



SEWON CELLONTECH

## TUBULAR HEAT EXCHANGER

SHEET 2 OF 21

CUSTOMER	MEG Energy Corp.				REV	MADE BY	CHECKED BY	APPROVED BY	DATE
LOCATION	CANADA				0	-	-	-	07-01-2013
JOB NO.	511036				1	-	-	-	08-14-2013
SERVICE	Condensate / Glycol Exchanger								
ITEM NO.	3A-E-335A/B (Max Duty Case)								

  

Total	2	Shells, Connected in	1	Parallel	2	Series Shells	Install	<input checked="" type="checkbox"/> Hor. <input type="checkbox"/> Vert.	Size	585.0 ID - 3,353.0 L
Code	ASME Sec.VIII Div.1 (STAMP), TEMA, API660 TEMA Type NEN					TEMA Class	R	Effective Area	61.99	m <sup>2</sup> /Shell

  

PERFORMANCE OF ONE BATTERY									
		SHELL SIDE				TUBE SIDE			
		INLET		OUTLET		INLET		OUTLET	
Fluid Circulated		MP Steam Condensate				TEG/Water(60%/40% wt)			
Total Fluid	kg/hr	70133.4				141943			
Vapor	kg/hr								
Liquid	kg/hr	70133.4		70133.4		141943		141943	
Steam	kg/hr								
Water	kg/hr	70133.4		70133.4					
Noncondensable	kg/hr								
Operating Temperature	°C	196.80		95.00		40.00		105.00	
Operating Pressure	kPaa	1455.02				994.015			
Density	kg/m <sup>3</sup>	L / V	868.1		962.0		1078.00		1026.00
Viscosity	cP	L / V	0.140		0.290		4.6600		1.3500
Thermal Conductivity	W/m·°C	L / V	0.667		0.679		0.3281		0.3401
Specific Heat	kJ/kg·°C	L / V	4.482		4.208		3.2231		3.4561
Latent Heat	kJ/kg								
Bubble / Dew Point	°C								
Critical Press. / Temp.	kPaa / °C								
Velocity	m/sec	0.38				1.77			
Pressure Drop	kPa.	Allow.	70.000	Calc.	15.600	Allow.	100.000	Calc.	94.595
Fouling Resistance	m <sup>2</sup> ·°C/kW	0.18				0.18			
Film Coefficient	W/m <sup>2</sup> ·K	6,351.17				3,332.24			
Overall Coefficient	W/m <sup>2</sup> ·K	Clean	1794.65	Calc.		1046.83	Design	1020.44	
Heat Duty	KW	8,588.00				LMTD	°C	MTD	67.6 °C

  

CONSTRUCTION									
Design Pressure	Design Temperature	1950.0 / FV	kPa.G	-29 / 214 °C	1500.0 / FV	kPa.G	-29 / 214 °C		
No. of Passes	1				4				
Tubes No.	240	/ Shell, Size	25.40 mm	Thickness	2.11 (Min.) mm	( BWG: 14 )	Length	3,353.0 mm	
Shell	585 mm ID		Tube Pitch	31.75 mm	Layout angle	30 °	Effective	- mm	
Baffles	Cross Baffle	8 ea / Shell, Type	Single Seg. (Vert.)	Cut	26.0 % Dia.	Spacing c/c	340.0 mm	End	- mm
pv <sup>2</sup>	Inlet Nozzle	1,545.80	Entrance	2,625.58	Outlet Nozzle	1,394.92	kg/m·sec <sup>2</sup>	Impingement plate	None
Material	Tube	SA 179 Seamless		Shell & Cover	SA 516 GR. 70N		Channel & Cover	SA 516 GR. 70N	
	Tube Sheet	SA 266 GR.2		Baffle	Carbon Steel		Expansion Joint	Not Required (Note 3)	
Estimated Weight	Empty Weight	kg		Bundle Weight	kg		Full Water Weight	kg	
Corrosion Allowance	Shell side	3.2 mm	Tube side	3.2 mm	Tube Joints:	Rolled (two grooves) and Expanded			
Insulation	Shell side	64 mm	Tube side	64 mm					

  

MEAN METAL TEMPERATURE		Temperature, °C		Pressure, kPa.G	
		Shell	Tube	Shell	Tube
Normal Operating	-	-	-	-	-
Startup	-	-	-	-	-

  

NOZZLE		SHELL SIDE				TUBE SIDE			
		Tag	No	NPS	Remarks	Tag	No	NPS	Remarks
Inlet	S1	1	6			T1	1	8	
Outlet	S2		6			T2	1	8	
Vent					(Note 9)				(Note 9)
Drain					(Note 9)				(Note 9)
Thermowell									
Util. Con.									
RATING		RFWN 300#				RFWN 300#			

  

Remarks	
1) Seller shall verify and guarantee thermal rating of the unit.	
2) Delete	
3) Expansion joint design shall be based on design conditions noted on page 4. Expansion joint shall be flanged and flued type per TEMA RCB 8. Expansion joint shall include vent and drain connections.	

  

4) Ribbon flow pass arrangement shall be used.

5) Exchangers shall be designed for future field hydrotest in the fully corroded condition.

6) Exchangers to be designed for liquid full condition at S.G. = 1.079.

7) Seller is to design and install electrical heat tracing for hold temperature of 10 °C.

8) CSA approval is required for electric components and installation. The heat exchanger is located in a non-hazardous area.

9) Seller shall supply and install 64mm mineral fiber insulation.

10) Each process nozzle shall be provided with one 1" 300# RFLWN (complete with blind flange, gasket, bolts & nuts).

11) Exchangers shall be stacked. Per API 660, exchangers shall be hydrotested stacked.

12) EHT design shall use voltage of 277 VAC.

13) Rear channel head shall be provided with 2" 300# RFLWN vent and drain.

14) Vent and drain shall be complete with blind flange, gasket, bolts & nuts.

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SHEET 3 OF 21

CUSTOMER	MEG Energy Corp.	REV	MADE BY	CHECKED BY	APPROVED BY	DATE
LOCATION	CANADA	0	-	-	-	07-01-2013
JOB NO.	511036	1	-	-	-	08-14-2013
SERVICE	Condensate / Glycol Exchanger					
ITEM NO.	3A-E-335A/B (Min Duty Case)					

Total	2	Shells, Connected in	1	Parallel	2	Series Shells	Install	<input checked="" type="checkbox"/> Hor. <input type="checkbox"/> Vert.	Size	585.0 ID - 3,353.0 L
Code	ASME Sec.VIII Div.1 (STAMP), TEMA, API660 TEMA Type					NEN	TEMA Class	R	Effective Area	61.99 m <sup>2</sup> /Shell

## PERFORMANCE OF ONE BATTERY

				SHELL SIDE				TUBE SIDE			
				INLET		OUTLET		INLET		OUTLET	
Fluid Circulated				MP Steam Condensate				TEG/Water(60%/40% wt)			
Total Fluid		kg/hr		36112.1				73087.2			
Vapor	kg/hr	MW									
Liquid	kg/hr	MW		36112.1		36112.1		73087.2		73087.2	
Steam	kg/hr										
Water	kg/hr			36112.1		36112.1					
Noncondensable	kg/hr	MW									
Operating Temperature	°C			196.80		95.00		40.00		105.00	
Operating Pressure	kPaa			1455.02				994.015			
Density	kg/m3	L / v		868.1		962.0		1078.0		1026.0	
Viscosity	cP	L / v		0.136		0.294		4.6610		1.3460	
Thermal Conductivity	W/m·°C	L / v		0.667		0.679		0.3277		0.3397	
Specific Heat	kJ/kg·°C	L / v		4.482		4.208		3.2231		3.4561	
Latent Heat	kJ/kg										
Bubble / Dew Point	°C			/		/		/		/	
Critical Press. / Temp.	kPaa / °C			/		/		/		/	
Velocity	m/sec			0.20				0.91			
Pressure Drop	kPa.			Allow.	70.000	Calc.	4.312	Allow.	100.000	Calc.	28.315
Fouling Resistance	m2·°C/kW			0.18				0.18			
Film Coefficient	W/m2·K			4,240.06				1,772.38			
Overall Coefficient	W/m2·K			Clean	1057.01	Calc.		740.51	Design	525.92	
Heat Duty	KW				4,422.00			LMTD	°C	MTD	67.6 °C

## CONSTRUCTION

Design Pressure		Design Temperature		/ kPa.G		/ °C		/ kPa.G		/ °C	
No. of Passes											
Tubes No.		/ Shell, Size		mm		Thickness (Min.) mm		{ BWG : }		Length mm	
Shell				mm ID		Tube Pitch		mm		Layout angle °, Leffective - mm	
Baffles		Cross Baffle		ea / Shell, Type		Cut		- % Dia.		Spacing c/c mm, End - mm	
pv²		Inlet Nozzle		409.84		Entrance		696.12		Outlet Nozzle 369.83 kg/m·sec²	
Material		Tube		Shell & Cover						Channel & Cover	
		Tube Sheet		Baffle						Expansion Joint	
Estimated Weight		Empty Weight		kg		Bundle Weight		kg		Full Water Weight kg	
Corrosion Allowance		Shell side		mm		Tube side		mm		Tube Joints :	
Insulation		Shell side		mm		Tube side		mm			

MEAN METAL TEMPERATURE	Temperature, °C				Pressure, kPa.G			
	Shell	Tube	Shell	Tube	Shell	Tube	Shell	Tube
Normal Operating	-	-	-	-	-	-	-	-
Startup	-	-	-	-	-	-	-	-
NOZZLE	SHELL SIDE				TUBE SIDE			
	Tag	No	NPS	Remarks	Tag	No	NPS	Remarks
Inlet								
Outlet								
Vent								
Drain								
Liquid Outlet								
Thermowell								
Util. Con.								
RATING								

## MMT Condition

item	condition	shell		tube	
		pressure (kPa(g))	temp	pressure (kPa(g))	temp
E335	Maximum Operating Temperature	1950	163.85	1500	128.72
	Maximum Operating Pressure	1950	163.85	1500	128.72
	Shutdown&Depressured	103.506	-39	103.506	-39
	Hydortest-Tube side	103.506	20	2186	15
	Hydortest-Shell side	2134	10	103.506	20
	Glycol CV. Fails Closed	1950	197	1500	196.7
	MP Steam Cond. CV Fails	1950	166.23	1500	130.5
	MP Steam Cond. Stagnant	1950	197.3	1500	151.81
	Start-up Tube side	103.506	10	1500	25
	Start-up Shell side	1950	184	103.506	184