—	12619 MWO)		ORM U-1 MANU								e t	5		
1 1	Manufactured a	nd certified		p, LLC, 611 No								VISION I			
			•	oulevard, Suite		ca, Illino	(Name a is, 6014	nd ad 13, U	ldress of Manufa ISA						
3. l	ocation of insta	allation Nil	es Ferry In	dustrial Park, 2	200 Indust				s of Purchaser) Fennessee, 3	7885,	USA				
	Гуре	Horizontal		***		BEMH Hea	(Nar	me ar	nd address)			1	1391 to 11	396	
4.	(Horizo	ntal, vertical,			(Tank, sepa				h., etc.)					al number)	
	· · · · · · · · · · · · · · · · · · ·	N/A (CRN)			(Di	SA-3395-				(Nati	9080-9	085 d number)		
5.	ASME Code, S		Div. 1		007/ 2008				N/	Α .				WA House	20/10
	Items 6-11 inc	ol to be com	inlated for si	Edition a agle wall vessels	nd Addenda i jackets of	200	vessels	she	Code Cas					ce per UG-12 ber vessels	
6. S	Shell (a) Numb					rall length		Onc		141.78		1007 07 11		-	,
N.	Course	1	0	Material		Thickness	0.000		Long, Joint (Cat.			Joint (Cat.		Heat Tre	atment Time
No.	Diameter 4.500" OD	Length 141.780		c./Grade or Type	.120'		Corr. N/A	1 ype	Full, Spot, Non None	e Eff.	N/A	III, Spot, No N/A	N/A	Temp.	N/A
7.	Heads: (a)			N/A				((b)			N/A			
	·			de or type) (H.T	N 60 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		Inii	A				, grade or	20 0 0	- Time & Te	. 13 - 53
	Location (Top, Bottom, Ends)	Min,	Corr.	Radiu Crown	Knuckle	Elliptical Ratio	Ang		Hemispherical Radius	Flat Diame		o Pressure Concave	Туре	Full, Spot,	
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4	N/A	N/A	N/A	N/A	N/A	N/A	N/A
lf r	emovable, bolts	s used (desc	cribe other fa	stening)						I/A					
o T	C 1.1			1000					ial, spec. numb	er, grad	e, size, ni				
B. 1	ype of jacket _			N/A			Ja	cket	closure		(Descri	Noe as oge	& weld, b	ar, etc.)	
lf	bar, give dimer	nsions				1	N/A		90.000	Tar.	OWICENSE		If bolt	ed, describe	or sketch.
. M		psi ernal)	N/A (external	at max. temp). <u>37</u> (inter	5 °F	(ext	N/A ernal		lesign ı	netal ter	np	-20 °F	at;	375 psi
0. lı	mpact test			mpact Testing	Not Requir	red Per U	HA-51(c	i), (d	, l)(1)(a) & (g)			at	test temp	perature of	N/A
1. H	ydro., pneu., or co	omb. test pres	s. Hydro	(Indicate yes on at 225 psi	or no and the Proof te		it(s) impa	ct tes	itea)		N/A				J ¹
li	tems 12 and 13	to be comp	leted for tub	e sections.											
2. T	ubesheet:		y (material sp		(Diameter,	4.998" (subject to	press.))	- (N	.890" Iominal thicknes	s) —	(Corr. a		Attach	Welded ment (welde	
		151	N/A			N/A			N/A		N/	11		N/A	-1/
3 T	ubes:	(A)	(material spe A-249 TP304L		(1	.750"		(1)	lominal thicknes	s)	(Corr. a	illow.)		Straight	
· ·			pec. no., grade			(O. D.)		(N	lominal thicknes	s) —	(Num	ber)	(T	ype (Straight	or U))
	tems 14-18 inci	The figure amount of which there	oleted for inn 1	er chambers of j		ssels or o		of h	eat exchanger 5.220"	S.					
	Course			Material		Thickness			Long, Joint (Cat.		1. 100 (1.45) (1.70 × 15)	loint (Cat. /	A COLUMN TO SERVICE AND ADDRESS OF THE PARTY	Heat Tre	
No.	Diameter 4.500" OD	Length 5.220"		:/Grade or Type	Nom.		Corr. N/A	Type N/A	Full, Spot, None	E Eff.	Type Fu	II, Spot, No	ne Eff.	Temp.	Time N/A
. 1	11000 00	0,220	0.10		1				1	1			11		
15. H	Heads: (a)	(Material spec		304L WPW de or type) (H.T	Time & Temr	<u>,) </u>		(1	b) (Mater	ial snec	number	N/A	type) (H T	- Time & Tei	mp.)
	Location (Top,		kness	Radiu		Elliptical	Conical		Hemispherical	Flat	Side t	o Pressure		Category A	
/n\	Bottom, Ends)	Min.	Corr.	Crown	Knuckle	Ratio	Angl		Radius	Diamet N/A	7700000	x Concave	Type 1	Full, Spot,	
(a)	ENDS	.120"	N/A	N/A	N/A	2	N/A	١	N/A	NIA				None	.03

					FC	RM U-1 (BAC	K)				NB N	umber	9080-9085
16. MAWP	150 psi		<mark>∥A</mark> atr	nax. temp	375	°F	N/A external)	Min.	design metal ten	ıp2	0 °F	at	150 psi
17. Impact test	• *************************************	(ext	No, Imp	act Test Not	Require	d Per UHA-51	(d), (d)(1)(a) & (g)	1	at t	est tempera	ature of	N/A
18. Hydro., pn	ieu., or coi	mb. test p		Hydro. at		component(s)	impact to	ested)		N/A			
19. Nozzles, in	spection, a	nd safety	valve openin	qs:									
Purpose (Inlet, Ou Drain, etc.)	a d I		Flange Type	Nozzle	Materia	l Flange	Nozzle 1	Corr.	Reinforcement Material	How A	ttached Flange	Locatio	on (Insp. Open
Inlet/Outlet	2	1" NPS	150# ANSI LJ	SA-312 TP30			.109"		19 (19 (19 (19 (19 (19 (19 (19 (19 (19 ((c)	bw		
Shell Inlet/Outle	et 2			SA-312 TP30	_	SA-403 304L	.109"			(c)	bw		
Shell Vent/Drai	n 2 3	3/4" NPT	Coupling	SA-312 TP 30	4L WLD	SA-182 F304L	.113"			(c)	sw		
20. Supports: 21. Manufacturer's N/A	(Ye		edy identified a	and signed by Co	ommission	8	e been fun	(Describe hished for th	e following items of the	ne report:	She (Whe	II, Weld Fre and h	ded now)
			(List the	name of part	t, item nı	ımber, Manufa	cturer's n	ame and	identifying numbe	er)			
Shell Side .890" Thic	zle Atta ld And/Or I n Openir e Body E ck x 7.0	Cemperatings are Tlange (000" Out	Describe ure Devic omitted 1 Qty 2) side Dian .562 Hol	ces Are No In Fixed T	ot By I Tubesh	Enerquip, I eet Heat Ex ameter Bolt	LC change	ers Per	UG 46(a)			<u>.</u> ,	
Additional Rema	arks - See A	ttached U-4	***										
AND PRESSURE	e statement E VESSEL 0	CODE, Secti	on VIII, Divisio	orrect and that n 1. U Certifica	all details te of Auth	orization Number	ial, constru 38115	uction, and	workmanship of this xpires <u>12/15/2</u> Signed _	011			
					(Manufa	acturer)				(1	Represent	nive)	N
and employed by August 26, PRESSURE VES the pressure vess property damage	N HSB CT of 2009 SSEL CODE sel describe	of Hartford, O , and state t , Section VII d in this Mar any kind ari	CT hat, to the bes II, Division 1. I nufacturer's Da	y The National t of my knowled By signing this of the Report. Furl onnested with the	Board of dge and be certificate thermore, nis inspec	elief, the Manufac neither the Inspe neither the Inspe tion. Cor	ure Vessel have inspecturer has ector nor hiector nor	Inspectors pected the constructed s/her emplois/her	al Board incl. endor	cribed in this el in accorda ranty, expres n any manne 75A, WI100	Manufacture nce with ASI ssed or impli er for any per	ME BOIL ed, conc sonal inj	ER AND eming jury or
We certify that the AND PRESSURE	e statements VESSEL C	s made in th ODE, Section	is report are co on VIII, Division	prect and that t	he field as	FIELD ASSEN ssembly construct prization No.	tion of all	OMPLIAI parts of this	vessel conforms w		ements of A	SME BO	ILER
Date		Name							Signed				
				((Assemb	oler)				(1	Represent	ative)	- 1
I, the undersigned and employed by	d, holding a	valid commi	ssion issued by	CERTIFICA The National I	TE OF Board of E	FIELD ASSEN Boiler and Pressu	MBLY IN tre Vessel of	SPECTION Inspectors	ON and/or the State or	Province of			
has constructed a inspected and su implied, concerni personal injury or	and assemb bjected to a ing the press	, no led this pres hydrostatic sure vessel o armage or a l	ot included in the sure vessel in test of described in the	ne certificate of accordance wit is Manufacturer I arising from or	shop insp th the ASN By signing s Data R r connecte	pection, have bee ME BOILER AND ng this certificate eport. Furthermond and with this inspe-	n inspecte PRESSU neither the ore, neither	ed by me ar RE VESSE Inspector	arts referred to as da nd to the best of my L CODE, Section V nor his/her employe tor nor his/her empl	knowledge a III, Division 1 er makes any	. The descri	bed ves	sel was
				(Authorized	Inspect	or)		(Nation	al Board incl. endors	sements. Sta	te. Province	and num	nber)

exe: v4.6.6

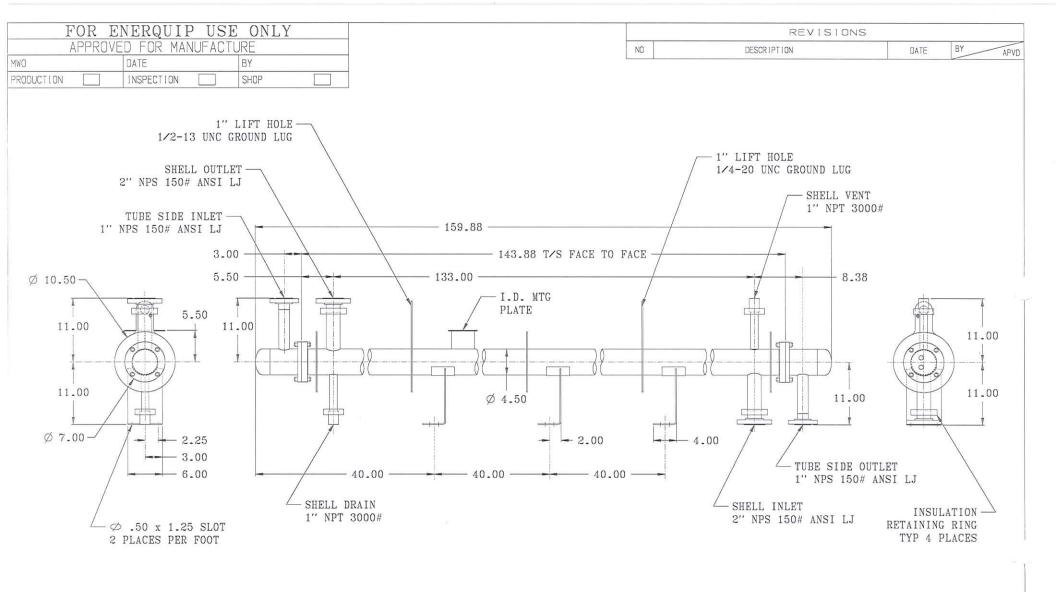
Enerquip, LLC



611 North Road • PO. Box 467 • Medford • Wisconsin • 54451 ENERQUIP Tel: 715.748.5888 • Fax: 715.748.6484 • Website: www.enerquip.com

Heat Exchanger Specification Sheet

					T. L. P. C.	
	1 Customer Name: Genera Energy, LLC	3		Proposal No.:	28220K	
	2 Location: Knoxville, TN			Your Reference:	7001-W07, W08,	W09, W10
3	3 Service of Unit: Stillage Exit Cooler					
4	4 Item No.:					
	5 Date: 6/17/09 11:00 AM					
		0 Type BEMH	hor/vert Hor	Connected in	1 parallel	4 series
	7 Surf/unit(eff.) 16.40 ft2	Shells/unit	4		65.6	
-		The second secon		Surf/shell (eff.)	05.0	ft2
		PERFORMAN	CE OF ONE UNIT			
	Fluid allocation		Shell	Side	Tube	Side
9	Fluid name					
10	Fluid quantity, Total	lb/h				
11		lb/h				
12		lb/h	 			
_	1 - 1				-	
13	TO THE PARTY OF THE PROPERTY OF THE PARTY OF	lb/h				
14						
15	Temperature (In/Out)	F				
16		F				
	Density (Vap / Lig)	lb/ft3				
	3 Viscosity	ср				
	Molecular wt, Vap					
20	Molecular wt, NC					
21	Specific heat	BTU/(lb*F)				
22	Thermal conductivity	BTU/(ft*h*F)				
	Latent heat	BTU/lb				
_	Pressure	psi				
	Velocity	ft/s				
26	Pressure drop, allow./calc.	psi				
27	Fouling resist. (min)	ft2*h*F/BTU				
	Heat exchanged	BTU/h		IMTD	corrected	F
	Transfer rate, Service	Brom	Calculated	Clear		BTU/(h*ft2*F)
2.0	Transier rate, cervice	COMPTRUCTO				טוט/(וווגדי)
_		CONSTRUCTIO	N OF ONE SHELL	No. of the last of		
30			Shell	Side	Tube	Side
31	Design/Test pressure psi	g	150	Code	150	Code
32		F	37	5	37	5
	Number passes per shell		1		j 1	
		n	0.		0.	
		щ	2 " NPS 1			
	Connections				1 NPS	150# ANSI
	Size/rating Out		2 " NPS 1	50# ANSI	1 " NPS 1	150# ANSI
37						
38	Tube No. 7 OD 0.750	Tkns - Avg	0.049 in	Length 12.0	ft Pitch	0.93750 in
39	Tube type Plain Welded		Material SS 304	L	Tube pa	attern 30
	Shell SS 304L	ID (in.) 4.260		Shell cover		
	Channel or bonnet SS 304L	Fabrica		Channel cover		
_	Tubesheet-stationary SS 304L	1 45/100	itou	Tubesheet-floatin	~	
						Mana
	Floating head cover	T 01 1 0		Impingement prote		None
	Baffle-crossing 22 SS 304	Type Single Se		%d) 40 H	Spacing: c/c	6 ir
_	Baffle-long		Seal type		Inlet	in
46	Supports-tube		U-bend	Туре		
47	Bypass seal		Tube-tubesheet joi	nt	Grooved & Ex	panded
	Expansion joint		Туре			
	RhoV2-Inlet nozzle	Bundle entrance	11100		Bundle exit	
The second name of	Gaskets - Shell side	Ibundle entrance	Tube Side	CDDM O Ding	Dundle exit	
			Tube Slue	EPDM O-Ring		
	Floating head					
	0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	(I 1/00 b) .		TEMA class		eral Service
		ction VIII Div. 1				
	Code requirements ASME Sec Weight/Shell 360.73	Filled with wate		43.88	Bundle	39.23 lb
53	Weight/Shell 360.73	Filled with wate	r 4	43.88	Bundle	39.23 lb
53	Weight/Shell 360.73 Remarks Unit designed by: Jon Clark -	Filled with wate	r 4	43.88	Bundle	39.23 lb
53	Weight/Shell 360.73 Remarks Unit designed by: Jon Clark - Non-Sanitary Design.	Filled with wate 715-748-5888 (ext. 230)	r 4) - jonclark@enerq	43.88 uip.com		39.23 Ib
53	Weight/Shell 360.73 Remarks Unit designed by: Jon Clark - Non-Sanitary Design. No performance evaluation of	Filled with wate 715-748-5888 (ext. 230) done for this unit. No the	r 4) - jonclark@enerq nermal process gu	43.88 uip.com arantees by Ene	rquip.	39.23 lb
53	Weight/Shell 360.73 Remarks Unit designed by: Jon Clark - Non-Sanitary Design. No performance evaluation of All nozzles to project 8" fron	Filled with wate 715-748-5888 (ext. 230) done for this unit. No the nunit and include insu	r 4) - jonclark@energ nermal process gu lation rings for ins	43.88 uip.com arantees by Ene sulation by others	rquip.	39.23 lb
53	Weight/Shell 360.73 Remarks Unit designed by: Jon Clark - Non-Sanitary Design. No performance evaluation of All nozzles to project 8" from Unit to be supplied with mou	Filled with wate 715-748-5888 (ext. 230) done for this unit. No the unit and include insu uting supports, lifting l	r 4) - jonclark@energ nermal process gu lation rings for ins ugs, and an electr	43.88 uip.com arantees by Ene sulation by others ical grounding pa	rquip.	39.23 lb
53	Weight/Shell 360.73 Remarks Unit designed by: Jon Clark - Non-Sanitary Design. No performance evaluation of All nozzles to project 8" fron	Filled with wate 715-748-5888 (ext. 230) done for this unit. No the unit and include insu uting supports, lifting l	r 4) - jonclark@energ nermal process gu lation rings for ins ugs, and an electr	43.88 uip.com arantees by Ene sulation by others ical grounding pa	rquip.	39.23 lb
53	Weight/Shell 360.73 Remarks Unit designed by: Jon Clark - Non-Sanitary Design. No performance evaluation of All nozzles to project 8" from Unit to be supplied with mou	Filled with wate 715-748-5888 (ext. 230) done for this unit. No the unit and include insu uting supports, lifting l	r 4) - jonclark@energ nermal process gu lation rings for ins ugs, and an electr	43.88 uip.com arantees by Ene sulation by others ical grounding pa	rquip.	39.23 lb
53	Weight/Shell 360.73 Remarks Unit designed by: Jon Clark - Non-Sanitary Design. No performance evaluation of All nozzles to project 8" from Unit to be supplied with mou	Filled with wate 715-748-5888 (ext. 230) done for this unit. No the unit and include insu uting supports, lifting l	r 4) - jonclark@energ nermal process gu lation rings for ins ugs, and an electr	43.88 uip.com arantees by Ene sulation by others ical grounding pa	rquip.	39.2 3 lb
53	Weight/Shell 360.73 Remarks Unit designed by: Jon Clark - Non-Sanitary Design. No performance evaluation of All nozzles to project 8" from Unit to be supplied with mou	Filled with wate 715-748-5888 (ext. 230) done for this unit. No the unit and include insu uting supports, lifting l	r 4) - jonclark@energ nermal process gu lation rings for ins ugs, and an electr	43.88 uip.com arantees by Ene sulation by others ical grounding pa	rquip.	39.2 3 lb
53	Weight/Shell 360.73	Filled with wate 715-748-5888 (ext. 230) clone for this unit. No the n unit and include insu niting supports, lifting I ated four (4) units in se	r 4) - jonclark@energ nermal process gu lation rings for ins ugs, and an electr	43.88 uip.com arantees by Ene sulation by others ical grounding pa	rquip.	39.2 3 lb
53 54 Mea	Weight/Shell 360.73 Remarks Unit designed by: Jon Clark - Non-Sanitary Design. No performance evaluation of All nozzles to project 8" from Unit to be supplied with mot NOTE: This design incorporate an metal temperatures (NOTE: Customer proving the supplied with the NOTE: This design incorporate and the supplied with the NOTE: This design incorporate and the supplied with the NOTE: This design incorporate and the supplied with the NOTE: This design incorporate and the supplied with the NOTE: This design incorporate and the NOTE: This design is the NOTE:	Filled with wate 715-748-5888 (ext. 230) clone for this unit. No the unit and include insulating supports, lifting lated four (4) units in seconds.	r 4) - jonclark@energ nermal process gu lation rings for ins ugs, and an electr rries per customer	43.88 uip.com arantees by Ene sulation by others ical grounding pa	rquip.	
53 54 Mea	Weight/Shell 360.73	Filled with wate 715-748-5888 (ext. 230) clone for this unit. No the n unit and include insu niting supports, lifting I ated four (4) units in se	r 4) - jonclark@energ nermal process gu lation rings for ins ugs, and an electr rries per customer	43.88 uip.com arantees by Ene sulation by others ical grounding pa	rquip.	1
53 54 Mea	Weight/Shell 360.73 Remarks Unit designed by: Jon Clark - Non-Sanitary Design. No performance evaluation of All nozzles to project 8" from Unit to be supplied with mot NOTE: This design incorporate an metal temperatures (NOTE: Customer proving the supplied with the NOTE: This design incorporate and the supplied with the NOTE: This design incorporate and the supplied with the NOTE: This design incorporate and the supplied with the NOTE: This design incorporate and the supplied with the NOTE: This design incorporate and the NOTE: This design is the NOTE:	Filled with wate 715-748-5888 (ext. 230) clone for this unit. No the unit and include insulating supports, lifting lated four (4) units in seconds.	r 4) - jonclark@energ nermal process gu lation rings for ins ugs, and an electr rries per customer	43.88 uip.com arantees by Ene sulation by others ical grounding pa	rquip.	1
53 54 Mea	Weight/Shell 360.73 Remarks Unit designed by: Jon Clark - Non-Sanitary Design. No performance evaluation of All nozzles to project 8" from Unit to be supplied with mot NOTE: This design incorporate an metal temperatures (NOTE: Customer proving the supplied with the NOTE: This design incorporate and the supplied with the NOTE: This design incorporate and the supplied with the NOTE: This design incorporate and the supplied with the NOTE: This design incorporate and the supplied with the NOTE: This design incorporate and the NOTE: This design is the NOTE:	Filled with wate 715-748-5888 (ext. 230) clone for this unit. No the unit and include insulating supports, lifting lated four (4) units in seconds.	r 4) - jonclark@energ nermal process gu lation rings for ins ugs, and an electr rries per customer	43.88 uip.com arantees by Ene ulation by others ical grounding pa	rquip.	1 2
53 54 Mea	Weight/Shell 360.73 Remarks Unit designed by: Jon Clark - Non-Sanitary Design. No performance evaluation of All nozzles to project 8" from Unit to be supplied with mot NOTE: This design incorporate an metal temperatures (NOTE: Customer proving the supplied with the NOTE: This design incorporate and the supplied with the NOTE: This design incorporate and the supplied with the NOTE: This design incorporate and the supplied with the NOTE: This design incorporate and the supplied with the NOTE: This design incorporate and the NOTE: This design is the NOTE:	Filled with wate 715-748-5888 (ext. 230) clone for this unit. No the unit and include insulating supports, lifting lated four (4) units in seconds.	r 4) - jonclark@energ nermal process gu lation rings for ins ugs, and an electr rries per customer	43.88 uip.com arantees by Ene ulation by others ical grounding pa	rquip.	1 2 3
53 54 Mea	Weight/Shell 360.73 Remarks Unit designed by: Jon Clark - Non-Sanitary Design. No performance evaluation of All nozzles to project 8" from Unit to be supplied with mot NOTE: This design incorporate an metal temperatures (NOTE: Customer proving the supplied with the NOTE: This design incorporate and the supplied with the NOTE: This design incorporate and the supplied with the NOTE: This design incorporate and the supplied with the NOTE: This design incorporate and the supplied with the NOTE: This design incorporate and the NOTE: This design is the NOTE:	Filled with wate 715-748-5888 (ext. 230) clone for this unit. No the unit and include insulating supports, lifting lated four (4) units in seconds.	r 4) - jonclark@energ nermal process gu lation rings for ins ugs, and an electr rries per customer	43.88 uip.com arantees by Ene ulation by others ical grounding pa	rquip.	1 2 3 4
53 54 Mea	Weight/Shell 360.73 Remarks Unit designed by: Jon Clark - Non-Sanitary Design. No performance evaluation of All nozzles to project 8" from Unit to be supplied with mot NOTE: This design incorporate an metal temperatures (NOTE: Customer proving the supplied with the NOTE: This design incorporate and the supplied with the NOTE: This design incorporate and the supplied with the NOTE: This design incorporate and the supplied with the NOTE: This design incorporate and the supplied with the NOTE: This design incorporate and the NOTE: This design is the NOTE:	Filled with wate 715-748-5888 (ext. 230) clone for this unit. No the unit and include insulating supports, lifting lated four (4) units in seconds.	r 4) - jonclark@energ nermal process gu lation rings for ins ugs, and an electr rries per customer	43.88 uip.com arantees by Ene ulation by others ical grounding pa	rquip.	1 2 3 4 5
53 54 Mea	Weight/Shell 360.73 Remarks Unit designed by: Jon Clark - Non-Sanitary Design. No performance evaluation of All nozzles to project 8" from Unit to be supplied with mot NOTE: This design incorporate an metal temperatures (NOTE: Customer proving the supplied with the NOTE: This design incorporate and the supplied with the NOTE: This design incorporate and the supplied with the NOTE: This design incorporate and the supplied with the NOTE: This design incorporate and the supplied with the NOTE: This design incorporate and the NOTE: This design is the NOTE:	Filled with wate 715-748-5888 (ext. 230) clone for this unit. No the unit and include insulating supports, lifting lated four (4) units in seconds.	r 4) - jonclark@energ nermal process gu lation rings for ins ugs, and an electr rries per customer	43.88 uip.com arantees by Ene ulation by others ical grounding pa	rquip.	1 2 3 4
53 54 Mea Sh	Remarks Unit designed by: Jon Clark - Non-Sanitary Design. No performance evaluation of All nozzles to project 8" from Unit to be supplied with mot NOTE: This design incorporates an metal temperatures (NOTE: Customer provincial side 94.00 °F Tube side	Filled with wate 715-748-5888 (ext. 230) clone for this unit. No the unit and include insulating supports, lifting I ated four (4) units in second values.)	r 4) - jonclark@energ nermal process gu lation rings for ins ugs, and an electr eries per customer	43.88 uip.com arantees by Ene sulation by others ical grounding parequest.	rquip. s. ad.	1 2 3 4 5 6
Mea Sh	Weight/Shell 360.73 Remarks Unit designed by: Jon Clark - Non-Sanitary Design. No performance evaluation of All nozzles to project 8" from Unit to be supplied with mot NOTE: This design incorporate an metal temperatures (NOTE: Customer proving the supplied with the NOTE: This design incorporate and the supplied with the NOTE: This design incorporate and the supplied with the NOTE: This design incorporate and the supplied with the NOTE: This design incorporate and the supplied with the NOTE: This design incorporate and the NOTE: This design is the NOTE:	Filled with wate 715-748-5888 (ext. 230) clone for this unit. No the unit and include insulating supports, lifting I ated four (4) units in second values.) 108.00	r 4) - jonclark@energ nermal process gu lation rings for ins ugs, and an electr eries per customer	43.88 uip.com arantees by Ene sulation by others ical grounding parequest.	rquip. s. ad.	1 2 3 4 5 6



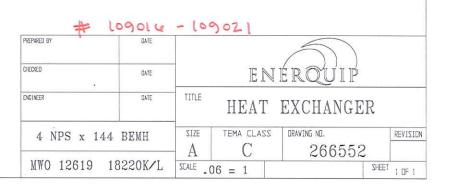
PLANE: DUPONT DANISCO CELLULOSIC ETHANOL, LLC

PROJECT: MARATHON

DDCE ORDER NO.: DDCE11-0083

EQUIPMENT NUMBER: E9000-2, E9000-3, E9000-4,

E9000-5, E9000-6, E9000-7



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,

2. Manufactured forDDCE, 500 Park B	oulevard, Suite 545, Itasca, Illinois, 60143, (Name and addres	USA s of Purchaser)	
B. Location of Installation		rial Drive, Vonore, Tennessee, 37885, US	SA
. Type Horizontal	BEMH Heat Exchanger	11391 to 1139	
(Horizontal, vertical, or sphere)	(Tank, separator, heat exh., etc.)	(Manufacturer's serial nur	2009
N/A (CRN)	SA-3395-C (drawing no.)	9080-9085 (National Board number)	(Year built)
lditional nozzles, inspection and safety val	ve openings:		
litional Remarks:			
be Side Body Flange (Qty 2)	meter x 7.000" Outside Diameter 6	060" Diameter Bolt Circle:	
-240 304L Quantity (4) .562"	Holes Equally Spaced Straddling H	orizontal And Vertical Centerlin	nes
be Side Nozzles Include 1" NP	S 150# SA-182 F304L Lap Joint Fla	nge	
ell Side Nozzles Include 2" N	PS 150# SA-182 F304L Lap Joint F1	ange	
			29
Certificate of Authorization: Type "U"	No. 38115	Expires 12/15/2011	
os odlo of 7 idifforization. 13po 0	110. 00110	12102011	_
Data 09/26/2000 Name	Engravia II.C		
Date 08/26/2009 Name	Enerquip, LLC (Manufacturer)	Signed	adive)

Enerquip, LLC

611 North Road • PO. Box 467 • Medford • Wisconsin • 54451 ENERQUIP Tel: 715.748.5888 • Fax: 715.748.6484 • Website: www.enerquip.com

Heat Exchanger Specification Sheet

			пеа	t Exchanger S	pecification		G L				
1	Customer Name:	Genera Energ					Proposal No.:	28220L			
2	Location:	Knoxville, TN					Your Reference	e: 7001-W	/11, W12		
3	Service of Unit:	Stillage Exit	Cooler								
4	Item No.:										
5	Date:	6/17/09 11:00	AM								
6	Shell OD (in.) 4.50	0 Length (in.)	144.00 Type		hor/vert	Hor	Connected in	1	parallel	2 8	series
7	Surf/unit(eff.)	16.40 ft2	Shell	ls/unit	4		Surf/shell (eff.)	V.	32.8	f	ft2
				PERFORMAN	CE OF ONE U	JNIT	7,				
8	Fluid allocation					Shell	Side		Tube	Side	
9	Fluid name						100 11444 1150				
10	Fluid quantity, Total			lb/h							
11	Vapor (In/Out)			lb/h							
12	Liquid			lb/h							
13	Noncondensable			lb/h							
14											
15	Temperature (In/Out)			F							
16	Dew / Bubble poin			F							
	Density (Vap / Lig)			lb/ft3	i			Ti T			
	Viscosity			Ср							
19	Molecular wt, Vap										
20	Molecular wt, NC										
21	Specific heat			BTU/(lb*F)							
22	Thermal conductivity			BTU/(ft*h*F)							
23	Latent heat			BTU/lb							
24	Pressure			psi							
25	Velocity			ft/s							
	Pressure drop, allow.	/calc.		psi							
27	Fouling resist. (min)			ft2*h*F/BTU							
28	Heat exchanged		BTU/	'h			M	D correcte	d		F
29	Transfer rate, Service)			Calculated		Cle	ean		BTU/(h*ft2	?*F)
				CONSTRUCTIO	N OF ONE SI	HELL					***
30						Shell	Side		Tube	Side	
31	Design/Test pressure		psig		150		Code	1 1	150	Code	е
	Design temperature		F			37	5		37	5	
22	Number passes per s	hall				1			1		
-		TICH									
34	Corrosion allowance		in								
34 35	Corrosion allowance Connections	In	in			IPS 1	50# ANSI		1 " NPS 1	50# ANSI	
34 35 36	Corrosion allowance Connections Size/rating	In Out	in			IPS 1			1 " NPS 1	50# ANSI 50# ANSI	
34 35 36 37	Corrosion allowance Connections Size/rating in	In Out Intermediate			2 " N	IPS 1	50# ANSI 50# ANSI		1 " NPS 1 1 " NPS 1	50# ANSI	
34 35 36 37 38	Corrosion allowance Connections Size/rating in Tube No.	In Out Intermediate 7 OD	in 0.750 Tkns	- Avg	2 " N 0.049 in	IPS 1	50# ANSI 50# ANSI Length 12	2.0 ft	1 " NPS 1 1 " NPS 1	50# ANSI 0.93750	in
34 35 36 37 38 39	Corrosion allowance Connections Size/rating in Tube No. Tube type	In Out Intermediate 7 OD Plain Welded	0.750 Tkns		2 " N 0.049 in Material S	IPS 1 IPS 1	50# ANSI 50# ANSI Length 12	2.0 ft	1 " NPS 1 1 " NPS 1	50# ANSI 0.93750	
34 35 36 37 38 39 40	Corrosion allowance Connections Size/rating in Tube No. Tube type Shell	In Out Intermediate 7 OD Plain Welded SS 304L	0.750 Tkns) 4.260	0.049 in Material S OD (in.) 4.	IPS 1 IPS 1	50# ANSI 50# ANSI Length 12 1L Shell cover	2.0 ft	1 " NPS 1 1 " NPS 1	50# ANSI 0.93750	in
34 35 36 37 38 39 40 41	Corrosion allowance Connections Size/rating in Tube No. Tube type Shell Channel or bonnet	In Out Intermediate 7 OD Plain Welded SS 304L SS 3	0.750 Tkns ID (in.		0.049 in Material S OD (in.) 4.	IPS 1 IPS 1	50# ANSI 50# ANSI Length 12 IL Shell cover Channel cover		1 " NPS 1 1 " NPS 1	50# ANSI 0.93750	in
34 35 36 37 38 39 40 41 42	Corrosion allowance Connections Size/rating in Tube No. Tube type Shell Channel or bonnet Tubesheet-stationary	In Out Intermediate 7 OD Plain Welded SS 304L SS 3	0.750 Tkns ID (in.) 4.260	0.049 in Material S OD (in.) 4.	IPS 1 IPS 1 S 304	50# ANSI 50# ANSI Length 12 L Shell cover Channel cover Tubesheet-floa	ting	1 " NPS 1 1 " NPS 1 Pitch Tube pa	0.93750 attern 3	in
34 35 36 37 38 39 40 41 42 43	Corrosion allowance Connections Size/rating in Tube No. Tube type Shell Channel or bonnet Tubesheet-stationary Floating head cover	In Out Intermediate 7 OD Plain Welded SS 304L SS 3	0.750 Tkns ID (in. 04L 04L) 4.260 Fabrica	0.049 in Material S OD (in.) 4.	IPS 1 IPS 1 S 304 500	50# ANSI 50# ANSI Length 12 L Shell cover Channel cover Tubesheet-floa Impingement p	ting rotection	1 " NPS 1 1 " NPS 1 Pitch Tube pa	0.93750 attern 3	in 30
34 35 36 37 38 39 40 41 42 43	Corrosion allowance Connections Size/rating in Tube No. Tube type Shell Channel or bonnet Tubesheet-stationary Floating head cover Baffle-crossing	In Out Intermediate 7 OD Plain Welded SS 304L SS 3	0.750 Tkns ID (in. 04L 04L) 4.260 Fabrica	2 " N 0.049 in Material S OD (in.) 4. ated	IPS 1 IPS 1 S 304	50# ANSI 50# ANSI Length 12 L Shell cover Channel cover Tubesheet-floa Impingement p	ting	1 " NPS 1 1 " NPS 1 Pitch Tube pa	0.93750 attern 3	in 30
34 35 36 37 38 39 40 41 42 43 44 45	Corrosion allowance Connections Size/rating in Tube No. Tube type Shell Channel or bonnet Tubesheet-stationary Floating head cover Baffle-crossing Baffle-long	In Out Intermediate 7 OD Plain Welded SS 304L SS 3	0.750 Tkns ID (in. 04L 04L) 4.260 Fabrica	0.049 in Material S OD (in.) 4. ated egmental Seal type	IPS 1 IPS 1 S 304 500	50# ANSI 50# ANSI Length 12 \$1L Shell cover Channel cover Tubesheet-floa Impingement po %d) 40 H	ting rotection Spacing	1 " NPS 1 1 " NPS 1 Pitch Tube pa	0.93750 attern 3	in 30
34 35 36 37 38 39 40 41 42 43 44 45 46	Corrosion allowance Connections Size/rating in Tube No. Tube type Shell Channel or bonnet Tubesheet-stationary Floating head cover Baffle-crossing Baffle-long Supports-tube	In Out Intermediate 7 OD Plain Welded SS 304L SS 3	0.750 Tkns ID (in. 04L 04L) 4.260 Fabrica	2 " N 0.049 in Material S OD (in.) 4. ated egmental Seal type U-bend	IPS 1 IPS 1 S 304 500	50# ANSI 50# ANSI Length 12 Length 1	ting rotection Spacing	1 " NPS 1 1 " NPS 1 Pitch Tube po	0.93750 attern 3	in 30
34 35 36 37 38 39 40 41 42 43 44 45 46 47	Corrosion allowance Connections Size/rating in Tube No. Tube type Shell Channel or bonnet Tubesheet-stationary Floating head cover Baffle-crossing Baffle-long Supports-tube Bypass seal	In Out Intermediate 7 OD Plain Welded SS 304L SS 3	0.750 Tkns ID (in. 04L 04L) 4.260 Fabrica	2 " N 0.049 in Material S OD (in.) 4. ated egmental Seal type U-bend Tube-tube she	IPS 1 IPS 1 S 304 500	50# ANSI 50# ANSI Length 12 Length 1	ting rotection Spacing	1 " NPS 1 1 " NPS 1 Pitch Tube pa	0.93750 attern 3	in 30
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48	Corrosion allowance Connections Size/rating in Tube No. Tube type Shell Channel or bonnet Tubesheet-stationary Floating head cover Baffle-crossing Baffle-long Supports-tube Bypass seal Expansion joint	In Out Intermediate 7 OD Plain Welded SS 304L SS 3	0.750 Tkns ID (in. 04L 04L 304 Type) 4.260 Fabrica Single S	2 " N 0.049 in Material S OD (in.) 4. ated egmental Seal type U-bend	IPS 1 IPS 1 S 304 500	50# ANSI 50# ANSI Length 12 Length 1	ting rotection Spacing pe Groo	1 " NPS 1 1 " NPS 1 Pitch Tube page 2 p: c/c Inlet	0.93750 attern 3	in 30
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49	Corrosion allowance Connections Size/rating in Tube No. Tube type Shell Channel or bonnet Tubesheet-stationary Floating head cover Baffle-crossing Baffle-long Supports-tube Bypass seal Expansion joint RhoV2-Inlet nozzle	In Out Intermediate 7 OD Plain Welded SS 304L SS 3	0.750 Tkns ID (in. 04L 04L 304 Type) 4.260 Fabrica	2 " N 0.049 in Material S OD (in.) 4. ated egmental Seal type U-bend Tube-tube she Type	IPS 1 IPS 1 S 304 500	50# ANSI 50# ANSI Length 12 \$1L Shell cover Channel cover Tubesheet-floa Impingement pr %d) 40 H Typint	ting rotection Spacing	1 " NPS 1 1 " NPS 1 Pitch Tube page 2 p: c/c Inlet	0.93750 attern 3	in 30
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	Corrosion allowance Connections Size/rating in Tube No. Tube type Shell Channel or bonnet Tubesheet-stationary Floating head cover Baffle-crossing Baffle-long Supports-tube Bypass seal Expansion joint	In Out Intermediate 7 OD Plain Welded SS 304L SS 3	0.750 Tkns ID (in. 04L 04L 304 Type) 4.260 Fabrica Single S	2 " N 0.049 in Material S OD (in.) 4. ated egmental Seal type U-bend Tube-tube she	IPS 1 IPS 1 S 304 500	50# ANSI 50# ANSI Length 12 Length 1	ting rotection Spacing pe Groo	1 " NPS 1 1 " NPS 1 Pitch Tube page 2 p: c/c Inlet	0.93750 attern 3	in 30
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51	Corrosion allowance Connections Size/rating in Tube No. Tube type Shell Channel or bonnet Tubesheet-stationary Floating head cover Baffle-crossing Baffle-long Supports-tube Bypass seal Expansion joint RhoV2-Inlet nozzle Gaskets - Shell side Floating head	In Out Intermediate 7 OD Plain Welded SS 304L SS 30 \$\frac{1}{2} \frac{1}{2} \	0.750 Tkns ID (in. 04L 04L 304 Type) 4.260 Fabrica Single So	2 " N 0.049 in Material S OD (in.) 4. ated egmental Seal type U-bend Tube-tube she Type	IPS 1 IPS 1 S 300 Cut(50# ANSI 50# ANSI Length 12 \$1L Shell cover Channel cover Tubesheet-floa Impingement pr %d) 40 H Typint	ting rotection Spacing pe Groo	1 " NPS 1 1 " NPS 1 Pitch Tube page of the	0.93750 attern 3	in 30
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52	Corrosion allowance Connections Size/rating in Tube No. Tube type Shell Channel or bonnet Tubesheet-stationary Floating head cover Baffle-crossing Baffle-long Supports-tube Bypass seal Expansion joint RhoV2-Inlet nozzle Gaskets - Shell side	In Out Intermediate 7 OD Plain Welded SS 304L SS 30 \$\frac{1}{2} \frac{1}{2} \	0.750 Tkns ID (in. 04L 04L 04L Bund) 4.260 Fabrica Single So	0.049 in Material S OD (in.) 4. ated egmental Seal type U-bend Tube-tube she Type Tube Side	IPS 1 IPS 1 S 300 Cut(50# ANSI 50# ANSI Length 12 IL Shell cover Channel cover Tubesheet-floa Impingement p %d) 40 H Ty Int EPDM O-Ring	ting rotection Spacing pe Groo	1 " NPS 1 1 " NPS 1 Pitch Tube page of the	0.93750 attern 3 None 6 panded	in 30 iiiiii
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53	Corrosion allowance Connections Size/rating in Tube No. Tube type Shell Channel or bonnet Tubesheet-stationary Floating head cover Baffle-crossing Baffle-long Supports-tube Bypass seal Expansion joint RhoV2-Inlet nozzle Gaskets - Shell side Floating head Code requirements Weight/Shell	In Out Intermediate 7 OD Plain Welded SS 304L SS 30 SS 30 \$ SS	0.750 Tkns ID (in. 04L 04L 304 Type Bund	Single Solle entrance	2 " N 0.049 in Material S OD (in.) 4. ated egmental Seal type U-bend Tube-tube she Type Tube Side	IPS 1 IPS 1 S 300 Cut(50# ANSI 50# ANSI Length 12 LLENGTH 12 LLENG	ting rotection Spacing pe Groo	1 " NPS 1 1 " NPS 1 Pitch Tube particle g: c/c Inlet Dived & Ex exit	0.93750 attern 3 None 6 panded eral Servi	in 30 i ii
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53	Corrosion allowance Connections Size/rating in Tube No. Tube type Shell Channel or bonnet Tubesheet-stationary Floating head cover Baffle-crossing Baffle-long Supports-tube Bypass seal Expansion joint RhoV2-Inlet nozzle Gaskets - Shell side Floating head Code requirements Weight/Shell Remarks Unit de	In Out Intermediate 7 OD Plain Welded SS 304L SS 30 \$\$ \$3 \$\$	0.750 Tkns ID (in. 04L 04L 304 Type Bund	Single Solle entrance	2 " N 0.049 in Material S OD (in.) 4. ated egmental Seal type U-bend Tube-tube she Type Tube Side	IPS 1 IPS 1 S 300 Cut(50# ANSI 50# ANSI Length 12 LLENGTH 12 LLENG	ting rotection Spacing pe Groo	1 " NPS 1 1 " NPS 1 Pitch Tube particle g: c/c Inlet Dived & Ex exit	0.93750 attern 3 None 6 panded eral Servi	in 30 i ii
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53	Corrosion allowance Connections Size/rating in Tube No. Tube type Shell Channel or bonnet Tubesheet-stationary Floating head cover Baffle-crossing Baffle-long Supports-tube Bypass seal Expansion joint RhoV2-Inlet nozzle Gaskets - Shell side Floating head Code requirements Weight/Shell Remarks Unit de Non-S	In Out Intermediate 7 OD Plain Welded SS 304L SS 30 \$S 30 \$\$ 22 \$\$ SS 3 \$\$ 360.73 esigned by: Jon O	0.750 Tkns ID (in. 04L 04L 304 Type Bund ME Section V	Single Solution Single Solution	2 " N 0.049 in Material S OD (in.) 4. ated egmental Seal type U-bend Tube-tube she Type Tube Side	IPS 1 IPS 1 IPS 1 Cut(Cut(44	50# ANSI 50# ANSI Length 12 \$L Shell cover Channel cover Tubesheet-floa Impingement p %d) 40 H Ty Int EPDM O-Ring TEMA class 43.88 uip.com	ting rotection Spacing pe Groot Bundle	1 " NPS 1 1 " NPS 1 Pitch Tube particle g: c/c Inlet Dived & Ex exit	0.93750 attern 3 None 6 panded eral Servi	in 30 i ii
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53	Corrosion allowance Connections Size/rating in Tube No. Tube type Shell Channel or bonnet Tubesheet-stationary Floating head cover Baffle-crossing Baffle-long Supports-tube Bypass seal Expansion joint RhoV2-Inlet nozzle Gaskets - Shell side Floating head Code requirements Weight/Shell Remarks Unit de Non-S No pe	In Out Intermediate 7 OD Plain Welded SS 304L SS 30 \$S 30 \$\$ 22 \$\$ SS 3 \$\$ 360.73 esigned by: Jon Canitary Design.	0.750 Tkns ID (in. 04L 04L 304 Type Bund ME Section V	Single Solution Single Solutio	2 " N 0.049 in Material S OD (in.) 4. ated egmental Seal type U-bend Tube-tube she Type Tube Side	IPS 1	50# ANSI 50# ANSI Length 12 Length 1	ting rotection Spacing pe Groot Bundle	1 " NPS 1 1 " NPS 1 Pitch Tube particle g: c/c Inlet Dived & Ex exit	0.93750 attern 3 None 6 panded eral Servi	in 30 i ii
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53	Corrosion allowance Connections Size/rating in Tube No. Tube type Shell Channel or bonnet Tubesheet-stationary Floating head cover Baffle-crossing Baffle-long Supports-tube Bypass seal Expansion joint RhoV2-Inlet nozzle Gaskets - Shell side Floating head Code requirements Weight/Shell Remarks Unit de Non-S No pe All no	In Out Intermediate 7 OD Plain Welded SS 304L SS 30 \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	0.750 Tkns ID (in. 04L 04L 304 Type Bund ME Section V Clark - 715-74	Single Solution Single Solutio	2 " N 0.049 in Material S OD (in.) 4. ated egmental Seal type U-bend Tube-tubeshe Type Tube Side r) - jonclark@e thermal proces	IPS 11 IPS 10 IP	50# ANSI 50# ANSI 50# ANSI Length 12 \$L Shell cover Channel cover Tubesheet-floa Impingement pi %d) 40 H Tyi Int EPDM O-Ring TEMA class 43.88 uip.com Itarantees by Esulation by oth	ting rotection Spacing pe Groo Bundle	1 " NPS 1 1 " NPS 1 Pitch Tube particle g: c/c Inlet Dived & Ex exit	0.93750 attern 3 None 6 panded eral Servi	in 30 i ii
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53	Corrosion allowance Connections Size/rating in Tube No. Tube type Shell Channel or bonnet Tubesheet-stationary Floating head cover Baffle-crossing Baffle-long Supports-tube Bypass seal Expansion joint RhoV2-Inlet nozzle Gaskets - Shell side Floating head Code requirements Weight/Shell Remarks Unit de Non-S No pe All no	In Out Intermediate 7 OD Plain Welded SS 304L SS 30 \$ 22 \$ SS 3 \$ 22 \$ SS 3 ASI 360.73 esigned by: Jon Canitary Design. rformance evaluzzles to project to	0.750 Tkns ID (in. 04L 04L 304 Type Bund ME Section V Clark - 715-74: action done for 8" from unit action set to mouting set to mouting set	Single Solution Single Solutio	2 " N 0.049 in Material S OD (in.) 4. ated general Seal type U-bend Tube-tubeshe Type Tube Side r) - jonclark@e thermal process lation rings fougs, and an est	IPS 1	Length 12 Shell cover Channel cover Tubesheet-floa Impingement pi //d) 40 H Tyi Int EPDM O-Ring TEMA class 43.88 uip.com arantees by Esulation by othical grounding	ting rotection Spacing pe Groo Bundle	1 " NPS 1 1 " NPS 1 Pitch Tube particle g: c/c Inlet Dived & Ex exit	0.93750 attern 3 None 6 panded eral Servi	in 30 i ii
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53	Corrosion allowance Connections Size/rating in Tube No. Tube type Shell Channel or bonnet Tubesheet-stationary Floating head cover Baffle-crossing Baffle-long Supports-tube Bypass seal Expansion joint RhoV2-Inlet nozzle Gaskets - Shell side Floating head Code requirements Weight/Shell Remarks Unit de Non-S No pe All no	In Out Intermediate 7 OD Plain Welded SS 304L SS 30 \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	0.750 Tkns ID (in. 04L 04L 304 Type Bund ME Section V Clark - 715-74: action done for 8" from unit action set to mouting set to mouting set	Single Solution Single Solutio	2 " N 0.049 in Material S OD (in.) 4. ated general Seal type U-bend Tube-tubeshe Type Tube Side r) - jonclark@e thermal process lation rings fougs, and an est	IPS 1	Length 12 Shell cover Channel cover Tubesheet-floa Impingement pi //d) 40 H Tyi Int EPDM O-Ring TEMA class 43.88 uip.com arantees by Esulation by othical grounding	ting rotection Spacing pe Groo Bundle	1 " NPS 1 1 " NPS 1 Pitch Tube particle g: c/c Inlet Dived & Ex exit	0.93750 attern 3 None 6 panded eral Servi	in 30 i ii
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53	Corrosion allowance Connections Size/rating in Tube No. Tube type Shell Channel or bonnet Tubesheet-stationary Floating head cover Baffle-crossing Baffle-long Supports-tube Bypass seal Expansion joint RhoV2-Inlet nozzle Gaskets - Shell side Floating head Code requirements Weight/Shell Remarks Unit de Non-S No pe All no	In Out Intermediate 7 OD Plain Welded SS 304L SS 30 \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	0.750 Tkns ID (in. 04L 04L 304 Type Bund ME Section V Clark - 715-74: action done for 8" from unit action set to mouting set to mouting set	Single Solution Single Solutio	2 " N 0.049 in Material S OD (in.) 4. ated general Seal type U-bend Tube-tubeshe Type Tube Side r) - jonclark@e thermal process lation rings fougs, and an est	IPS 1	Length 12 Shell cover Channel cover Tubesheet-floa Impingement pi //d) 40 H Tyi Int EPDM O-Ring TEMA class 43.88 uip.com arantees by Esulation by othical grounding	ting rotection Spacing pe Groo Bundle	1 " NPS 1 1 " NPS 1 Pitch Tube particle g: c/c Inlet Dived & Ex exit	0.93750 attern 3 None 6 panded eral Servi	in 30 i ii
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54	Corrosion allowance Connections Size/rating in Tube No. Tube type Shell Channel or bonnet Tubesheet-stationary Floating head cover Baffle-crossing Baffle-long Supports-tube Bypass seal Expansion joint RhoV2-Inlet nozzle Gaskets - Shell side Floating head Code requirements Weight/Shell Remarks Unit de Non-S No pe All not Unit to	In Out Intermediate 7 OD Plain Welded SS 304L SS 30 SS 30 \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	0.750 Tkns ID (in. 04L 04L 804 Type Bund ME Section V Clark - 715-74 sation done for 8" from unit a strong successor of the corporated two	Single Solution Single Solution Single Solution le entrance Ill Div. 1 Filled with wate 8-5888 (ext. 230 or this unit. No to the control of the contro	2 " N 0.049 in Material S OD (in.) 4. ated general Seal type U-bend Tube-tubeshe Type Tube Side r) - jonclark@e thermal process lation rings fougs, and an est	IPS 1	Length 12 Shell cover Channel cover Tubesheet-floa Impingement pi //d) 40 H Tyi Int EPDM O-Ring TEMA class 43.88 uip.com arantees by Esulation by othical grounding	ting rotection Spacing pe Groo Bundle	1 " NPS 1 1 " NPS 1 Pitch Tube particle g: c/c Inlet Dived & Ex exit	0.93750 attern 3 None 6 panded eral Servi	in 30 i ii
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54	Corrosion allowance Connections Size/rating in Tube No. Tube type Shell Channel or bonnet Tubesheet-stationary Floating head cover Baffle-crossing Baffle-long Supports-tube Bypass seal Expansion joint RhoV2-Inlet nozzle Gaskets - Shell side Floating head Code requirements Weight/Shell Remarks Unit de Non-S No pe All no	In Out Intermediate 7 OD Plain Welded SS 304L SS 30 SS 30 \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	0.750 Tkns ID (in. 04L 04L 804 Type Bund ME Section V Clark - 715-74 sation done for 8" from unit a strong successor of the corporated two	Single Solution Single Solution Single Solution le entrance Ill Div. 1 Filled with wate 8-5888 (ext. 230 or this unit. No to the control of the contro	2 " N 0.049 in Material S OD (in.) 4. ated general Seal type U-bend Tube-tubeshe Type Tube Side r) - jonclark@e thermal process lation rings fougs, and an est	IPS 1	Length 12 Shell cover Channel cover Tubesheet-floa Impingement pi //d) 40 H Tyi Int EPDM O-Ring TEMA class 43.88 uip.com arantees by Esulation by othical grounding	ting rotection Spacing pe Groo Bundle	1 " NPS 1 1 " NPS 1 Pitch Tube particle g: c/c Inlet Dived & Ex exit	0.93750 attern 3 None 6 panded eral Servi	in 30 i i
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54	Corrosion allowance Connections Size/rating in Tube No. Tube type Shell Channel or bonnet Tubesheet-stationary Floating head cover Baffle-crossing Baffle-long Supports-tube Bypass seal Expansion joint RhoV2-Inlet nozzle Gaskets - Shell side Floating head Code requirements Weight/Shell Remarks Unit de Non-S No pe All nos Unit to NOTE	In Out Intermediate 7 OD Plain Welded SS 304L SS 30 SS 30 \$ SS	0.750 Tkns ID (in. 04L 04L 804 Type Bund ME Section V Clark - 715-74 sation done for 8" from unit a strong successor of the corporated two	Single Solution Single Solution Single Solution le entrance Ill Div. 1 Filled with wate 8-5888 (ext. 230 or this unit. No to the control of the contro	2 " N 0.049 in Material S OD (in.) 4. ated egmental Seal type U-bend Tube-tubeshe Type Tube Side r) - jonclark@e hermal proces lation rings fougs, and an eries per custo	IPS 1	Length 12 Shell cover Channel cover Tubesheet-floa Impingement pi //d) 40 H Tyi Int EPDM O-Ring TEMA class 43.88 uip.com arantees by Esulation by othical grounding	ting rotection Spacing pe Groo Bundle	1 " NPS 1 1 " NPS 1 Pitch Tube particle g: c/c Inlet Dived & Ex exit	0.93750 attern 3 None 6 panded eral Servi	in in ii i
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54	Corrosion allowance Connections Size/rating in Tube No. Tube type Shell Channel or bonnet Tubesheet-stationary Floating head cover Baffle-crossing Baffle-long Supports-tube Bypass seal Expansion joint RhoV2-Inlet nozzle Gaskets - Shell side Floating head Code requirements Weight/Shell Remarks Unit de Non-S No pe All nos Unit to NOTE	In Out Intermediate 7 OD Plain Welded SS 304L SS 30 SS 30 \$ SS	0.750 Tkns ID (in. 04L 04L 804 Type Bund ME Section V Clark - 715-74 action done for 8" from unit a 1th mouting secorporated tweeler provided value of the corporated of the c	Single Solution Single Solutio	2 " N 0.049 in Material S OD (in.) 4. ated egmental Seal type U-bend Tube-tubeshe Type Tube Side r) - jonclark@e hermal proces lation rings fougs, and an eries per custo	IPS 1	Length 12 Shell cover Channel cover Tubesheet-floa Impingement pi //d) 40 H Tyi Int EPDM O-Ring TEMA class 43.88 uip.com arantees by Esulation by othical grounding	ting rotection Spacing pe Groo Bundle	1 " NPS 1 1 " NPS 1 Pitch Tube particle g: c/c Inlet Dived & Ex exit	0.93750 attern 3 None 6 panded eral Servi	in i
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54	Corrosion allowance Connections Size/rating in Tube No. Tube type Shell Channel or bonnet Tubesheet-stationary Floating head cover Baffle-crossing Baffle-long Supports-tube Bypass seal Expansion joint RhoV2-Inlet nozzle Gaskets - Shell side Floating head Code requirements Weight/Shell Remarks Unit de Non-S No pe All nos Unit to NOTE	In Out Intermediate 7 OD Plain Welded SS 304L SS 30 SS 30 \$ SS	0.750 Tkns ID (in. 04L 04L 804 Type Bund ME Section V Clark - 715-74 action done for 8" from unit a 1th mouting secorporated tweeler provided value of the corporated of the c	Single Solution Single Solutio	2 " N 0.049 in Material S OD (in.) 4. ated egmental Seal type U-bend Tube-tubeshe Type Tube Side r) - jonclark@e hermal proces lation rings fougs, and an eries per custo	IPS 1	Length 12 Shell cover Channel cover Tubesheet-floa Impingement pi //d) 40 H Tyi Int EPDM O-Ring TEMA class 43.88 uip.com arantees by Esulation by othical grounding	ting rotection Spacing pe Groo Bundle	1 " NPS 1 1 " NPS 1 Pitch Tube particle g: c/c Inlet Dived & Ex exit	0.93750 attern 3 None 6 panded eral Servi	in i
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54	Corrosion allowance Connections Size/rating in Tube No. Tube type Shell Channel or bonnet Tubesheet-stationary Floating head cover Baffle-crossing Baffle-long Supports-tube Bypass seal Expansion joint RhoV2-Inlet nozzle Gaskets - Shell side Floating head Code requirements Weight/Shell Remarks Unit de Non-S No pe All nos Unit to NOTE	In Out Intermediate 7 OD Plain Welded SS 304L SS 30 SS 30 \$ SS	0.750 Tkns ID (in. 04L 04L 804 Type Bund ME Section V Clark - 715-74 action done for 8" from unit a 1th mouting secorporated tweeler provided value of the corporated of the c	Single Solution Single Solutio	2 " N 0.049 in Material S OD (in.) 4. ated egmental Seal type U-bend Tube-tubeshe Type Tube Side r) - jonclark@e hermal proces lation rings fougs, and an eries per custo	IPS 1	Length 12 Shell cover Channel cover Tubesheet-floa Impingement pi //d) 40 H Tyi Int EPDM O-Ring TEMA class 43.88 uip.com arantees by Esulation by othical grounding	ting rotection Spacing pe Groo Bundle	1 " NPS 1 1 " NPS 1 Pitch Tube particle g: c/c Inlet Dived & Ex exit	0.93750 attern 3 None 6 panded eral Servi	in i
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54	Corrosion allowance Connections Size/rating in Tube No. Tube type Shell Channel or bonnet Tubesheet-stationary Floating head cover Baffle-crossing Baffle-long Supports-tube Bypass seal Expansion joint RhoV2-Inlet nozzle Gaskets - Shell side Floating head Code requirements Weight/Shell Remarks Unit de Non-S No pe All nos Unit to NOTE	In Out Intermediate 7 OD Plain Welded SS 304L SS 30 SS 30 \$ SS	0.750 Tkns ID (in. 04L 04L 804 Type Bund ME Section V Clark - 715-74 action done for 8" from unit a 1th mouting secorporated tweeler provided value of the corporated of the c	Single Solution Single Solutio	2 " N 0.049 in Material S OD (in.) 4. ated egmental Seal type U-bend Tube-tubeshe Type Tube Side r) - jonclark@e hermal proces lation rings fougs, and an eries per custo	IPS 1	Length 12 Shell cover Channel cover Tubesheet-floa Impingement pi //d) 40 H Tyi Int EPDM O-Ring TEMA class 43.88 uip.com arantees by Esulation by othical grounding	ting rotection Spacing pe Groo Bundle	1 " NPS 1 1 " NPS 1 Pitch Tube particle g: c/c Inlet Dived & Ex exit	0.93750 attern 3 None 6 panded eral Servi	in i
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54	Corrosion allowance Connections Size/rating in Tube No. Tube type Shell Channel or bonnet Tubesheet-stationary Floating head cover Baffle-crossing Baffle-long Supports-tube Bypass seal Expansion joint RhoV2-Inlet nozzle Gaskets - Shell side Floating head Code requirements Weight/Shell Remarks Unit de Non-S No pe All nos Unit to NOTE	In Out Intermediate 7 OD Plain Welded SS 304L SS 30 SS 30 \$ SS	0.750 Tkns ID (in. 04L 04L 804 Type Bund ME Section V Clark - 715-74 action done for 8" from unit a 1th mouting secorporated tweeler provided value of the corporated of the c	Single Solution Single Solutio	2 " N 0.049 in Material S OD (in.) 4. ated egmental Seal type U-bend Tube-tubeshe Type Tube Side r) - jonclark@e hermal proces lation rings fougs, and an eries per custo	IPS 1	Length 12 Shell cover Channel cover Tubesheet-floa Impingement pi //d) 40 H Tyi Int EPDM O-Ring TEMA class 43.88 uip.com arantees by Esulation by othical grounding	ting rotection Spacing pe Groo Bundle	1 " NPS 1 1 " NPS 1 Pitch Tube particle g: c/c Inlet Dived & Ex exit	0.93750 attern 3 None 6 panded eral Servi	in 30 i ir
34 35 36 37 38 39 40 41 42 43 44 45 50 51 52 53 54 Sh	Corrosion allowance Connections Size/rating in Tube No. Tube type Shell Channel or bonnet Tubesheet-stationary Floating head cover Baffle-crossing Baffle-long Supports-tube Bypass seal Expansion joint RhoV2-Inlet nozzle Gaskets - Shell side Floating head Code requirements Weight/Shell Remarks Unit de Non-S No pe All nos Unit to NOTE	In Out Intermediate 7 OD Plain Welded SS 304L SS 30 SS 30 \$ 22 \$ SS 3 \$ 360.73 esigned by: Jon Canitary Design. rformance evaluzzles to project to be supplied wi : This design inc S (NOTE: Custom DO °F Tub	0.750 Tkns ID (in. 04L 04L 304 Type Bund ME Section V Clark - 715-74 action done for 8" from unit a ith mouting su corporated two	Single Solution Single Solution Single Solution Single Solution Single Solution Single Solution Solution Single Solution Singl	2 " N 0.049 in Material S OD (in.) 4. ated egmental Seal type U-bend Tube-tube she Type Tube Side f) - jonclark@e hermal proces lation rings fougs, and an eries per custo	Cut(continued by the state of t	Length 12 Length	ting rotection Spacing pe Groo Bundle	1 " NPS 1 1 " NPS 1 Pitch Tube particles g: c/c Inlet oved & Execute C - Gen Bundle	0.93750 attern 3 None 6 panded eral Service 39.23	i in

CALCULATIONS

DDCE ORDER NO.: DDCE11-0083 EQUIP NO.: E9000-2, E9000-3, E9000-4

E9000-5, E9000-6, E9000-7

STILLAGE EXIT COOLER

Master Work Order #: 12619

Issued By: J. Dumholt Date: July 30, 2009

Customer: DDCE

Final Assembly Drawing #: SA-3395-C

Reviewed By: A. Olejnichak Date: 31 July 09

The following calculations submitted are in compliance with: ASME Boiler and Pressure Vessel Code Section VIII, Division 1, 2007 Edition, A08

Calculations Submitted:

	1 2000	
X	OUTLET WATERBOX SHELL	Х
X	OUTLET WATERBOX FLANGE	×
	WATERBOX 'HEAD #2	X
X	OUTLET	X
X	DRAIN	
X	LIFT RING	X
X	NOZZLE (1" NPS)	X
X	STUB END (1" NPS)	X
	TUBESHEET TO SHELL WELD SHEET	X
	NOZZLE (2" NPS)	X
X	NOZZLE (3/4" NPS)	X
X	STUB END (2" NPS)	X
X	SUPPORT FOOT	X
X	NOZZLE FLATHEAD TO NOZZLE WELD SHEET	
	SLIP-ON FLANGE DIMENSION SHEET	
	SLIP-ON FLANGE TO NOZZLE PIPE WELD SHEET	
	UG-22 LOADINGS SPECIFICATION SHEET	X
	UG-38 FLUED OPENINGS IN SHELLS & HEADS	
	HYDRO-STATIC TEST PRESSURE VERIFICATION	X
	X X X X X X	X OUTLET WATERBOX FLANGE WATERBOX HEAD #2 X OUTLET X DRAIN X LIFT RING X NOZZLE (1" NPS) X STUB END (1" NPS) TUBESHEET TO SHELL WELD SHEET NOZZLE (2" NPS) X NOZZLE (3/4" NPS) X STUB END (2" NPS) X SUPPORT FOOT X NOZZLE FLATHEAD TO NOZZLE WELD SHEET SLIP-ON FLANGE DIMENSION SHEET UG-22 LOADINGS SPECIFICATION SHEET UG-38 FLUED OPENINGS IN SHELLS & HEADS

UG-22 LOADINGS CHECKLIST SHEET

WMO:	12619
APPLICA CONSIDERE ENCLOSED.	BLE LOADINGS PER UG-22 HAVE BEEN O WITH SUPPORTING CALCULATIONS
X	UG-22(a): INTERNAL OR EXTERNAL DESIGN PRESSURE (AS DEFINED IN UG-21.) UG-22(b): WEIGHT OF THE VESSEL AND NORMAL CONTENTS UNDER OPERATING OR TEST CONDITIONS (THIS INCLUDES ADDITIONAL PRESSURE DUE TO STATIC HEADS OF LIQUIDS.)
X	UG-22(c): SUPERIMPOSED STATIC REACTIONS. UG-22(d): THE ATTACHMENT OF: 1. INTERNALS (SEE APPENDIX D) 2. VESSEL SUPPORTS, SUCH AS LUGS, RINGS, SKIRTS, SADDLES, AND LEGS (SEE APPENDIX G)
	UG-22(e): CYCLIC AND DYNAMIC REACTIONS DUE TO PRESSURE OR THERMAL VARIATIONS, MECHANICAL LOADINGS.
	UG-22(f): WIND, SNOW, AND SEISMIC REACTIONS.
	UG-22(g): IMPACT REACTIONS SUCH AS THOSE DUE TO FLUID SHOCK.
	UG-22(h): TEMPERATURE GRADIENTS AND DIFFERENTIAL THERMAL EXPANSION.
	UG-22(i): ABNORMAL PRESSURES, SUCH AS THOSE CAUSED BY DEFLAGRATION.

HYDRO-STATIC TEST PRESSURE VERIFICATION MASTER WORK ORDER NO: 12619X BEM HEAT EXCHANGER BEUB HEAT EXCHANGER TANK 4 NPS x 144 BEMH FINAL ASS'Y PART NO: SA-3395-CTUBE SIDE DESIGN PRESSURE: 150 PSI @ 375 °F

°F

SHELL SIDE DESIGN PRESSURE: 150 PSI ≥ 375

CALCULATION	ALLOWABLE STRESS @ 70° F	ALLOWABLE STRESS @ DESIGN TEMPERATURE	STRESS @ 70°F STRESS @ DESN TEMP	DESIGN PRESSURE X 1.30	ALLOWABLE HYDRO-STATIC PRESSURE
TUBING	14,200	13,600	1.0441	195	203
TUBESHEET	16,700	12,000	1.3916	195	271
SHELL W/	14,200	13,600	1.0441	195	203
INLET NOZZLE (2 NPS)	14,200	13,600	1.0441	195	203
DUTLET NDZZLE (2 NPS)	14,200	13,600	1.0441	195	203
VENT/DRAIN (3/4 NPS)	14,200	13,600	1.0441	195	203
STUB END (2 NPS)	16,700	16,000	1.0437	195	203
WATERBOX SHELL	16,700	16,000	1.0437	195	203
WATERBOX FLANGE	16,700	12,000	1.3916	195	271
WATERBOX HEAD	16,700	16,000	1.0437	195	203
IN/OUT NOZZLE (1 NPS)	14,200	13,600	1.0441	195	203
STUB END (1 NPS)	16,700	16,000	1.0437	195	203

HYDROSTATIC TEST PROCEDURE:

HYDRO SHELL SIDE @ __203___PSIG CHECK TUBE/TUBESHEET JOINTS FOR LEAKS

HYDRO TUBE SIDE @ 203 PSIG (SHELL SIDE PRESSURE TO BE O PSIG)

Tubes

ASME Section VIII Division 1, 2007 Edition, A08 Addenda

Component:

Material specification:

Tubes

SA-249 TP304L Wld tube (II-D p. 82, ln. 41)

Impact test exempt per UHA-51(d)

Internal design pressure: P = 150 psi @ 375 °FExternal design pressure: $P_e = 150 \text{ psi } @ 375 \text{ °F}$

Static liquid head:

$$P_{th} = 0.13 \text{ psi} (SG = 1, H_s = 3.5775", Horizontal test head)$$

Corrosion allowance

Inner C = 0"

Outer C = 0"

Design MDMT = $0 \, ^{\circ}F$ Rated MDMT = $-320 \, ^{\circ}F$ No impact test performed Material is not normalized

Material is not produced to Fine Grain Practice

PWHT is not performed

Estimated weight New = 4.5 lb

corr = 4.5 lb

Capacity

New = 0.21 US gal corr = 0.21 US gal

OD = 0.75"

Length $L_c = 144$ "

t = 0.049"

Design thickness, (at 375 °F) Appendix 1-1

$$t = P*R_0 / (S*E + 0.40*P) + Corrosion$$

= 150*0.375 / (13,600*1.00 + 0.40*150) + 0

= 0.0042"

Maximum allowable working pressure, (at 375 °F) Appendix 1-1

$$P = S*E*t/(R_0 - 0.40*t) - P_S$$

= 13,600*1.00*0.0429 / (0.375 - 0.40*0.0429) - 0

= 1,629.45 psi

Maximum allowable pressure, (at 70 °F) Appendix 1-1

$$P = S*E*t/(R_0 - 0.40*t)$$

= 14,200*1.00*0.0429 / (0.375 - 0.40*0.0429)

= 1,701.34 psi

External Pressure, (Corroded & at 375 °F) UG-28(c)

$$L/D_0 = 144/0.75 = 50.0000$$

$$D_0/t = 0.75/0.0164 = 45.7237$$

From table G:
$$A = 0.000546$$

From table HA-3: B = 5,144 psi

$$\begin{split} P_{a} &= 4*B / (3*(D_{o} / t)) \\ &= 4*5143.8037 / (3*(0.75 / 0.0164)) \\ &= 150 \text{ psi} \end{split}$$

Design thickness for external pressure $P_a = 150$ psi

$$t_a = t + Corrosion = 0.0164 + 0 = 0.0164"$$

Maximum Allowable External Pressure, (Corroded & at 375 °F) UG-28(c)

$$L/D_0 = 144/0.75 = 50.0000$$

 $D_0/t = 0.75/0.0429 = 17.4927$

From table G: A = 0.003828From table HA-3: B = 7,211 psi

$$P_a = 4*B / (3*(D_0 / t))$$

= 4*7211.4199 / (3*(0.75 / 0.0429))
= 549.67 psi

Tubesheet -- ASME

ASME Section VIII, Division 1, 2007 Edition, A08	Addenda
Tubesheet	
Type of heat exchanger:	Fixed Both Ends
Type of construction:	Fixed\Stationary tubesheet per Fig. UHX-13.1 Configuration b: shell-side integral, tubesheet extended as a flange
Simply supported:	No
Tubesheet material specification:	SA-240 304L (II-D p. 82, ln. 39)
Tube layout:	Triangular
Tubesheet outer diameter, A:	7 in -
Tubesheet thickness, h:	1.19 in $(t_{design} = 0.4226 in)$
Number of tubes, N _t :	7.
Tube pitch, p:	0.9375 in
Radius to outer tube center, r _o :	0.9375 in
Total area of untubed lanes, AL:	0 in^2
Pass partition groove depth, hg:	0 in
Corrosion allowance shell side , c_s :	0 in
Corrosion allowance tube side , c_t :	0 in
Tubesheet poisson's ratio, v:	0.3
Consider radial thermal expansion per UHX-13.8:	No
Gasket groove depth shell side:	0 in
Gasket groove depth tube side:	0 in
Shell	
Shell material specification:	SA-312 TP304L Wld pipe (II-D p. 86, ln. 3)
Shell inner diameter, D _s :	4.26 in
5 (4)	2.12.1

0.12 in Shell thickness, ts: 0 in Shell inner corrosion allowance: Shell outer corrosion allowance: 0 in 0.31 Shell poisson's ratio, v_s :

Channel

SA-312 TP304L Wld pipe (II-D p. 86, ln. 3) Channel material specification: 4.26 in Channel inner diameter, Dc: Channel thickness, tc: 0.12 in 0 in Channel inner corrosion allowance: 0 in Channel outer corrosion allowance: 0.3 Channel poisson's ratio, v_c :

Tubes

SA-249 TP304L Wld tube (II-D p. 82, ln. 41) Tube material specification: 0.75 in Tube outer diameter, dt: Tube nominal thickness, tt: 0.049 in Tube minimum thickness, t_{t,min}: 0.0429 in Tube tolerance: 12.5% Tube length between outer tubesheet faces, L_t : 144 in 0 in Tube inner corrosion allowance: Tube outer corrosion allowance: 0 in 0.85 Tube expansion depth ratio, ρ : 0.3 Tube poisson's ratio, v_t:

Flange

Bolt circle diameter, C:

6.06 in

Channel side gasket load reaction diameter, Gc:

5.137 in

Tube Supports

Tube supports present:

Calculation method:

Yes

Support all tubes:

No

Maximum distance from tubesheet to first support:

18.3075 in

Maximum distance between tube supports:

11.25 in

Tube-To-Tubesheet Joints

Appendix A

Joint type:

Table A-2 Type i, Expanded, enhanced with two or more grooves

Tube-To-Tubesheet Joint Loads

Summary Tables

Tubesheet D Thickness Sur			
Condition	t _{design} (in)		
Operating	0.4225683		
Tube side hydrotest	0.3672333		
Shell side hydrotest	0.1714878		

Bolt	Load Summa	ıry
Condition	Load Case	Design bolt load W (lb _f)
	Load case 1	7,853.64
	Load case 2	6,300
	Load case 3	7,853.64
Operating	Load case 4	6,300
	Load case 5	7,853.64
	Load case 6	6,300
	Load case 7	7,853.64
Tube side hydrotest	Load case 1	8,323.14
Shell side hydrotest	Load case 2	6,300

		Pi	ressures and Te	mperatures				
Condition	Shell side design pressure P _s (psi)	Tube side design pressure P _t (psi)	Tubesheet design temp T (°F)	Shell design temp T _s (°F)	Channel design temp T _c (°F)	Tube design temp T _t (°F)	Shell mean temp T _{s,m} (°F)	Tube mean temp T _{t,m} (°F)
Operating	150	150	375	375	375	375	94	108
Tube side hydrotest	0	195.33	70	70	70	70	70	70
Shell side hydrotest	203.93	0	70	70	70	70	70	70