUBE SIDE
FLUID CIRCULATED		**200 SSU Oil**	**WATER**
TOTAL FLUID ENTERING	kg/HR	**18.17 m³/Hr**	**21.8 m³/Hr**
VAPOR	kg/HR		
LIQUID	kg/HR		
STEAM	kg/HR		
NON-CONDENSIBLES	kg/HR		
FLUID VAPORIZED OR CONDENSED	kg/HR		
STEAM CONDENSED	kg/HR		
SPECIFIC GRAVITY		**.86**	**1.0**
VISCOSITY @ TEMP	cP @ ºC	**16.0 @ 58.89**	**.716 @ 35.56**
MOLECULAR WEIGHT			
SPECIFIC HEAT	kJ/kg-ºC	**2.0097**	**4.1868**
THERMAL CONDUCTIVITY	W/m-ºC	**.135**	**.6248**
LATENT HEAT – VAPORS	kJ/kg		
TEMPERATURE IN	ºC	**69.0**	**32.0**
TEMPERATURE OUT	ºC	**48.89**	**38.89**
OPERATING PRESSURE	BarA		
NO. PASSES PER SHELL		**ONE**	**FOUR**
VELOCITY	m/sec		**1.372**
PRESSURE DROP	Bar	**.621**	**.345**
FOULING RESISTANCE (Min)	m²-ºC/W	**.000088**	**.000176**

HEAT EXCHANGED **175277.84** W MTD CORRECTED **21.778** ºC

TRANSFER RATE – SERVICE **427.6** CLEAN W/m²-ºC

CONSTRUCTION

		SHELL SIDE	TUBE SIDE
DESIGN PRESSURE	BarG	**10.34**	**10.34**
TEST PRESSURE	BarG	**Per Code**	**Per Code**
DESIGN TEMPERATURE (Max/Min)	ºC	**93.3 / -28.9**	**93.3 / -28.9**

TUBES **90/10 Cu/Ni** NO. **344** OD **9.5 mm** BWG **22** LENGTH **182.9 cm** PITCH **11.5 mm Tri**

SHELL	**Carbon Steel** ID **25.75 cm** OD **27.3 cm**	SHELL COVER	(INTEG)(REMOV)
BONNET/CHANNEL	**Fab.Steel(Hog-outs)**	CHANNEL COVER	
TUBESHEET-STATIONARY	**Carbon Steel**	TUBESHEET-FLOATING	
BAFFLES - CROSS	**Carbon Steel** TYPE **Seg.**	FLOATING HEAD COVER	
BAFFLES - LONG	TYPE	IMPINGEMENT PROTECTION	

TUBE SUPPORTS

TUBE TO TUBESHEET JOINT **Mechanically Rolled**

GASKETS **Compressed Fiber** PACKING

CONNECTIONS-SHELL SIDE	IN	**3" - 150#**	OUT	**3" - 150#**	RATING	**ANSI RF SO**
BONNET/CHANNEL SIDE	IN	**2.5"**	OUT	**2.5"**	RATING	**NPT**

CORROSION ALLOWANCE – SHELL SIDE **1.6 mm on C. Steel** TUBE SIDE **1.6 mm on C. Steel**

CODE REQUIREMENTS **ASME Sec. VIII, Div. 1 (Latest Addenda)** TEMA CLASS **C**

OTHER

REMARKS

Cameron P/N AAP1401429-

Includes 20% Oversizing

• **API Basco** • 2777 Walden Avenue, Buffalo, NY 14225 • (716) 684-6700 Fax: (716) 684-2129

Compression Systems
3101 Broadway, PO Box 209
Buffalo, NY14225-0209 USA
Tel. 716.896.6600
Fax 716.896.1233

Tue Nov 19 10:29:51 2013

Heat Exchanger Specification

Metric Units

Customer: ROS ROCA INDOX CRYO-ENERGY, S.L. - Bolivia & Ecuador	Job No.: CB-18580,1
Service of Unit: 3R2MSGP-7ARC : A/C	Cooper PN: A3806480 - 00840
Size: 1112.5 / 15 X 17 X 4978.4	Effective Surface: 1444.2 m^2

Performance

Fluid Allocation	**Shell**	**Tube**
Fluid Name	Nitrogen	Water
Fluid Quantity, Total	14992.6 m^3/Hr*	132.8 m^3/Hr
Vapor (In/Out) Kg/Hr	0.0 / 0.0	
Liquid Kg/Hr		132767.8
Condensate Kg/Hr	0.0	
Non Condensables Kg/Hr	104539.4	
Temperature (In/Out) Deg C	94.3 / 40.0	32.0 / 42.3
Specific Heat Kcal/KgC	0.25	1.0
Inlet Pressure BAR(abs)	26.4	
Core Velocity	m/s	1.8 m/s
Pressure Drop BAR	0.059	0.505
Fouling Resistance Hrm^2C/Kcal	0.0001	0.0002

Heat Ex.: 1363595.3 Kcal/Hr // LMTD: 23.5 Deg C // Transfer Rate: 58.1 Kcal/Hrm^2C

Construction

Design/Test Pressure BAR(g)	39.6 / 51.6	10.3 / 13.4
Design Temperature (min/max)Deg C	-28.9 / 176.7	-28.9 / 65.6
Number of Passes	1	2
Corrosion Allowance mm	1.5875	1.5875
Connections: Size (In/Out) in	12.0 / 12.0**	6.0 / 6.0**
Connections: Rating		150 PSIG**
Tube No.: 255	OD: 0.6250 in**	Thk: 18.0 BWG**
Length: 4978.4 mm	Pitch: 38.1 mm	---> 30 deg. triangular

Tube/Fin Arrangement:BARE with ALUMINUM fins // Tube Material: 90/10 CuNi

Shell: STEEL Shell Cover: STEEL ID / OD: 1066.8 mm / 1112.5 mm

Bonnet, Supply: STEEL // Bonnet, Return: STEEL

Tubesheet, Stationary: STEEL // Tubesheet, Floating: STEEL

Bypass Seal: Silicone Rubber	Tubesheet Joint: Rolled/Grooved	Expansion Joint: O-Ring

Gasket, Shell: Non-Asbestos // Gasket, Tube: Non-Asbestos // Gasket, Floating Head: Non-Asbestos

Code Requirements: A.S.M.E. Section VIII Division 1

Weights-Dry: 7801.9 Kg // Wet: 8151.1 Kg // Bundle: 2041.2 Kg

Remarks: * Measured @ 6.41 BAR(abs); 36.8 Deg C; 0.0 %RH

** ASME Nominal Values

Notes: ***Cooler Performance based on Final Aero Design

Continue

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Compression Systems
3101 Broadway, PO Box 209
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Heat Exchanger Specification

Metric Units

Customer: ROS ROCA INDOX CRYO-ENERGY, S.L. - Bolivia & Ecuador	Job No.: CB-18580,1
Service of Unit: 3R2MSGP-7ARC : I/C #1	Cooper PN: A3806478 - 00840
Size: 1071.9 / 16 X 14 X 4699.0	Effective Surface: 1201.8 m^2

Performance

Fluid Allocation	**Shell**	**Tube**
Fluid Name	Nitrogen	Water
Fluid Quantity, Total	14992.6 m^3/Hr*	155.6 m^3/Hr
Vapor (In/Out) Kg/Hr	0.0 / 0.0	
Liquid Kg/Hr		155470.4
Condensate Kg/Hr	0.0	
Non Condensables Kg/Hr	104539.4	
Temperature (In/Out) Deg C	99.4 / 40.5	32.0 / 41.6
Specific Heat Kcal/KgC	0.25	1.0
Inlet Pressure BAR(abs)	11.2	
Core Velocity	m/s	2.4 m/s
Pressure Drop BAR	0.072	0.827
Fouling Resistance Hrm^2C/Kcal	0.0001	0.0002

Heat Ex.: 1480105.5 Kcal/Hr // LMTD: 25.7 Deg C // Transfer Rate: 60.1 Kcal/Hrm^2C

Construction

Design/Test Pressure BAR(g)	19.6 / 25.6	10.3 / 13.4
Design Temperature (min/max)Deg C	-28.9 / 176.7	-28.9 / 65.6
Number of Passes	1	2
Corrosion Allowance mm	1.5875	1.5875
Connections: Size (In/Out) in	16.0 / 12.0**	6.0 / 6.0**
Connections: Rating		150 PSIG**
Tube No.: 224	OD: 0.6250 in**	Thk: 18.0 BWG**
Length: 4699.0 mm	Pitch: 38.1 mm	---> 30 deg. triangular

Tube/Fin Arrangement:BARE with ALUMINUM fins // Tube Material: 90/10 CuNi

Shell: STEEL Shell Cover: STEEL ID / OD: 1046.5 mm / 1071.9 mm

Bonnet, Supply: STEEL // Bonnet, Return: STEEL

Tubesheet, Stationary: STEEL // Tubesheet, Floating: STEEL

Bypass Seal: Silicone Rubber	Tubesheet Joint: Rolled/Grooved	Expansion Joint: O-Ring

Gasket, Shell: Non-Asbestos // Gasket, Tube: Non-Asbestos // Gasket, Floating Head: Non-Asbestos

Code Requirements: A.S.M.E. Section VIII Division 1

Weights-Dry: 5533.9 Kg // Wet: 5837.8 Kg // Bundle: 1678.3 Kg

Remarks: * Measured @ 6.41 BAR(abs); 37.4 Deg C; 0.0 %RH

** ASME Nominal Values

Notes: ***Cooler Performance based on Final Aero Design

Continue

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Compression Systems
3101 Broadway, PO Box 209
Buffalo, NY14225-0209 USA
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Fax 716.896.1233

Tue Nov 19 10:24:42 2013

Heat Exchanger Specification

Metric Units

Customer: ROS ROCA INDOX CRYO-ENERGY, S.L. - Bolivia & Ecuador	Job No.: CB-18580,1
Service of Unit: 3R2MSGP-7ARC : I/C #2	Cooper PN: A3806479 - 00840
Size: 1087.1 / 16 X 14 X 4699.0	Effective Surface: 1201.8 m^2

Performance

Fluid Allocation	Shell	Tube
Fluid Name	Nitrogen	Water
Fluid Quantity, Total	14992.6 m^3/Hr*	155.6 m^3/Hr
Vapor (In/Out) Kg/Hr	0.0 / 0.0	
Liquid Kg/Hr		155470.4
Condensate Kg/Hr	0.0	
Non Condensables Kg/Hr	104539.4	
Temperature (In/Out) Deg C	85.1 / 38.6	32.0 / 39.6
Specific Heat Kcal/KgC	0.25	1.0
Inlet Pressure BAR(abs)	16.3	
Core Velocity	m/s	2.4 m/s
Pressure Drop BAR	0.053	0.827
Fouling Resistance Hrm^2C/Kcal	0.0001	0.0002

Heat Ex.: 1166460.4 Kcal/Hr // LMTD: 20.2 Deg C // Transfer Rate: 60.5 Kcal/Hrm^2C

Construction

Design/Test Pressure BAR(g)	31.0 / 40.3	10.3 / 13.4
Design Temperature (min/max)Deg C	-28.9 / 176.7	-28.9 / 65.6
Number of Passes	1	2
Corrosion Allowance mm	1.5875	1.5875
Connections: Size (In/Out) in	15.0 / 14.0**	6.0 / 6.0**
Connections: Rating		150 PSIG**
Tube No.: 224	OD: 0.6250 in**	Thk: 18.0 BWG**
Length: 4699.0 mm	Pitch: 38.1 mm	---> 30 deg. triangular

Tube/Fin Arrangement:BARE with ALUMINUM fins // Tube Material: 90/10 CuNi

Shell: STEEL Shell Cover: STEEL ID / OD: 1046.5 mm / 1087.1 mm

Bonnet, Supply: STEEL // Bonnet, Return: STEEL

Tubesheet, Stationary: STEEL // Tubesheet, Floating: STEEL

Bypass Seal: Silicone Rubber	Tubesheet Joint: Rolled/Grooved	Expansion Joint: O-Ring

Gasket, Shell: Non-Asbestos // Gasket, Tube: Non-Asbestos // Gasket, Floating Head: Non-Asbestos

Code Requirements: A.S.M.E. Section VIII Division 1

Weights-Dry: 6378.9 Kg // Wet: 6658.8 Kg // Bundle: 1698.7 Kg

Remarks: * Measured @ 6.41 BAR(abs); 36.8 Deg C; 0.0 %RH

** ASME Nominal Values

Notes: ***Cooler Performance based on Final Aero Design

Continue

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SAMSUNG
삼성테크윈

13. HEAT EXCHANGER MATERIAL of CONSTRUCTION			YES		
13-1. INTERCOOLER					
Type		Water-In-Tube			
Shell size		D430 x L874			
Tubes		Externally L-Foot Finned Tube			
Dimensions	mm	OD12.0 x T1.0 x L823			
Material (tube/fin)		COPPER(C1220T) / COPPER(C1220)			
Tube Number		126			
Fouling Resistance(min.)	m2.Hr.℃/kcal	0.00035			
Design Temperature	℃	100			
Design/Test Pressure	㎏/㎠.G	5 / 10.0			
Shell		Air Side			
Material		FCD400			
Design Temperature	℃	200			
Design/Test Pressure	㎏/㎠.G	10.5/13.1			
Fouling resistance(min.)	m2.Hr.℃/kcal	0.00035			
Water Separator		Automatic Water Separation Structure			
Auto Trap					
Type		Elec.Level Sensor			
Manufacture & Model		BECO / DM150			
13-2. AFTER COOLER					
Type		Water-In-Tube			
Shell size		D410 x L874			
Tubes		Externally L-Foot Finned Tube			
Dimensions	mm	OD12.0 x T1.0 x L823			
Material (tube/fin)		COPPER(C1220T) / COPPER(C1220)			
Tube Number		126			
Fouling Resistance(min.)	m2.Hr.℃/kcal	0.00035			
Design Temperature	℃	100			
Design/Test Pressure	㎏/㎠.G	5 / 10.0			
Shell		Air Side			
Material		FCD400			
Design Temperature	℃	200			
Design/Test Pressure	㎏/㎠.G	10.5/13.1			
Fouling resistance(min.)	m2.Hr.℃/kcal	0.00035			
Water Separator		Automatic Water Separation Structure			
Auto Trap					
Type		Elec.Level Sensor			
Manufacture & Model		BECO / DM150			
13-3. OIL COOLER					
Manufacturer		Samsung STD			
Type	mm	Water - in - Tube			
Tube Outside Diameter		OD8.0 x T0.8 x L988			
Tube Number		170			
Design/Test Pressure	℃	Shell Side: 10.0/12.5, Tube Side: 6.5/7.5			
Disign Temperature	mm	Shell Side: 100, Tube Side: 100			
Material (Tube)		COPPER(C1220T)			
Fouling Resistance	m2.Hr.℃/kcal	0.00035			
14. INLET AIR FILTER			YES		
Filter Case					
Material		SS400, Anti Rust Coated			
Filter Element		Catridge , circular			
Manufacture / Model		Samsung / FA-6386			
Specification		2 microns, 2500scfm / each			
Element / Q'ty		Efficiency to be 99.5%, 2 EA			
15. SHOP TEST			YES		
Compressor					
Impeller		Spin Test(115% Designed RPM)			
Gear Box & Cooler Case		Hydro Pressure Test			
Performance Test		Samsung STD			Per ASME PTC 10
Sound Level		Max 95 dB(A) at Free Field Condition			
Main Motor		Winding Resistance Measurement,NoiseLevel,No-Load,Locked rotor test			

HEAT EXCHANGER SPECIFICATION SHEET

	MADE BY	CHECKED BY	APPROVED BY
Customer			
Address	Date		Revision No.
Plant Location	*2014.01.30*		*None*

Service of Unit	*OIL COOLER*				Item No.		
Size		Type	*Horz.*	(Hor/Vert)		Connected In	*1* Parallel *1* Series
Surf/Unit (Gross/Eff	*14.29*	m2	Shells/Unit	*1*	Surf/shell(Gross/Eff.)		14.29 m2

PERFORMANCE OF ONE UNIT

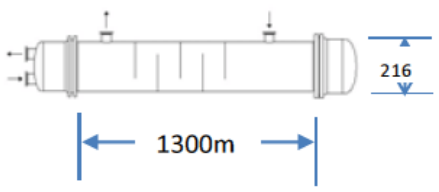
		Shell Side		Tube Side	
Fluid Allocation		Shell Side		Tube Side	
Fluid Name		*Oil(ISO VG 32)*		*Cooling Water*	
Fluid Quantity, Total	L/Min	*165*		*130*	
Vapor(In/Out)					
Liquid	kg/hr	*8345.42*	*8345.42*		
Steam					
Water				*7737.53*	*7737.53*
Noncondensable					
Temperature (In/Out)	℃	*65.0*	*48.0*	*32.0*	*39.0*
Viscosity, Liquid	Cp	*12.690*	*19.134*	*0.714*	*0.661*
Molecular Weight, Vapor	mol.				
Molecular Weight, Noncondensable					
Specific Heat	kJ/kg.℃	*2.04299*	*1.9934*	*4.17929*	*4.17722*
Thermal Conductivity	W/m.K	*0.137175*	*0.138*	*0.632557*	*0.634692*
Inlet Pressure	kg/cm2(G)	*4.0*		*3.0*	
Velocity	m/s	*0.26*		*0.77*	
Pressure Drop, Allow./Calc.	kg/cm2	*1.00*	*0.8*	*1.00*	*0.4*
Fouling Resistance (Min.)	m2.Hr.℃/kcal	*0.00041*		*0.00041*	

Heat Exchanged	*69,249*	kcal/Hr:	MTD(Corrected)	*18.47*	℃
Transfer rate, Service	*255*	Clean			kcal/m2.Hr.℃

CONSTRUCTION OF ONE SHELL

Sketch(Bundle/Nozzle Orientation)

			Shell Side	Tube Side
Design/Test Pressur		kg/cm2.G	*10* / *11*	*6.5* / *7.15*
Design Temperature		℃	*100*	*100*
No. Passes per Shell			*1*	*2*
Corrosion Allwance		mm	*3.0*	*3.0*
Connections	In		*ASME #150 1-1/2" SO.RF.*	*2" PF*
Size &	Out		*ASME #150 1-1/2" SO.RF.*	*2" PF*
Rating	Intermediate		–	–



Tube No. 106	OD 9.52	mm;	Thk(Min/Avg)	*0.7*	mm; Length	*1300*	mm; Pitch		mm; **30°** 60° 90° 45°
Tube Type	*Finned Tube*				Material		*SB111-C70600*		
Shell (O.D/I.D)	*216.3/204.6*	mm			Shell Cover	*N/A*	(Integ.)(Remov.)		
Channel or Bonnet	*Channel*				Channel Cover	*N/A*	(Integ.)(Remov.)		
Tubesheet-Stationary	*Confinded*				Tubesheet-Floating	*Confinded*			
Floating Head Cover					Impingement Protection	Y / N			
Baffles-Cross	*SINGLE SEG*	Type	–	%Cut	Spacing:c/c	–	Inlet	–	*mm*
Baffles-Long	*N/A*			Seal Type					
Bypass Seal Arrangement	*N/A*			Tube-Tubesheet Joint	*Expanding + Welding*				
Expansion Joint	–			Type					
ρV2- Inlet Nozzle		Bundle Entrance			Bundle Exit				
Gaskets-Shell Side	*Non-Asbe.*			Tube Side	*Non-Asbe.*				
-Floating Head	*Non-Asbe.*								
Code requirements	*ASME SEC VIII DIV.1(WITHOUT STAMP)*			Code Stamp: Y / **N**		TEMA Class	*'C'*		
Weight/Shell	*133.2* kg	Filled with Water	*222.2* kg		Bundle	*75* kg			

Remarks

1. Detailed shell & bundle's structure,dimensions, and coolant specifications may be determined by agreement between STW and vendor.
2. Float side structure shall be fixed type.
3. Connections specification and dimensions for oil and water side may be determined by STW and vendor agree to STW's requirements.
4. Main Oil Pump power consumption is also considered as a Oilcooler heat duty
5. Tube type is subject to manufacture's recommendation.

Design Data Sheet

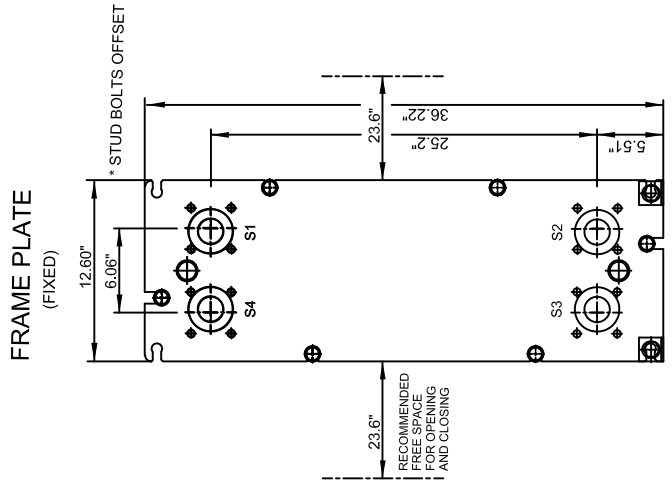
Designation: ..... CO_2 Gas Cooler (Ucarsol Condenser)
Tag Number: E-11502-01
UE Unit: 115-2
Stockcode: B0084431

HEAT EXCHANGER SPECIFICATION:
Duty: ..... 253.3 kW [865,065 Btu/hr]
Surface Area: ..... 3.4 m^2 [36.6 Ft^2]
Design Code: ..... ASME Section VIII, Div.1, Latest edition w/ U-Stamp
Type: ..... Gasketed Plate and Frame

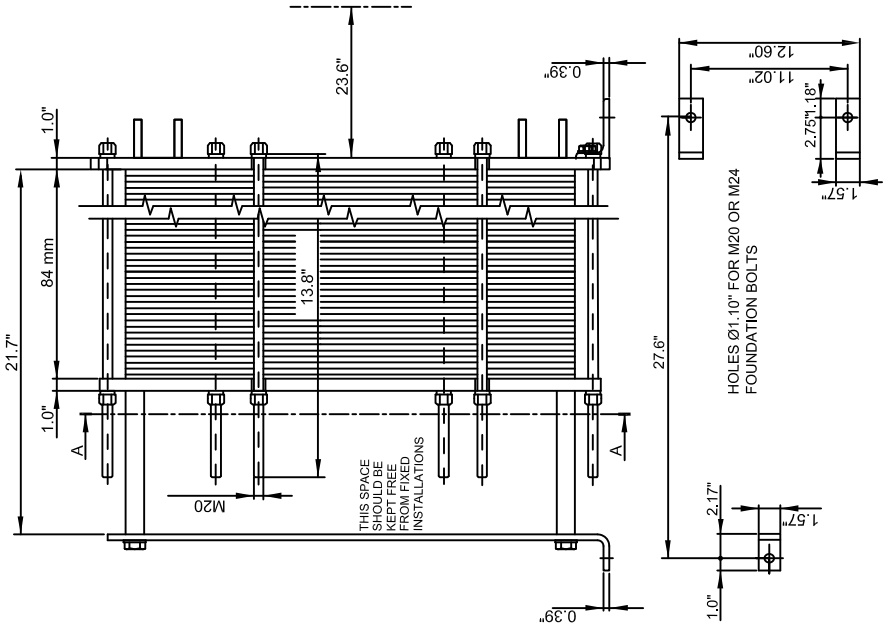
COLD SIDE:
Media: ..... Cooling Water
Flow: ..... 19,840 kg/hr [43,740 lbs/hr]
Inlet Pressure: ..... 2.6 Bara [37.7 Psia]
Inlet Temperature: ..... 32°C [89.6°F]
Outlet Temperature: ..... 43°C [109.4°F]
Passes per shell: 1
Design Pressure: ..... 10 Barg [145 Psig]
Design Temperature: ..... 0°C /160°C [32°F /320°F]
Connections:
Inlet ..... 2”-150#RF
Outlet ..... 2”-150#RF

HOT SIDE:
Media: ..... Vapor CO_2 & Steam
CO2 Inlet Flow: ..... 563 kg/hr [1241 lbs/hr]
Steam Inlet Flow: ..... 375 kg/hr [827 lbs/hr]
Inlet Pressure: ..... 1.70 Bara [24.7 Psia]
Inlet Temperature: ..... 102.2°C [216°F]
Outlet Temperature: ..... 49°C [120.2°F]
Design Pressure: ..... 10 Barg [145 Psig]
Design Temperature: ..... 0°C /160°C [32°F /320°F]
Connections:
Inlet ..... 2”-150#RF
Outlet ..... 2”-150#RF

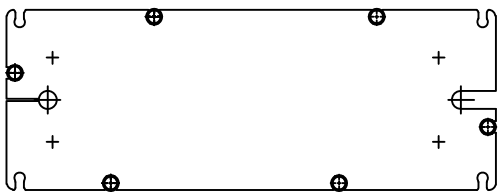
MATERIALS:
Plates: ..... 316L Stainless Steel – (qty 26)
Seals: ..... EPDMP Clip-on
Connection Liner: ..... Stainless Steel
Prohibited Materials (wetted parts): ..... Aluminum, zinc, galv. metals, copper, Viton, BunaN

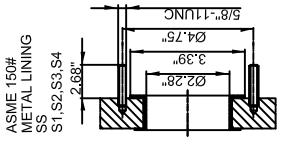


FRAME PLATE
(FIXED)



PRESSURE PLATE
(MOVABLE)
SECTION A-A





TOTAL LENGTH 29.7"
TOTAL WIDTH 12.6"
TOTAL HEIGHT 36.2"

REV.1:REVISED DESIGN PRESS.

ALL DIMENSIONS IN INCHES

SIDE	MEDIA	INLET	TEMP.	OUTLET	TEMP.	FLOW RATE	PRESSURE DROP	LIQUID VOL.
1	CO2/H2O	S1	216.0 °F	S2	120.2 °F	2068 lb/h	2.149 psi	0.17 ft³
2	Water	S3	89.6 °F	S4	109.4 °F	43740 lb/h	3.091 psi	0.19 ft³

REMARKS:	SIDE 1	SIDE 2
DESIGN PRESSURE	146 psi	146 psi
TEST PRESSURE	189.8 psi	189.8 psi
MAX TEMPERATURE	320 °F	320 °F
MIN TEMPERATURE	32 °F	32 °F
MAWP	146 psi	146 psi
MDMT	-20 °F	

GASKET	EPDMP CLIP-ON
PLATE MATERIAL	ALLOY 316
PLATE THICKNESS	0.50 mm
HEATING SURFACE	33.2 ft²
PLATE GROUPING	1*11L/1*12L
WEIGHT WITH WATER	348 lb
NETWEIGHT	326 lb

SUPPLIER	REF.	ITEM NO.
	71586-10	E-11502-01

AGENT / REF.
/ 1815433

CUSTOMER NAME / REF. NO.
Union Engineering North America, LLC / 41109

SIGN.		RISK CATEGORY
CFN		N/A

PLATE HEAT EXCHANGER

M6-MFG

ASME AS BUILT
2014-05-13

SERIAL NUMBER
30115-74255

DATE
2014-03-13

REV NO. 1

Designed constructed and stamped in accordance with 2013 ASME Code and latest Addendum.

This is a general drawing. Additional parts. if required. like protection sheets. inspection covers. etc. are not displayed.

E-11502-01 CO2 GAS COOLER

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

As Required by the Provisions of the ASME Code Rules, Section VIII, Division 1

1. Manufactured and certified by Alfa Laval Inc., 5400 International Trade Drive, Richmond, Virginia, 23231
(Name and address of Manufacturer)

2. Manufactured for Union Engineering North America, LLC, 1 Industry Drive, Palm Coast, FL, 32137
(Name and address of Purchaser)

3. Location of installation 2794 Old Richburg Road, Richburg, SC, 29729
(Name and address)

4. Type Vertical (Horiz., vert., or sphere) | Plate Heat Exchanger (Tank, separator, jkt. vessel, heat exh., etc.) | 30115-74255 (Mfg's serial No.)

N/A (CRN) | 30115-74255.1 (Drawing No.) | 34746 (Nat'l. Bd. No.) | 2014 (Year built)

5. ASME Code, Section VIII, Div. 1 | 2013/ N/A Edition and Addenda (date) | N/A Code Case No. | N/A Special Service per UG-120(d)

Items 6-11 incl. to be completed for single wall vessels, jackets of jacketed vessels, shell of heat exchangers, or chamber of multichamber vessels.

6. Shell (a) No. of course(s): N/A (b) Overall length: 0'

Course(s)			Material	Thickness		Long. Joint (Cat. A)			Circum. Joint (Cat. A, B, & C)			Heat Treatment	
No.	Diameter	Length	Spec./Grade or Type	Nom.	Corr.	Type	Full, Spot, None	Eff.	Type	Full, Spot, None	Eff.	Temp.	Time
	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. Heads: (a) SA-516-70 (Mat'l Spec. No., Grade or Type) (H.T. - Time & Temp.) (b) SA-516-70 (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)	Fixed	1"	0"	N/A	N/A	N/A	N/A	N/A	36" X 13"			N/A	N/A	N/A
(b)	Movable	1"	0"	N/A	N/A	N/A	N/A	N/A	34" X 13"			N/A	N/A	N/A

If removable, bolts used (describe other fastening) SA193-B7 (6) 0.787" (M20 actual) BOLTS
(Mat'l, Spec. No., Grade, Size, No.)

8. Type of jacket N/A Jacket closure N/A
(Describe as ogee & weld, bar, etc.)

If bar, give dimensions N/A If bolted, describe or sketch.

9. MAWP 146 psi (internal) / N/A (external) at max. temp. 320 °F (internal) / N/A (external) Min. design metal temp. -20 °F at 146 psi

10. Impact test NO (Impact Exemption UCS-66(a), (b), UHA-51, UNF-65, as applicable) at test temperature of N/A
(Indicate yes or no and the component(s) impact tested)

11. Hydro., pneu., or comb. test press. HYDRO at 190 psi Proof test N/A

Items 12 and 13 to be completed for tube sections.

12. Tubesheet: N/A (Stationary (Mat'l Spec. No.)) | N/A (Dia., (subject to press.)) | N/A (Nom. thk.) | N/A (Corr. Allow.) | N/A (Attachment (welded or bolted))

N/A (Floating (Mat'l Spec. No.)) | N/A (Dia.) | N/A (Nom. thk.) | N/A (Corr. Allow.) | N/A (Attachment)

13. Tubes: N/A (Mat'l Spec. No., Grade or Type) | N/A (O. D.) | N/A (Nom. thk.) | N/A (Number) | N/A (Type (Straight or U))

Items 14-18 incl. to be completed for inner chambers of jacketed vessels or channels of heat exchangers.

14. Shell (a) No. of course(s): N/A (b) Overall length: N/A

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

15. Heads: (a) N/A (Mat'l Spec. No., Grade or Type) (H.T. - Time & Temp.) (b) N/A (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)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			N/A	N/A	N/A

If removable, bolts used (describe other fastening) N/A
(Mat'l, Spec. No., Grade, Size, No.)

S.O. 95021

SS 5-23-14

FORM U-1 (BACK)

NB Number 34746

16. MAWP N/A (internal) N/A (external) at max. temp. N/A (internal) N/A (external) Min. design metal temp. N/A at N/A

17. Impact test N/A (Indicate yes or no and the component(s) impact tested) at test temperature of N/A

18. Hydro., pneu., or comb. test press. N/A Proof test N/A

19. Nozzles, inspection, and safety valve openings:

Purpose (Inlet, Outlet, Drain, etc.)	No.	Diameter or Size	Flange Type	Material		Nozzle Thickness		Reinforcement Material	How Attached		Location (Insp. Open.)
				Nozzle	Flange	Nom.	Corr.		Nozzle	Flange	
Inlet	2	2"	STUDS	SA193-B7		5/8"					
Outlet	2	2"	STUDS	SA193-B7		5/8"					

20. Supports: Skirt ____ (Yes or no) Lugs N/A (No.) Legs N/A (No.) Others FEET (Describe) Attached BOLTED (Where and how)

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

N/A

(List the name of part, item number, mfg's. name and identifying number)

22. Remarks:

Actual Plates (24) SA240-316 .02" (52)" Plates Maximum; Distance between Heads = 3.3096";
Customer PO#: 41109; Tag #: ; Owner to supply Safety Valve/Noncorrosive Service Only

CERTIFICATE OF SHOP 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 Code for Pressure Vessels, Section VIII, Division 1. U Certificate of Authorization No. 25017 Expires July 5, 2016

Date 05/16/2014 Name Alfa Laval Inc. (Manufacturer) Signed (Representative)

CERTIFICATE OF SHOP INSPECTION

I, the undersigned, holding a valid commission issued by The National Board of Boiler and Pressure Vessel Inspectors and/or the State or Province of VA and employed by OneCIS Insurance Company, of Lynn, MA have inspected the pressure vessel described in this Manufacturer's Data Report on May 12, 2014, and state that, to the best of my knowledge and belief, the Manufacturer has constructed this pressure vessel in accordance with ASME Code, Section VIII, Division 1. By signing this certificate neither the Inspector nor his employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his employer shall be liable in any manner for any personal injury or properly damage or a loss of any kind arising from or connected with this inspection.

Date 05/16/2014 Signed (Authorized Inspector) Commissions 10803A, VA951R (Nat'l Board incl. endorsements, State, Province and No.)

CERTIFICATE OF FIELD ASSEMBLY COMPLIANCE

We certify that the statements made in this report are correct and that the field assembly construction of all parts of this vessel conforms with the requirements of ASME Code, Section VIII, Division 1. U Certificate of Authorization No. ____ Expires ____

Date ____ Name ____ (Assembler) Signed ____ (Representative)

CERTIFICATE OF FIELD ASSEMBLY INSPECTION

I, the undersigned, holding a valid commission issued by The National Board of Boiler and Pressure Vessel Inspectors and/or the State or Province of ____ and employed by ____ of ____, have compared the statements in this Manufacturer's Data Report with the described pressure vessel and state that parts referred to as data items ____, not included in the certificate of shop inspection, have been inspected by me and to the best of my knowledge and belief, the Manufacturer has constructed and assembled this pressure vessel in accordance with the ASME Code, Section VIII, Division 1. The described vessel was inspected and subjected to a hydrostatic test of ____ psi. By signing this certificate neither the Inspector nor his employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his employer shall be liable in any manner for any personal injury or properly damage or a loss of any kind arising from or connected with this inspection.

Date ____ Signed ____ (Authorized Inspector) Commissions ____ (Nat'l Board incl. endorsements, State, Province and No.)

Design Data Sheet

Designation: ..... Ucarsol Cooler - 1
Tag Number: E-11420-01
UE Unit: 114-1
Stockcode: B0084421

HEAT EXCHANGER SPECIFICATION:

Duty:	231 kW	[787,785 Btu/hr]
Surface Area:	23.3 m^2	[251.3 Ft^2]
Design Code:	ASME Section VIII, Div.1, Latest edition w/ U-Stamp	
Seismic Design:	UBC97/IBC Zone 3	
Wind Load:	36 m/s ASCE 7-95, Exposure Cat. B	
Tube Bundle:	Removable	
Design:	TEMA class R – Refinery service	
Surface Treatment:	100% pickled and passivated	

TUBE SIDE:

Media:	Cooling Water	
Flow:	28,016 kg/hr	[61,764 lbs/hr]
Inlet Pressure:	2.55 Bara	[37 Psia]
Inlet Temperature:	35.9°C	[96.6°F]
Outlet Temperature:	43.0°C	[109.4°F]
Passes per shell:	2	
Design Pressure:	10.0 Barg	[146 Psig]
Design Temperature:	-29°C /160°C	[-20°F /320°F]
Tube Diameter:	19 mm	[3/4”]
Tube Quantity:	80	
Connections:		
Inlet – Bottom	3”-150#RF	
Outlet – Top	3”-150#RF	

SHELL SIDE:

Media:	Lean Ucarsol Solution- 40%w	
Liquid Inlet Flow:	9,430 kg/hr	[20,783 lbs/hr]
Inlet Pressure:	34.7 Bara	[503 Psia]
Inlet Temperature:	70.5°C	[158.9°F]
Outlet Temperature:	47.3°C	[117.1°F]
Design Pressure:	52.0 Barg	[755 Psig]
Design Temperature:	-29°C /160°C	[-20°F /320°F]
Shell Diameter:	324mm	[12-3/4”]
Connections:		
Liquid Inlet	2”-600#RF	
Liquid Outlet	2”-600#RF	

MATERIALS:

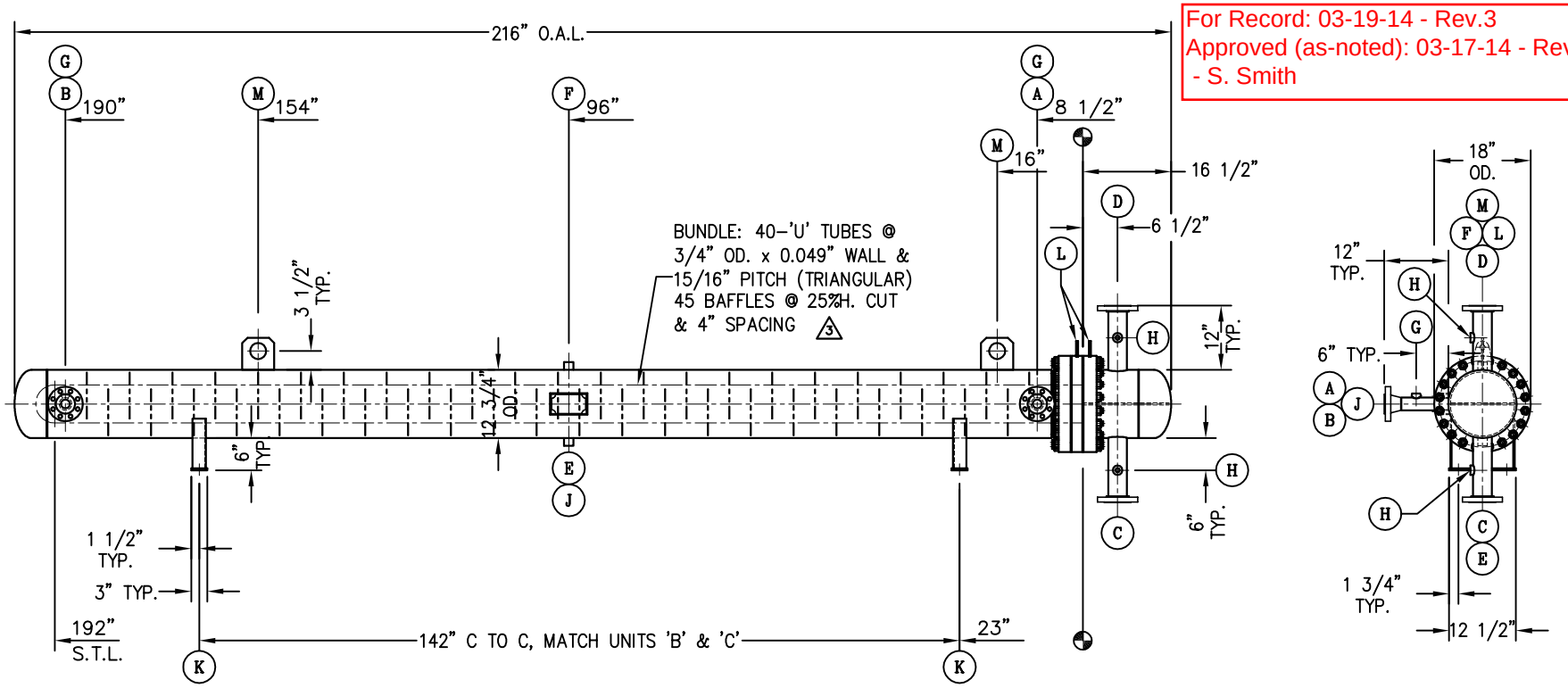
Tubes, Tube-sheet, Shell: ..... 304L Stainless steel
Bonnet: ..... Carbon Steel
Gaskets: ..... Spiral wound
Prohibited Materials (wetted parts): ..... Aluminum, zinc, galv. metals, copper, Viton, BunaN

ITEM	QTY	DESCRIPTION
A	1	UCARSOL INLET: 2" NPS. (SCH.160) c/w 600 LB R.F.W.N. FLANGE
B	1	UCARSOL OUTLET: 2" NPS. (SCH.160) c/w 600 LB R.F.W.N. FLANGE
C	1	WATER INLET: 3" NPS. (SCH.40) c/w 150 LB R.F.S.O. FLANGE
D	1	WATER OUTLET: 3" NPS. (SCH.40) c/w 150 LB R.F.S.O. FLANGE
E	1	DRAIN CONN.: 3/4" FPT. 6000LB COUPLING

ITEM	QTY	DESCRIPTION
F	1	RELIEF: 3/4" FPT. 6000LB COUPLING
G	2	P.I.: 3/4" FPT. 6000LB THREADED O-LET
H	2	P.I.: 3/4" FPT. 6000LB COUPLING
J	1	NAMEPLATE: c/w 2" RAISED BRACKET
K	2	SADDLES: c/w 9/16" DIA. HOLES. (2 PER SADDLE)

ITEM	QTY	DESCRIPTION
L	2	LIFTING LUG: c/w 1" DIA. HOLE. (FOR HEAD ONLY)
M	2	LIFTING LUG: c/w 3" DIA. HOLE

For Record: 03-19-14 - Rev.3
Approved (as-noted): 03-17-14 - Rev.2
- S. Smith



UNION ENGINEERING LLC NORTH AMERICA
PALM COAST, FL
UE PROJECT: 00116 3

STOCK CODE: B0084421, TAG: E-11420-01
EMPTY WEIGHT: 2,450 (LBS) QTY.: 1

NOTES
1. DO NOT SCALE DRAWING.
2. ALL DIMENSIONS ARE IN INCHES.
3. VESSEL TO BE DESIGNED & CONSTRUCTED IN ACCORDANCE WITH A.S.M.E. SECTION VIII, DIVISION 1, 2013 EDITION, UW-12(d)(e), C.S.A. B-51 CODES & TEMA class 'R'.
4. TAIL DIMENSIONS REFERENCED FROM DATUM LINE.
5. VESSEL TO BE CLEAN & FREE OF ALL DIRT & SCALE.
6. ALL EXPOSED INSIDE EDGES TO BE CHAMFERED OR ROUNDED.
7. EXTERIOR FINISH: ONE COAT GREY PAINT, (CARBON STEEL ONLY) ALL STAINLESS STEEL TO BE PICKLED AND PASSIVATED.
8. FLANGE BOLT HOLES TO STRADDLE VESSEL CENTERLINES.
9. TUBES TO BE SEAL WELDED TO TUBESHEETS.
10. CORROSION ALLOWANCE: SHELLSIDE=NIL, TUBESIDE=1/8".
11. RADIOGRAPHY: SPOT RT SHELL SIDE CIR. SEAM ONLY.
12. UW-50 APPLIES SHELL SIDE ONLY.
13. VESSEL TO HAVE A 'e'-DOCUMENTATION PACKAGE COMPLETED.
14. VESSEL TO BE SHIPPED c/w 5 PSIG. NITROGEN CHARGE.
15. VESSEL DESIGNED TO SEISMIC: UBC97, ZONE 3, WIND LOAD: 36m/s. ASCE7-95 EXP. CAT. B
16. UNIT TO BE PNEUMATICALLY TESTED IN ACCORDANCE WITH CODE CASE 1518-5.
17. REMOVABLE BUNDLE DESIGN. SPIRAL WOUND GASKETS.
18. TOLERANCES PER TEMA.

MATERIALS			
SHELLS :	SA 312 TP304/L WLD -SHELL SA 53B ERW -CHANNEL	FLANGE RINGS :	SA 240 304/L -SHELL SIDE SA 516 70 NORM. -TUBE SIDE
NOZZLES :	SA 312 TP304/L WLD -SHELL SIDE SA 106B SMLS -TUBE SIDE	NOZZLE FLANGES :	SA 182 F304/L -SHELL SIDE SA 105N -TUBE SIDE
TUBESHEETS :	SA 240 304/L	BOLTING :	SA 193-B8,CL.2/SA 194-8
HEADS :	SA 403 304/L WP-W -SHELL SIDE SA 234 WPB -TUBE SIDE	TUBES :	SA 249 TP304/L WLD (PLAIN)

DESIGN CONDITIONS	
SHELL SIDE D.W.P. : 755 P.S.I.G. SHELL SIDE D.W.T. : -20°F. / 320°F. M.D.M.T. : -20°F @ 755 PSIG.	TUBE SIDE D.W.P. : 146 P.S.I.G. TUBE SIDE D.W.T. : -20°F. / 320°F. M.D.M.T. : -20°F @ 146 PSIG.
FLUID : LEAN UCARSOL	FLUID : WATER
TEMP. RANGE : 158.9°F. to 117.12°F.	TEMP. RANGE : 96.62°F. to 109.4°F
FLOW : 20,783 LB/HR	FLOW : 61,764 LB/HR
CAPACITY : 787,785 BTU/HR.	PRESSURE DROP : 1.36 P.S.I. -SHELL SIDE 1.39 P.S.I. -TUBE SIDE

DATE	REV.	BY	REVISION	APP'D.
MAR. 17/14	3	PQ	ADDED BAFFLE & BUNDLE SPECIFICATIONS, REVISED LIFTING LUG HOLE LOCATION	
MAR. 13/14	2	PQ	NTL WAS 168", RELOCATED NOZZLES & SADDLES, REVISED WEIGHT REVISED PRESSURE DROP, REDESIGNED SADDLE	
FEB. 20/14	1	PQ	REVISED DESIGN CONDITIONS RELOCATED 'A' 'B', ADDED 'M', REVISED NOTE #17	

HENRY TECHNOLOGIES
P. O. BOX 1385, BRANTFORD, ONTARIO, CANADA, N3T 5T6
PHONE: (519) 759 3010
FAX: (519) 759 6746 or (519) 759 1611
WEB: www.HENRYTECH.ca

MODEL No.: LXXU-12192-210 UCARSOL COOLER

CUSTOMER: UNION ENGINEERING N. AMERICA					CUSTOMER ORDER No.: 40999	
DATE:	BY:	CHK'D:	APP'D:	SCALE:	ORDER NUMBER:	REV. No.:
FEB. 10/14	PQ			N.T.S.	C340059A	3

Serial No.: C340059A-1 E-11420-01 UCARSOL COOLER #1 N.B. No.: 25625

FORM U-1 MANUFACTURER'S DATA REPORT FOR PRESSURE VESSELS PO# 40999

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

1. Manufactured and certified by HENRY TECHNOLOGIES LIMITED, 36 CRAIG STREET, BRANTFOR D, ONTARIO, CANADA, N3R 7J 1
(Name and address of Manufacturer)

2. Manufactured for UNION ENGINEERING NORTH AMERICA, 1 INDUSTRY DR., SUITE A, PALM COAST, FL 32137
(Name and address of Purchaser)

3. Location of ins tallation UNKNOWN
(Name and address)

4. Type HORIZONTAL (Horizontal., vertical., or sphere) | HEAT EXCHANGER (Tank,separator, ikt. vessel, heat exch., etc.) | C340059A-1 (Manufacturer's serial No.)

N/A (CRN) | P340059A / 1 (Drawing number) | 25625 (National Board number) | 2014 (Year built)

5. ASME Code, Section VIII , Div.1 | 2013 EDITION - [Edition and Addenda, if applicable (date)] | 1518-5 (Tubeside only) (Code Case number) | - [Special Service per UG-120(d)]

Items 6-11 incl. to be completed for single wall vessels, jackets of jacketed vessels, shell of heat exchanger, or chamber of multichamber vessels.

6. Shell: (a) Num ber of course(s) 1 (b) Overall length 187.8125"

Course(s)			Material	Thickness		Long Joint (Cat. A)			Circum. Joint (Cat. A,B & C)			Heat Treatm ent	
No.	Diameter	Length	Spec./Grade or Type	Nom.	Corr.	Type	Full,Spot,Non e	Eff.	Type	Full,Spot,Non e	Eff.	Temp.	Time
1	12.75" O.D.	187.8125"	SA 312 TP304/L	0.5"	NIL	SMLS	NONE	100%	B-1	NONE	70%	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-

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
1	CUSTOM WN	11.75"	18"	3.25"	0.4688"	SA 182 F304/L	WELDED	END	20-7/8"-9UNC	SA 193 B8,CL.2	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-

7. Heads: (a) SA 403-304/L WP-W (Material spec. number, grade or type) (H.T. - time and temp.) (b) - (Material spec. number, grade or type) (H.T. - time and 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.
	END	0.4375"	NIL	-	-	2:1	-	-	-	-	YES	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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
	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-

8. Type of jacket - Jacket closure - (Describe as ogee and weld, bar, etc.)

If bar, give dim ensions - If bolted, des cribe or sketch.

9. MAWP 755 (Internal) - (External) psi at max. temp. 320 (Internal) - (External) °F Min. design metal temp. -20 °F at 755 psi

10. Impact test NO - AS PER UHA-51(d) [Indicate yes or no and the component(s) impact tested] at test temperature of - °F

11. PNEU test pressure 885 PSIG proof test -

Items 12 and 13 to be c ompleted for tube sections.

12. Tubesheet SA 240 304/L [Stationary (material spec. no.)] | 12" [Diameter (subject to press.)] | 2" (Nominal thickness) | NIL (Corr. allow.) | WELDED [Attachment (welded or bolted)]

- [Floating (material spec. no.)] | - (Diameter) | - (Nominal thickness) | - (Corr. allow.) | - (Attachment)

13. Tubes SA 249 TP 304/L W LD (Material spec. no. grade or type) | 0.75" (O.D.) | 0.049" (Nominal thickness) | 40 (Number) | U [Type (straight or U)]

Design Data Sheet

Designation: ..... Ucarsol Cooler - 2
Tag Number: E-11420-02
UE Unit: 114-1
Stockcode: B0084422

HEAT EXCHANGER SPECIFICATION:

Duty:	94.2 kW	[321,772 Btu/hr]
Surface Area:	23.3 m^2	[251.3 Ft^2]
Design Code:	ASME Section VIII, Div.1, Latest edition w/ U-Stamp	
Seismic Design:	UBC97/IBC Zone 3	
Wind Load:	36 m/s ASCE 7-95, Exposure Cat. B	
Tube Bundle:	Removable	
Design:	TEMA class R – Refinery service	
Surface Treatment:	100% pickled and passivated	

TUBE SIDE:

Media:	Cooling Water	
Flow:	28,016 kg/hr	[61,764 lbs/hr]
Inlet Pressure:	2.55 Bara	[37 Psia]
Inlet Temperature:	33.0°C	[91.4°F]
Outlet Temperature:	35.9°C	[96.6°F]
Passes per shell:	2	
Design Pressure:	10.0 Barg	[146 Psig]
Design Temperature:	-29°C /160°C	[-20°F /320°F]
Tube Diameter:	19 mm	[3/4”]
Tube Quantity:	80	
Connections:		
Inlet – Bottom	3”-150#RF	
Outlet – Top	3”-150#RF	

SHELL SIDE:

Media:	Lean Ucarsol Solution- 40%w	
Liquid Inlet Flow:	9,430 kg/hr	[20,783 lbs/hr]
Inlet Pressure:	34.7 Bara	[503 Psia]
Inlet Temperature:	47.3°C	[117.1°F]
Outlet Temperature:	38.0°C	[100.4°F]
Design Pressure:	52.0 Barg	[755 Psig]
Design Temperature:	-29°C /160°C	[-20°F /320°F]
Shell Diameter:	324mm	[12-3/4”]
Connections:		
Liquid Inlet	2”-600#RF	
Liquid Outlet	2”-600#RF	

MATERIALS:

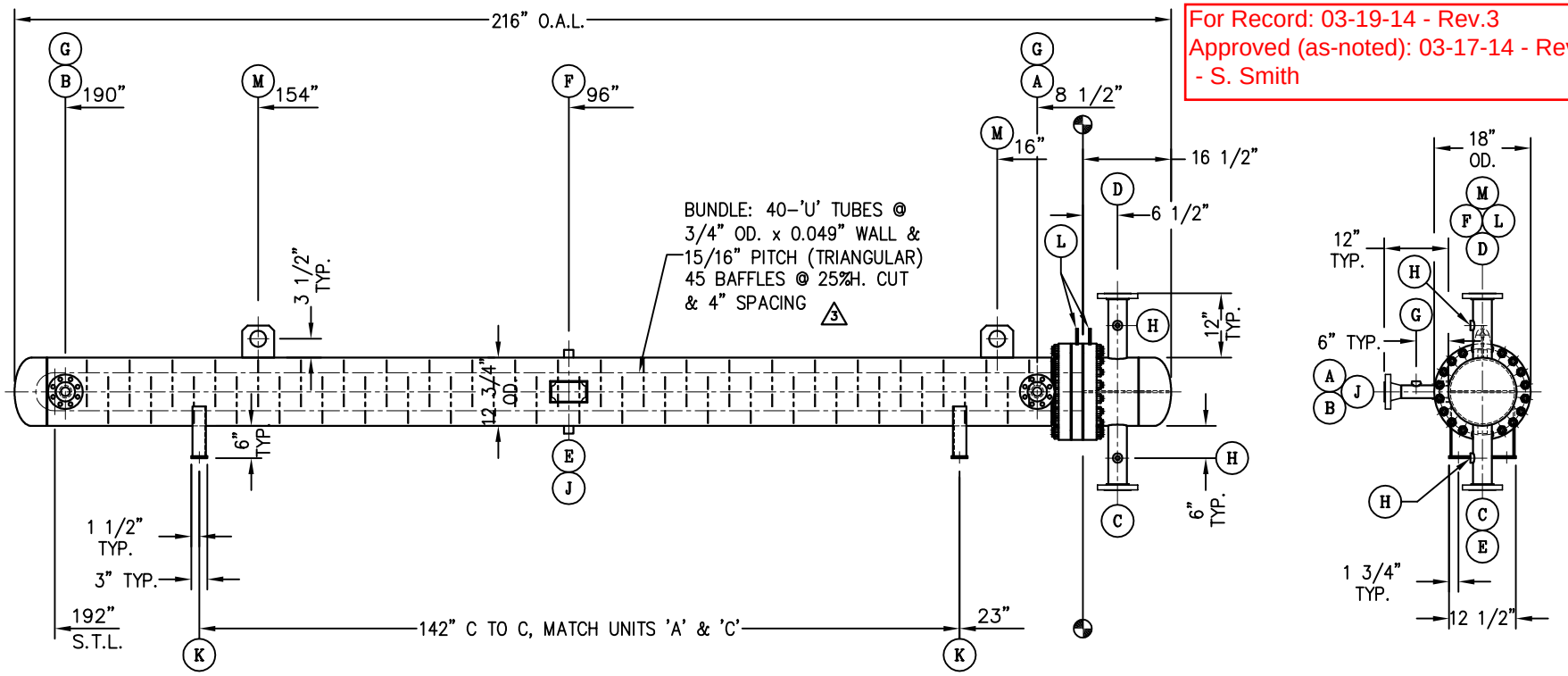
Tubes, Tube-sheet, Shell: ..... 304L Stainless steel
Bonnet: ..... Carbon Steel
Gaskets: ..... Spiral wound
Prohibited Materials (wetted parts): ..... Aluminum, zinc, galv. metals, copper, Viton, BunaN

ITEM	QTY	DESCRIPTION
A	1	UCARSOL INLET: 2" NPS. (SCH.160) c/w 600 LB R.F.W.N. FLANGE
B	1	UCARSOL OUTLET: 2" NPS. (SCH.160) c/w 600 LB R.F.W.N. FLANGE
C	1	WATER INLET: 3" NPS. (SCH.40) c/w 150 LB R.F.S.O. FLANGE
D	1	WATER OUTLET: 3" NPS. (SCH.40) c/w 150 LB R.F.S.O. FLANGE
E	1	DRAIN CONN.: 3/4" FPT. 6000LB COUPLING

ITEM	QTY	DESCRIPTION
F	1	RELIEF: 3/4" FPT. 6000LB COUPLING
G	2	P.I.: 3/4" FPT. 6000LB THREADED O-LET
H	2	P.I.: 3/4" FPT. 6000LB COUPLING
J	1	NAMEPLATE: c/w 2" RAISED BRACKET
K	2	SADDLES: c/w 9/16" DIA. HOLES. (2 PER SADDLE)

ITEM	QTY	DESCRIPTION
L	2	LIFTING LUG: c/w 1" DIA. HOLE. (FOR HEAD ONLY)
M	2	LIFTING LUG: c/w 3" DIA. HOLE

For Record: 03-19-14 - Rev.3
Approved (as-noted): 03-17-14 - Rev.2
- S. Smith



UNION ENGINEERING LLC NORTH AMERICA
PALM COAST, FL
UE PROJECT: 00116 3

STOCK CODE: B0084422, TAG: E-11420-02
EMPTY WEIGHT: 2,450 (LBS) QTY.: 1

NOTES
1. DO NOT SCALE DRAWING.
2. ALL DIMENSIONS ARE IN INCHES.
3. VESSEL TO BE DESIGNED & CONSTRUCTED IN ACCORDANCE WITH A.S.M.E. SECTION VIII, DIVISION 1, 2013 EDITION, UW-12(d)(e), C.S.A. B-51 CODES & TEMA class 'R'.
4. TAIL DIMENSIONS REFERENCED FROM ℄ DATUM LINE.
5. VESSEL TO BE CLEAN & FREE OF ALL DIRT & SCALE.
6. ALL EXPOSED INSIDE EDGES TO BE CHAMFERED OR ROUNDED.
7. EXTERIOR FINISH: ONE COAT GREY PAINT, (CARBON STEEL ONLY) ALL STAINLESS STEEL TO BE PICKLED AND PASSIVATED.
8. FLANGE BOLT HOLES TO STRADDLE VESSEL CENTERLINES.
9. TUBES TO BE SEAL WELDED TO TUBESHEETS.
10. CORROSION ALLOWANCE: SHELLSIDE=NIL, TUBESIDE=1/8".
11. RADIOGRAPHY: SPOT RT SHELL SIDE CIR. SEAM ONLY.
12. UW-50 APPLIES SHELL SIDE ONLY.
13. VESSEL TO HAVE A 'e'-DOCUMENTATION PACKAGE COMPLETED.
14. VESSEL TO BE SHIPPED c/w 5 PSIG. NITROGEN CHARGE.
15. VESSEL DESIGNED TO SEISMIC: UBC97, ZONE 3, WIND LOAD: 36m/s. ASCE7-95 EXP. CAT. B
16. UNIT TO BE PNEUMATICALLY TESTED IN ACCORDANCE WITH CODE CASE 1518-5.
17. REMOVABLE BUNDLE DESIGN. c/w SPIRAL WOUND GASKETS.
18. TOLERANCES PER TEMA.

MATERIALS			
SHELLS :	SA 312 TP304/L WLD -SHELL SA 53B ERW -CHANNEL	FLANGE RINGS :	SA 240 304/L -SHELL SIDE SA 516 70 NORM. -TUBE SIDE
NOZZLES :	SA 312 TP304/L WLD -SHELL SIDE SA 106B SMLS -TUBE SIDE	NOZZLE FLANGES :	SA 182 F304/L -SHELL SIDE SA 105N -TUBE SIDE
TUBESHEETS :	SA 240 304/L	BOLTING :	SA 193-B8,CL.2/SA 194-8
HEADS :	SA 403 304/L WP-W -SHELL SIDE SA 234 WPB -TUBE SIDE	TUBES :	SA 249 TP304/L WLD (PLAIN)

DESIGN CONDITIONS	
SHELL SIDE D.W.P. : 755 P.S.I.G. SHELL SIDE D.W.T. : -20°F. / 320°F. M.D.M.T. : -20°F @ 755 PSIG.	TUBE SIDE D.W.P. : 146 P.S.I.G. TUBE SIDE D.W.T. : -20°F. / 320°F. M.D.M.T. : -20°F @ 146 PSIG.
FLUID : LEAN UCARSOL	FLUID : WATER
TEMP. RANGE : 117.12°F. to 100.4°F.	TEMP. RANGE : 91.4°F. to 96.62°F
FLOW : 20,783 LB/HR	FLOW : 61,764 LB/HR
CAPACITY : 321,772 BTU/HR.	PRESSURE DROP : 1.38 P.S.I. -SHELL SIDE 1.44 P.S.I. -TUBE SIDE

DATE	REV.	BY	REVISION	APP'D.
MAR. 17/14	3	PQ	ADDED BAFFLE & BUNDLE SPECIFICATIONS, REVISED LIFTING LUG HOLE LOCATION	
MAR. 13/14	2	PQ	NTL WAS 168", RELOCATED NOZZLES & SADDLES, REVISED WEIGHT REVISED PRESSURE DROP, REDESIGNED SADDLE	
FEB. 20/14	1	PQ	REVISED DESIGN CONDITIONS RELOCATED 'A' 'B', ADDED 'M', REVISED NOTE #17	

HENRY TECHNOLOGIES
P. O. BOX 1385, BRANTFORD, ONTARIO, CANADA, N3T 5T6
PHONE: (519) 759 3010
FAX: (519) 759 6746 or (519) 759 1611
WEB: www.HENRYTECH.ca

MODEL No.: LXXU-12192-210 UCARSOL COOLER

CUSTOMER: UNION ENGINEERING N. AMERICA					CUSTOMER ORDER No.: 40999	
DATE:	BY:	CHK'D:	APP'D:	SCALE:	ORDER NUMBER:	REV. No.:
FEB. 10/14	PQ			N.T.S.	C340059B	3

Serial No.: C340059B-1 E-11420-02 UCARSOL COOLER #2 N.B. No.: 25626

FORM U-1 MANUFACTURER'S DATA REPORT FOR PRESSURE VESSELS PO# 40999

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

1. Manufactured and certified by HENRY TECHNOLOGIES LIMITED, 36 CRAIG STREET, BRANTFOR D, ONTARIO, CANADA, N3R 7J 1
(Name and address of Manufacturer)

2. Manufactured for UNION ENGINEERING NORTH AMERICA, 1 INDUSTRY DR., SUITE A, PALM COAST, FL 32137
(Name and address of Purchaser)

3. Location of ins tallation UNKNOWN
(Name and address)

4. Type HORIZONTAL (Horizontal., vertical., or sphere) | HEAT EXCHANGER (Tank,separator, jkt. vessel, heat exch., etc.) | C340059B-1 (Manufacturer's serial No.)

N/A (CRN)	P340059B / 1 (Drawing number)	25626 (National Board number)	2014 (Year built)

5. ASME Code, Section VIII, Div.1 | 2013 EDITION - [Edition and Addenda, if applicable (date)] | 1518-5 (Tubeside only) (Code Case number) | - [Special Service per UG-120(d)]

Items 6-11 incl. to be completed for single wall vessels, jackets of jacketed vessels, shell of heat exchanger, or chamber of multichamber vessels.

6. Shell: (a) Num ber of course(s) 1 (b) Overall length 187.8125"

Course(s)			Material	Thickness		Long Joint (Cat. A)			Circum. Joint (Cat. A,B & C)			Heat Treatment	
No.	Diameter	Length	Spec./Grade or Type	Nom.	Corr.	Type	Full,Spot,Non e	Eff.	Type	Full,Spot,Non e	Eff.	Temp.	Time
1	12.75" O.D.	187.8125"	SA 312 TP304/L	0.5"	NIL	SMLS	NONE	100%	B-1	NONE	70%	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-

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
1	CUSTOM WN	11.75"	18"	3.25"	0.4688"	SA 182 F304/L	WELDED	END	20-7/8"-9UNC	SA 193 B8,CL.2	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-

7. Heads: (a) SA 403-304/L WP-W (Material spec. number, grade or type) (H.T. - time and temp.) (b) - (Material spec. number, grade or type) (H.T. - time and 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.
	END	0.4375"	NIL	-	-	2:1	-	-	-	-	YES	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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
	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-

8. Type of jacket - Jacket closure - (Describe as ogee and weld, bar, etc.)

If bar, give dim ensions - If bolted, des cribe or sketch.

9. MAWP 755 (Internal) - (External) psi at max. temp. 320 (Internal) - (External) °F Min. design metal temp. -20 °F at 755 psi

10. Im pact test NO - AS PER UHA-5 1(d) [Indicate yes or no and the component(s) impact tested] at test temperature of - °F

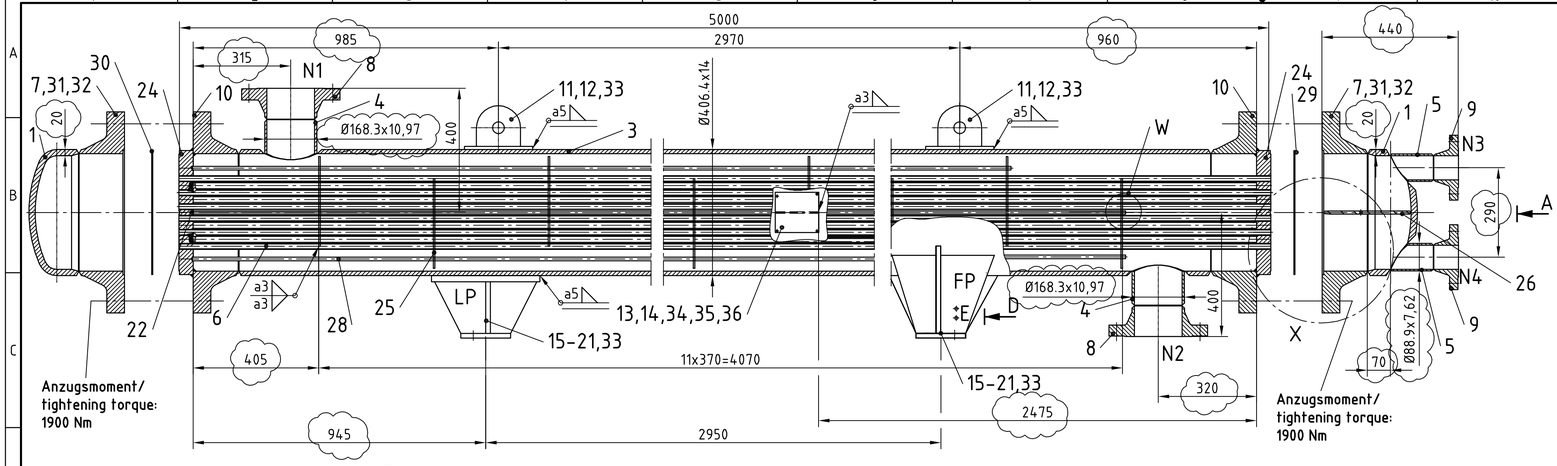
11. PNEU test pressure 885 PSIG proof test -

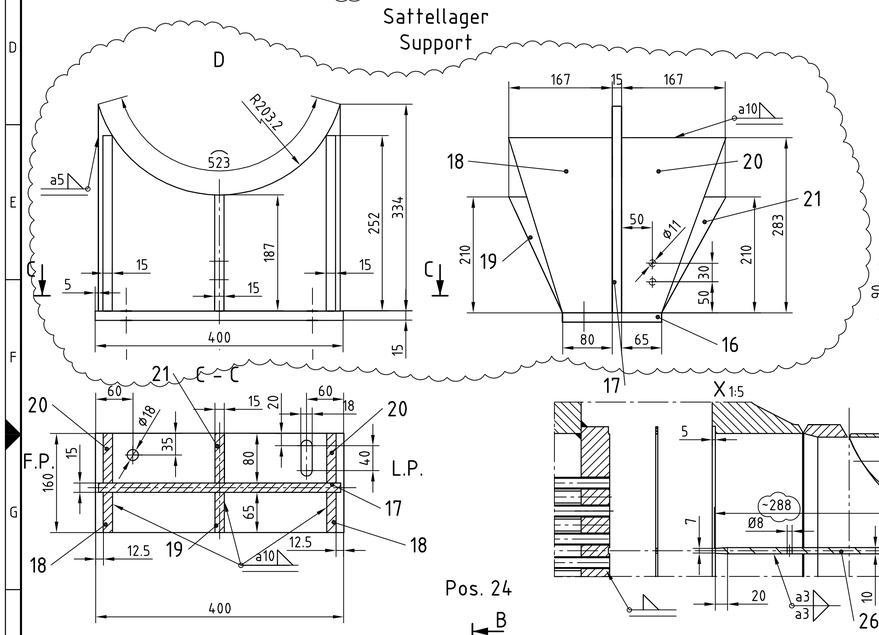
Items 12 and 13 to be c ompleted for tube sections.

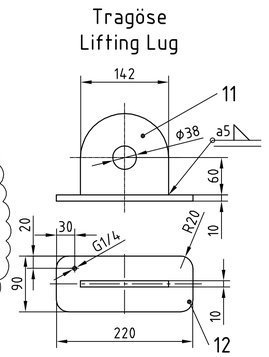
12. Tubesheet SA 240 304/L [Stationary (material spec. no.)] | 12" [Diameter (subject to press.)] | 2" (Nominal thickness) | NIL (Corr. allow.) | WELDED [Attachment (welded or bolted)]

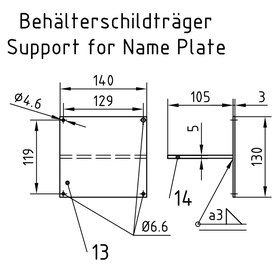
\- [Floating (material spec. no.)] | - (Diameter) | - (Nominal thickness) | - (Corr. allow.) | - (Attachment)

13. Tubes SA 249 TP 304/L W LD (Material spec. no. grade or type) | 0.75" (O.D.) | 0.049" (Nominal thickness) | 40 (Number) | U [Type (straight or U)]

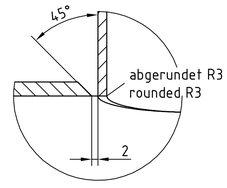




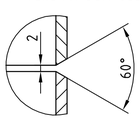




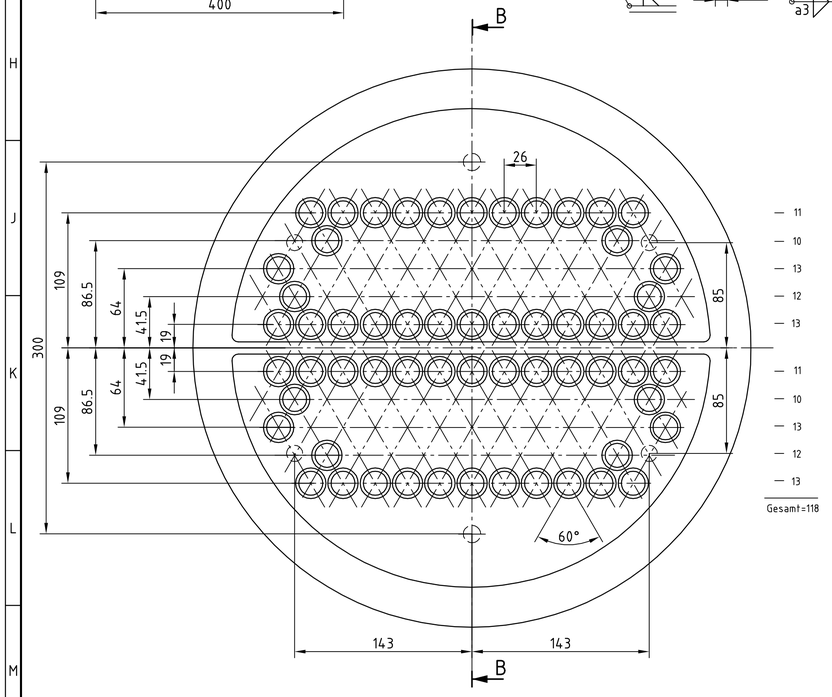
gilt für alle Stutzennähte
valid for neck-seams

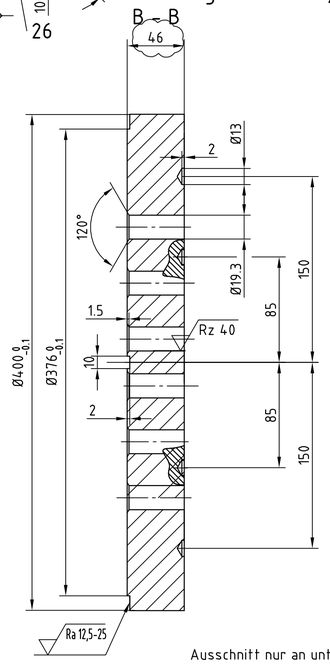


gilt für alle Stumpfnähte
valid for butt seams



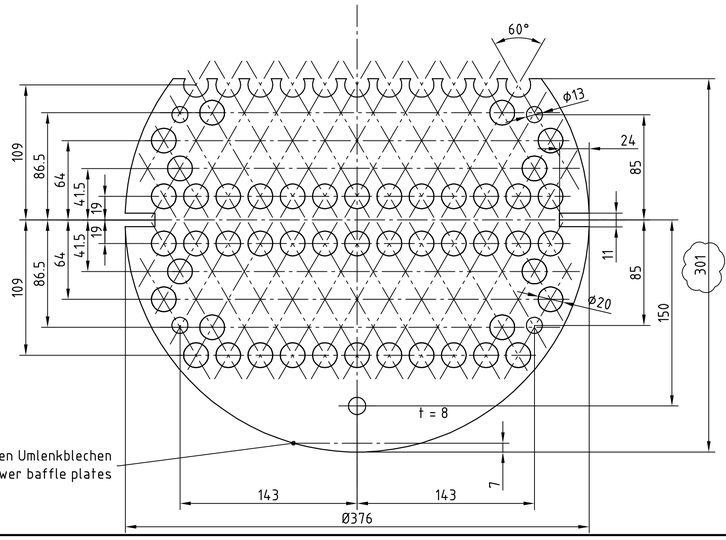
Pos. 24

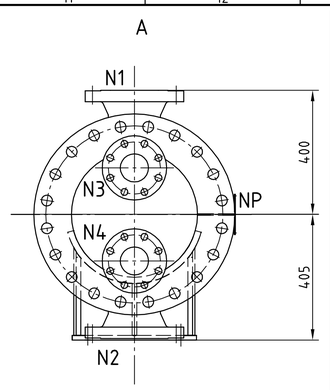




Ausschnitt nur an unteren Umlenkblechen
cut-out only at lower baffle plates

Pos.25





VERSANDVORBEREITUNG / PREPARATIONS FOR SHIPMENT

ALLE DRUCKRÄUME SIND NACH DER WASSERDRUCKPRÜFUNG RESTLOS ZU ENTLEEREN UND ZU SÄUBERN.
ALLE ÖFFNUNGEN SIND STAUB- UND SPRITZWASSERDICHT ZU VERSCHLIESSEN.

AFTER HYDROSTATIC PRESSURE TEST ALL SPACES SUBJECT TO PRESSURE SHALL BE ENTIRELY EMPTY AND CLEANED.
ALL OPENINGS ARE TO BE SEALED DUST AND SPLASH WATER TIGHT.

OBERFLÄCHENBEHANDLUNG / PROTECTIVE COATING

EDELSTAHL / SS:

ALLE OBERFLÄCHEN SIND METAL. SAUBER. ZUNDER, ANLAUFFARBEN UND RESTE VON SCHWEISSSCHLACKEN SIND MECHANISCH ODER CHEMISCH ZU ENTFERNEN. BEIZEN UND PASSIVIEREN.

ALL SURFACES ARE METALLIC CLEAN. SCALE, ANNEALING COLOURS AND RESIDUES OF WELDING SLAG SHALL BE REMOVED MECHANICALLY OR CHEMICALLY. PICKLING AND PASSIVATION.

C-STAHL / CS:

– MEDIUMSEITIG / ON MEDIUM SIDE

VORSCHRIFT / REGULATION :

C-STAHL / CS :

– AUSSENSEITIG / OUTSIDE

VORSCHRIFT / REGULATION :

C-STAHL / CS : ENTROSTEN / UNRUSTING : Sandstrahlen Sa 2,5 nach DIN EN ISO 12944-4/ sandblasting Sa 2 1/2 acc. to DIN EN ISO 12944-4
GRUNDIERUNG / PRIMER : 1x inorganic zinc coating TSD 75...125 µm, 1x epoxy coating TSD 125...200 µm
DECKSCHICHT / FINISH : 1x polyurethane TSD 50 µm

TRANSPORTMAßE / DIMENSION FOR TRANSPORTATION: 6,4 m / 0,7 m / 0,8 m (L / B / H)

GEWICHTE / WEIGHTS

TRANSPORTGEWICHT CA. 2110 kg LEERGEWICHT	**BETRIEBSGEWICHT CA.** 2205 kg MIT FÜLLUNGEN	**MIT WASSERFÜLLUNG CA.** 2575 kg DRUCKPRÜFUNG
TRANSPORT WEIGHT WEIGHT EMPTY	**OPERATING WEIGHT** WITH FILLING	**WITH WATER FILLING** PRESSURE TEST

TOLERANZEN UND OBERFLÄCHEN / TOLERANCES AND SURFACES

MAßE OHNE TOLERANZANGABEN
DIMENSIONS WITHOUT TOLERANCES

ALLGEMEIN / GENERAL	DIN ISO 2768-m
SCHWEISSTEILE / WELDING PARTS	DIN EN ISO 13920
BEHÄLTER / VESSEL	DIN 28005
WÄRMETAUSCHER / HEAT EXCHANGER	DIN 28008

OBERFLÄCHENZEICHEN / SURFACE SYMBOLS

SYMBOL	DIN EN ISO 1302 (Rz in µm)	DIN EN ISO 1302 (Ra in µm)	DIN 3141 REIHE/SERIE 1 (veraltet)
	= √Rz160	= √Ra25	= ▽
	= √Rz40	= √Ra6,3	= ▽▽
	= √Rz16	= √Ra1,6	= ▽▽▽
FERTIGUNGSVERFAHREN NACH DIN-NORM DES EINZELTEILS			
MANUFACTURING PROCESS ACC. DIN STANDARD OF INDIVIDUAL PART			

ZUGEHÖRIGE UNTERLAGEN

SCHWEIß- UND PRÜFPLAN /
WELDING AND TESTING PLAN
ZCHNG.-NR. / DRWG. NO.:

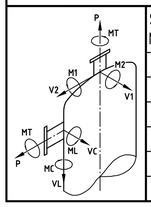
RÖNTGENPLAN /
X RAYING PLAN
ZCHNG.-NR. / DRWG. NO.:

FESTIGKEITSBERECHNUNG /
CALCULATON OF STRENGTH
ZCHNG.-NR. / DRWG. NO.:

ALLE ANGEGEBENEN MAßE SIND FERTIGMAßE. TECHNOLOGISCH BEDINGTE ZUGABEN SIND DURCH DEN APPARATE- BZW. WÄRMETAUSCHERHERSTELLER ZU BERÜCKSICHTIGEN.

ALL DIMENSIONS ARE FINAL DIMENSIONS. OVERMEASURES CAUSED BY TECHNOLOGY SHALL BE CONSIDERED BY THE MANUFACTURER OF THE APPARATUS RESP. HEAT EXCHANGER.

Stutzenlast - Angaben / Nozzle Loads



Stutzen Nozzle	DN NPS	N P	N VL V1	N VC V2	Nm ML M1	Nm MC M2	Nm MT
N1	6"	6700	6800	4800	4000	2600	4800
N2	6"	6700	6800	4800	4000	2600	4800
N3	3"	3500	4100	3000	1400	900	1800
N4	3"	3500	4100	3000	1400	900	1800

Pos. 36

Silica Verfahrenstechnik GmbH
Berlin, Germany

SILICA

HERSTELLER MANUFACTURER	Silica Verfahrenstechnik GmbH, Wittestr. 24, D-13509 Berlin		
FABRIK NR. SERIAL NO.	13755	BAUJAHR/YEAR OF CONSTRUCTION	2014
		MANTELRAUM SHELL SPACE	ROHRRAUM TUBE SPACE
HÖCHSTZUL. BETRIEBSÜBERDRUCK MAX. ALLOW. WORKING GAUGE PRESSURE		37	37 bar
HÖCHSTZUL. BETRIEBSTEMPERATUR MAX. ALLOW. WORKING TEMPERATURE		120	120 °C
INHALT VOLUME		465	78 l
PRODUKTGRUPPE FLUID GROUP		-	-
CODE	ASME VIII Div.1		
OBJEKTART TYPE OF VESSEL	Precooler		
LEERGEWICHT WEIGHT EMPTY	2110 kg	BETRIEBSGEWICHT OPERATING WEIGHT	2205 kg
02Z04-E-01			

STUTZENTABELLE / NOZZLES

FLANSCHE (LOCHANORDNUNG) NACH DIN EN 1092-1 UND 1092-2 /
FLANGES (ARRANGEMENT OF HOLES) ACC. DIN EN 1092-1 AND 1092-2

Stutzen-Nr. NOZZLE-NO.	DN NOM.PIPE SIZE	PN NOM.PRESS. RATING	Dichtfläche FACING	Flanschart FLANGE TYPE	Benennung DESCRIPTION
N1	6"	300	RF	B16.5	Gas Inlet
N2	6"	300	RF	B16.5	Gas Outlet
N3	3"	300	RF	B16.5	Cooling Water Inlet
N4	3"	300	RF	B16.5	Cooling Water Outlet
-	-	-	-	-	-
NP	-	-	-	-	-
E	-	-	-	-	-

BEHÄLTER DATEN / VESSEL DATA

Komm. Nr. / COM. NO.			100522-2-2400
Anzahl / QUANTITY			1
Fabrik Nr. / SERIAL NO.			13755
Baujahr / YEAR OF CONSTRUCTION			2014
Mantelraum SHELL SPACE	Höchstzul. Betriebsüberdruck / MAX. ALLOW. WORKING GAUGE PRESSURE	bar	-1/37
	Höchstzul. Betriebstemperatur / MAX. ALLOW. WORKING TEMPERATURE	°C	120
	Prüfüberdruck / TEST PRESSURE	bar	52,9
	Inhalt / VOLUME	l	465
	Medium MEDIUM		Erdgas/ naturalgas
	Korrosionszuschlag für drucktrag. Teile (ohne WT-Rohre) / CORROSIONS ALLOWANCE	mm	1,6
Rohraum TUBE SPACE	Höchstzul. Betriebsüberdruck / MAX. ALLOW. WORKING GAUGE PRESSURE	bar	-1/37
	Höchstzul. Betriebstemperatur / MAX. ALLOW. WORKING TEMPERATURE	°C	120
	Prüfüberdruck / TEST PRESSURE	bar	49,4
	Inhalt / VOLUME	l	78
	Medium MEDIUM		Wasser/water
	Korrosionszuschlag für drucktrag. Teile (ohne WT-Rohre) / CORROSIONS ALLOWANCE	mm	1
Schweißnahtfaktor / WELDING FACTOR			0,85
Auslegungscode / DESIGN CODE	**ASME VIII div. 1 (ohne U-Stamp)**		
Behälter-Kategorie / VESSEL-CATEGORY	Ausleg. u. Herstell. / DESIGN AND MANUFACTURING		-
Gefahrenanalyse / Erstellung tech. Unterlagen / ESSENTIAL SAFETY REQUIREMENTS / TECHNICAL DOCUMENTATION			Silica
Entwurfsprüfung / DESIGN-EXAMINATION		TÜV	-
Einzelprüfung (Schluß- und Druckprüfung) / UNIT VERIFICATION		TÜV	-
Betriebsanltg. / Konformitätserkl. / CE-Kennzchng. / OP. INSTRUCTION / DECLARATION OF CONFORMITY / CE-MARKING			Silica
Endabnahme / FINAL INSPECTION			Silica / Customer
Isolierung / Warm-Berührungsschutz / INSULATION HOT - PROTECTIVE COATING		mm	-

Rev.	Datum/DATE	Name/NAME	Änderung/MODIFICATION
4			
3			
2			
1	08.04.2014	ys	wallthickness, tube and baffle plate, material, Pos.15
0	24.02.14	mr	Erstausgabe / FIRST ISSUE

Komm.-Nr./COM.-NO.: 100522-2-2400 | Projekt/PROJECT: LNG Bolivia

	Datum/DATE	Name/NAME
Gez./DESIGN	24.02.14	mr
Gepr./CHK.	24.02.14	We

SILICA Verfahrenstechnik GmbH
Wittestraße 24, 13509 Berlin

Precooler
Ø406,4 x 5000
02Z04-E-01

Maßstab/SCALE 1:10, 1:5, 1:2,5 | Rev. 1
Zchng. Nr./DRAW. NO. 153/161 | Seite/SHEET 1 | von/OF 1
Ersatz für/REPL. FOR:
Ersetzt durch/SUPERSEDED BY:

Silica Verfahrenstechnik GmbH
Wittestr. 24
D - 13509 Berlin

Stückliste/PartList

SILICA

Pos. pos.	**Menge** quantity	**Benennung** description	**Abmessung** dimension	**Werkstoff/Norm** material/standard	**Dokumentation/Atteste** documentation/certificate	**Gewicht in kg** weight in kg	**Lv.** st.	**Rev.**
1	2	Klöpperboden torispherical head DIN 28011 Nennwanddicke = Mindestwanddicke US-Prüfung gem. SA-435 mit V-Naht 37,5 ° - aussen, Ansatzdicke vom zyl. Bord innen unter 15° beigedreht Wärmebehandlung gem. UG-79 heat treatment in acc. to ASME UG 79	Ø406,4 x 20 - VA Ansatz s = 14 mm	ASTM A516 Gr. 60	3.1 ASME II	41,3/St. pc.		1
2								
3	1	Mantel, geschweißt aus Blech plate	Ø406,4 x 14 x ~ 4616 aus Bl. 14 x ~4616 x 1233	ASTM A516 Gr. 60	3.1 ASME II	625		1
4	2	Rohr, nahtlos tube ASME B36.10	Ø168,3 x 10,97 x 131 (80S)	ASTM A516 Gr. 60	3.1 ASME II	5,5/St. pc.		1
5	2	Rohr, nahtlos tube ASME B36.10	Ø88,9 x 7,62 x ~140 (80S)	ASTM A516 Gr. 60	3.1 ASME II	2/St. pc.		1
6	118	Rohr, nahtlos tube DIN 28181 Tol. Kl 1	Ø19,05 x 2,11 x 5000	ASTM A179	3.1 ASME II	4,4/St. pc.		
7	2	Vorschweißflansch welding neck flange ASME B16.5 Dichtfläche: kleiner Rücksprung facing: small female	16" 300 lbs J = 378,4 mm	ASTM A105	3.1 ASME II	106/St. pc.		1

Komnr./comn	100522						Titel/title	Liefertermin/delivery dt.
Aktennr./ref.	2-2400						**Precooler Ø406,4 x 5000 02Z04-E-01/**	
Aufgabe/aband	1	1	08.04.2014	wallthickness, tube and baffle plate, material, Pos.	ys	rr		Zeichngsnr/drawingno. **153-161**
Datum/date	21.02.2014	0	21.02.2014	Erstausführung/first issue	mr	we		
Name	mr	Rev.	Datum/date	Änderung/change	Erstellt/issue	Geprüft/check		Seite/page 1 +

Silica Verfahrenstechnik GmbH
Wittestr. 24
D - 13509 Berlin

Stückliste/PartList

SILICA

Pos. pos.	**Menge** quantity	**Benennung** description	**Abmessung** dimension	**Werkstoff/Norm** material/standard	**Dokumentation/Atteste** documentation/certificate	**Gewicht in kg** weight in kg	**Lv.** st.	**Rev.**
8	2	Vorschweißflansch welding neck flange ASME B16.5 Dichtfläche RF facing: RF	6" 300 lbs J = 146,4	ASTM A105	3.1 ASME II	19,1/St. pc.		1
9	2	Vorschweißflansch welding neck flange ASME B16.5 Dichtfläche RF facing: RF	3" 300 lbs J = 73,7	ASTM A105	3.1 ASME II	6,9/St. pc.		1
10	2	Vorschweißflansch welding neck flange ASME B16.5 Dichtfläche RF facing: RF	16" 300 lbs J = 378,4 mm	ASTM A105	3.1 ASME II	106/St. pc.		1
11	2	Blech plate DIN EN 10029	10 x 131 x 142	ASTM A516 Gr. 60	2.2	1,5/St. pc.		1
12	2	Blech plate DIN EN 10029	10 x 90 x 220	ASTM A516 Gr. 60	3.1 ASME II	1,6/St. pc.		1
13	1	Blech plate DIN EN 10029	3 x 130 x 140	ASTM A516 Gr. 60	2.2	0,4		1
14	1	Blech plate DIN EN 10029	5 x 105 x 140	ASTM A516 Gr. 60	3.1 ASME II	0,6		1
15								1

Komnr./comn	100522						Titel/title	Liefertermin/delivery dt.
Aktennr./ref.	2-2400						**Precooler Ø406,4 x 5000 02Z04-E-01/**	
Aufgabe/aband	1	1	08.04.2014	wallthickness, tube and baffle plate, material, Pos.	ys	rr		Zeichngsnr/drawingno. **153-161**
Datum/date	21.02.2014	0	21.02.2014	Erstausführung/first issue	mr	we		
Name	mr	Rev.	Datum/date	Änderung/change	Erstellt/issue	Geprüft/check		Seite/page 2 +

Silica Verfahrenstechnik GmbH
Wittestr. 24
D - 13509 Berlin

Stückliste/PartList

SILICA

Pos. pos.	**Menge** quantity	**Benennung** description	**Abmessung** dimension	**Werkstoff/Norm** material/standard	**Dokumentation/Atteste** documentation/certificate	**Gewicht in kg** weight in kg	**Lv.** st.	**Rev.**
16	2	Blech plate DIN EN 10029 1 x gebohrt als Festlager 1 x gebohrt als Loslager 1 x drilled for fixpoint 1 x drilled for loose point	15 x 160 x 400	ASTM A516 Gr. 60	2.2	7,5/St. pc.		1
17	2	Blech plate DIN EN 10029	15 x 330 x 390	ASTM A516 Gr. 60	2.2	15/St. pc.		1
18	4	Blech plate DIN EN 10029	15 x 167 x 279	ASTM A516 Gr. 60	2.2	5,5/St. pc.		1
19	2	Blech plate DIN EN 10029	15 x 167 x 183	ASTM A516 Gr. 60	2.2	3,5/St. pc.		1
20	4	Blech plate DIN EN 10029	15 x 167 x 279	ASTM A516 Gr. 60	2.2	5,5/St. pc.		1
21	2	Blech plate DIN EN 10029	15 x 167 x 183	ASTM A516 Gr. 60	2.2	3,5/St. pc.		1
22	2	Abdichtstreifen flat sealing strip DIN EN 10058 Flach	Fl 25 x 10 x 4495	ASTM A516 Gr. 60	2.2	8,8/St. pc.		1
23								

Komnr./comn	100522					
Aktennr./ref.	2-2400					
Aufgabe/aband	1	1	08.04.2014	wallthickness, tube and baffle plate, material, Pos.	ys	rr
Datum/date	21.02.2014	0	21.02.2014	Erstausführung/first issue	mr	we
Name	mr	Rev.	Datum/date	Änderung/change	Erstellt/issue	Geprüft/check

Titel/title
Precooler Ø406,4 x 5000 02Z04-E-01/

Liefertermin/delivery dt.

Zeichngsnr/drawingno. **153-161**

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Stückliste/PartList

SILICA

Pos. pos.	**Menge** quantity	**Benennung** description	**Abmessung** dimension	**Werkstoff/Norm** material/standard	**Dokumentation/Atteste** documentation/certificate	**Gewicht in kg** weight in kg	**Lv.** st.	**Rev.**
24	2	Rohrboden aus Blech tube plate DIN EN 10029 mit US-Flächenprüfung gemäß DIN EN 10160, Klasse S2 bzw. E2	Bl 46 x Ø400	ASTM A516 Gr. 60	3.1 ASME II	45,5/St. pc.		1
25	12	Umlenkblech baffle plate DIN EN 10029 davon 6 Stück mit Ausschnitt für Entleerung 6 parts with cut-out for drain	Bl 8 x Ø376	ASTM A516 Gr. 60	2.2	4,6/St. pc.		1
26	1	Blech plate DIN EN 10029	Bl 8 x 378 x 288	ASTM A516 Gr. 60	3.1 ASME II	6,8		1
27	1	Rund round DIN EN 10060	Rd 12 x 4125	ASTM A516 Gr. 60	2.2	3,7		1
28	5	Rund round DIN EN 10060	Rd 12 x 4495	ASTM A516 Gr. 60	2.2	4/St. pc.		1
29	3	Spiraldichtring spiral wound gasket ASME B 16.20 NPS 16", für Vor-und Rücksprung,schmal, RF, mit separatem Steg 8mm 1 x für Druckprobe 1 x Reserve for small male and female 1 x for pressure test 1 x reserve	Ø400 x Ø376 x 3,5	Spiroflex mit Graphiteinlage SpV1	---	0,1/St. pc.		

Komnr./comn	100522						Titel/title	Liefertermin/delivery dt.
Aktennr./ref.	2-2400							
Aufgabe/aband	1	1	08.04.2014	wallthickness, tube and baffle plate, material, Pos.	ys	rr	**Precooler Ø406,4 x 5000 02Z04-E-01/**	Zeichngsnr/drawingno. **153-161**
Datum/date	21.02.2014	0	21.02.2014	Erstausführung/first issue	mr	we		
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Stückliste/PartList

SILICA

Pos. pos.	**Menge** quantity	**Benennung** description	**Abmessung** dimension	**Werkstoff/Norm** material/standard	**Dokumentation/Atteste** documentation/certificate	**Gewicht in kg** weight in kg	**Lv.** st.	**Rev.**
30	3	Spiraldichtring spiral wound gasket ASME B 16.20 NPS 16", für Vor-und Rücksprung,schmal, RF 1 x für Druckprobe 1 x Reserve for small male and female 1 x for pressure test 1 x reserve	Ø400 x Ø376 x 3,5	Spiroflex mit Graphiteinlage SpV1	---	0,1/St. pc.		
31	42	Gewindebolzen stud bolt ANSI B18.2 davon 2 Reserve	1 1/4"-8UN x 250 mm	ASTM A193-B7	3.1 ASME II	1,5/St. pc.		1
32	84	Sechskantmutter hex. nut ANSI B18.2.2 davon 4 Reserve	1 1/4"-8UN	ASTM A194-B7	3.1 ASME II	0,2/St. pc.		1
33	4	Verschlussschraube lock screw DIN 906	G1/4A	5.6		0,1/St. pc.		1
34	3	Halbrundniet snap rivet DIN 660	A4 x 12	Al	---			
35	1	Niet rivet DIN 7338	A6 x 15	Cu	---			
36	1	Silica-Schild name plate		1.4301	---	0,1		

Komnr./comn	100522						Titel/title	Liefertermin/delivery dt.
Aktennr./ref.	2-2400						**Precooler Ø406,4 x 5000 02Z04-E-01/**	
Aufgabe/aband	1	1	08.04.2014	wallthickness, tube and baffle plate, material, Pos.	ys	rr		Zeichngsnr/drawingno. **153-161**
Datum/date	21.02.2014	0	21.02.2014	Erstausführung/first issue	mr	we		
Name	mr	Rev.	Datum/date	Änderung/change	Erstellt/issue	Geprüft/check		Seite/page 5 +

SILICA	Technical Datasheet	Draw.-No.: 153-158
	Title: Regenerationsgas cooler	Rev.-No.: 1
	Description: Reg.-gas cooler 02Z04-E-05	Page: 1 / 4

Comm.-No.:	V 100522-2-2400	Ident.-No.:	13754
Project:	LNG Bolivia		
Customer-No.:	Ros Roca Indox Cryo-Energy S.L.	Quantity:	1

Operating Conditions

		Shell Side	Tube Side
Medium:	--	Natural Gas	Cooling Water
Flow rate:	Nm³/h	1700	27,5
Operating pressure:	bar (g)	18,5	4
Inlet temperature:	°C	200	32
Outlet temperature:	°C	37	37
Quantity of condensate:	kg/h	Ø 38 (max. ~ 110)	-
Quantity of heat:	kJ/h	571070	571070
Standard density:	kg/m³	0,831	992,64
dyn. viskosity:	Ns/m²	1,4E-05	7,6E-04
spec. heat:	J/kgK	2480	4178
Heat conductivity:	W/mK	0,045	0,622
Fouling factor:	m²K/W		2,5E-04
Loss of pressure:	mbar	28,5	71,3
Exchange surface (required):	m²	12,15	
Exchange surface (real):	m²	16,16	13,36

Design Conditions

		Shell Side	Tube Side
max. pressure:	bar	-1/ 37	-1/ 37
Test pressure:	bar	53	53
max. temperature:	°C	270	270
Welding factor:	v	0,85	0,85
Corrosion allowance:	mm	0	0

Regulations, Tests

Preliminary check:	X	TÜV	Penetrant test:	X		Regulations		
Works test:	X	TÜV	Leak test:	X		Work stand.		
Pressure test:	X	TÜV	Acceptance:	X		DIN		
Design Review:	X	TÜV	X-Ray test:	X		AD		
			US test:			ASME	x	TÜV
						TEMA -	x	

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Date:	11.11.2013	20.6.2014							
Name:	Cf	rr							

SILICA	Technical Datasheet	Draw.-No.: 153-158
	Title: Regenerationsgas cooler	Rev.-No.: 1
	Description: Reg.-gas cooler 02Z04-E-05	Page: 2 / 4

Comm.-No.:	V 100522-2-2400	Ident.-No.:	13754
Project:	LNG Bolivia		
Customer-No.:	Ros Roca Indox Cryo-Energy S.L.	Quantity:	1

Technical Design

Design:	type	BET	Position:	
Diameter of shell:	mm	323,9	vertical	
Length of bundle:	mm	3000	horizontal	X
Tube number:	piece	82		
Tube dimension:	mm	19,05 x 1,65	Expansion joint	
Tube System:		◉△ ○□ 24		
Number of passes:	--	2	Deflector	
Number of tube rows:	piece	10		
Tubes in pass partition lane:	piece	7	Tube bundle:	
Turning vanes:	piece	18	welded in	
Distance between turning vanes:	mm	140	pull-out	x
Dimension of pass partition lane:	mm	48,81		
Chamber length:	mm	310	Tubes:	
Number of sealing flats (pairs):	piece	1	welded in	X
			rolled in	
			rolled and welded	

Dimension, Material

Description	Dimension	Material	Certificate
Shell:	Ø 323,9 x 3000	ASTM A312 Gr. TP321	3.1 ASME II
Formed heads:	Ø 323,9	ASTM A240 Gr. 321	3.1 ASME II
Floating head:		ASTM A240 Gr. 321	3.1 ASME II
Tube sheet:		ASTM A240 Gr. 321	3.1 ASME II
Tubes:	Ø 19,05 x 1,65	ASTM A312 (TP316/316L)	3.1 ASME II
Guiding plates:		ASTM A240 Gr. 321	3.1 ASME II
Nozzles shell side			
- Flanges:		ASTM A182 Gr. F321	3.1 ASME II
- Tubes:		ASTM A312 Gr. TP321	3.1 ASME II
- Bolts and Nuts:		ASTM A193 Gr.B8/194 Gr.8	3.1 ASME II
- Gaskets:		spiral wounded gasket	3.1 ASME II
Nozzles tube side			
- Flanges:		ASTM A182 Gr. F321	3.1 ASME II
- Tubes:		ASTM A312 Gr. TP321	3.1 ASME II
- Bolts and Nuts:		ASTM A193 Gr.B8/194 Gr.8	3.1 ASME II
- Gaskets:		spiral wounded gasket	3.1 ASME II
Supports:		ASTM A240 Gr. 321	3.1 ASME II

Weights: kg	empty:	870	in operation:	970	filled with water:	1015

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SILICA	Technical Datasheet	Draw.-No.: 153-158
	Title: Regenerationsgas cooler	Rev.-No.: 1
	Description: Reg.-gas cooler 02Z04-E-05	Page: 3 / 4

Comm.-No.:	V 100522-2-2400	Ident.-No.:	13754
Project:	LNG Bolivia		
Customer-No.:	Ros Roca Indox Cryo-Energy S.L.	Quantity:	1

Accessories

Anchor / Fixing bolts:			Nameplate:	X	
Saddle:	X				
Plugs:			Counterflanges:		
Lifting lugs	x		Gaskets and bolts:	x	
Support for pressure test:			Earth connection:	X	
Insulation holder:					
Insulation:	x				
Thickness of insulation:	30	mm			
Insulation cover:					

Surface Treatment

Sandblasting:		Sa 2,5 DIN 55928 part 4				
Primer:	x	Color type:	Intertherm 751CSA	TSD:	50	µm
Intermediate coat:		Color type:		TSD:		µm
Top coat:		Color type:		TSD:		µm
Pickling and neutralisation:	x	VDI 2532 / DIN 28051				
Glass bead blasting						

Nozzle Table

No.	Description	DN	PN	Nozzle Tubes	Sealing face	ANSI
N1	Inlet	3"	Cl.300	Ø88,9x7,62	RF	B16.5
N2	Outlet	3"	Cl.300	Ø88,9x7,62	RF	B16.5
N3	Cooling Water Inlet	3"	Cl.300	Ø88,9x7,62	RF	B16.5
N4	Cooling Water Outlet	3"	Cl.300	Ø88,9x7,62	RF	B16.5
N5						
N6						
N7						
N8						
N9						
N10						
N11						
N12						
N13						
NP	Nameplate					
E1	Earthing					

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SILICA	Technical Datasheet	Draw.-No.: 153-158
	Title: Regenerationsgas cooler	Rev.-No.: 1
	Description: Reg.-gas cooler 02Z04-E-05	Page: 4 / 4
Comm.-No.: V 100522-2-2400		Ident.-No.: 13754
Project: LNG Bolivia		
Customer-No.: Ros Roca Indox Cryo-Energy S.L.		Quantity: 1

Dimension Sheet

s. dwg: ZCHG2-2400Regeneration-Gas-Cooler Ø323,9x3000_02Z04-E-05_100522_153-158

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