

**SEWON CELLONTECH****TUBULAR HEAT EXCHANGER**

SHEET 2 OF 20

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	MP Steam / Glycol Trim Condenser								
ITEM NO.	3A-E-327 (Max Case)								
Total	1	Shells, Connected in	1 Parallel 1 Series Shells	Install	<input type="checkbox"/> Hor. <input checked="" type="checkbox"/> Vert.	Size	670.0 ID - 3,658.0 L		
Code	ASME Sec.VIII Div.1 (STAMP), TEMA, API660 TEMA Type			NEN	TEMA Class	R	Effective Area	74.83 (Note 1) m ² /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			90289.5				
Vapor kg/hr		14026.7							
Liquid kg/hr		56106.7			70133.4		90289.5		90289.5
Steam kg/hr		14026.7							
Water kg/hr		56106.7			70133.4				
Noncondensable kg/hr									
Operating Temperature °C		197.33			196.80		40.00		130.00
Operating Pressure kPa		1470.02					994.015		
Density kg/m ³		L / v	867.76	7.4462	868.37		1078.40	1003.00	
Viscosity cP		L / v	0.1362	0.0156	0.1366		4.6610	0.9840	
Thermal Conductivity W/m·°C		L / v	0.6653	0.0386	0.6656		0.3277	0.3413	
Specific Heat kJ/kg·°C		L / v	4.4809	2.9503	4.4783		3.2221	3.5421	
Latent Heat kJ/kg									
Bubble / Dew Point °C		/			/		/		/
Critical Press. / Temp. kPa / °C		/			/		/		/
Velocity m/sec		2.50			1.53				
Pressure Drop kPa		Allow.	18.000	Calc.	11.101	Allow.	100.002	Calc.	52.354
Fouling Resistance m ² ·°C/kW		0.18			0.18				
Film Coefficient W/m ² ·K		8,614.10			3,367.62				
Overall Coefficient W/m ² ·K		Clean	1941.20	Calc.	1097.68	Design	968.19		
Heat Duty KW		7,624.00			LMTD		°C	MTD	105.4 °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			6				
Tubes No.	270 / Shell	Size	25.40 mm	Thickness	2.11 (Min.) mm	(BWG : 14)	Length	3,658.0 mm	
Shell	670 mm ID	Tube Pitch	31.75 mm	Layout angle	60 °	Effective	- mm		
Baffles	Cross Baffle 8 ea / Shell	Type	Single Seg.	Cut	(29.1 % Dia.)	Spacing c/c	350.0 mm	End - mm	
pv ²	Inlet Nozzle 2,247.76	Entrance 3,817.43	Outlet Nozzle 1,545.33	kg/m·sec ²	Impingement plate	Circular Plate			
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, °C		Pressure, kPa.G						
TEMPERATURE	Shell	Tube	Shell	Tube					
Normal Operating	-	-	-	-					
Startup	-	-	-	-					
NOZZLE	SHELL SIDE			TUBE SIDE					
	Tag	No	NPS	Remarks	Tag	No	NPS	Remarks	
Inlet	S1	1	12		T1	1	8		
Outlet	S2	1	6		T2	1	8		
Vent				(Note 9 & 11)				(Note 9 & 11)	
Drain				(Note 9 & 11)				(Note 9 & 11)	
Thermowell									
Util. Con.									
RATING	RFWN 300#			RFWN 300#					
Remarks									
1) Seller shall verify and guarantee thermal rating of the unit.									
2) Mixed flow pass arrangement shall be used.									
3) Expansion joint design shall be based on design conditions noted on page 6. Expansion joint shall be flanged and flued type per TEMA RCB 8. Expansion joint shall include vent and drain connections.									



SEWON CELLONTECH

TUBULAR HEAT EXCHANGER

SHEET 3 OF 20

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	MP Steam / Glycol Trim Condenser					
ITEM NO.	3A-E-327 (Min Case)					

Total	1	Shells, Connected in	1	Parallel	1	Series Shells	Install	<input type="checkbox"/> Hor. <input checked="" type="checkbox"/> Vert.	Size	670.0 ID - 3,658.0 L
Code	ASME Sec.VIII Div.1 (STAMP), TEMA, API660	TEMA Type	NEN	TEMA Class	R	Effective Area	74.83 (Note 1)	m ² /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				46490.3			
Vapor	kg/hr	MW		7222.43							
Liquid	kg/hr	MW		28889.7		36112.1		46490.3		46490.3	
Steam	kg/hr			7222.43							
Water	kg/hr			28889.7		36112.1					
Noncondensable	kg/hr	MW									
Operating Temperature °C				197.33		196.80		40.00		130.00	
Operating Pressure kPa.G				1470.02				994.015			
Density	kg/m3	L / v		867.76	7.4462	868.37		1078.40		1003.20	
Viscosity	cP	L / v		0.1362	0.0156	0.1366		4.6610		0.9840	
Thermal Conductivity	W/m·°C	L / v		0.6653	0.0386	0.6656		0.3277		0.3413	
Specific Heat	kJ/kg·°C	L / v		4.4809	2.9503	4.4782		3.2231		3.5431	
Latent Heat	kJ/kg										
Bubble / Dew Point	°C			/		/		/		/	
Critical Press. / Temp.	kPa.G / °C			/		/		/		/	
Velocity	m/sec			1.32				0.78			
Pressure Drop	kPa.			Allow.	18.000	Calc.	3.180	Allow.	100.002	Calc.	15.719
Fouling Resistance	m2·°C/kW			0.18				0.18			
Film Coefficient	W/m2·K			8,442.83				1,795.18			
Overall Coefficient	W/m2·K			Clean	1205.65	Calc.		816.13	Design	497.91	
Heat Duty	KW			3,931.00				LMTD	°C	MTD	105.6 °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 °	Effective - mm
Baffles	Cross Baffle	ea / Shell, Type	Cut	- % Dia. ,	Spacing c/c mm , End - mm
pv ²	Inlet Nozzle	595.95	Entrance	1,012.11	Outlet Nozzle 409.71 kg/m-sec ² Impingement plate
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
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								

**SEWON CELLONTECH****TUBULAR HEAT EXCHANGER**

SHEET 4 OF 20

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	MP Steam / Glycol Trim Condenser					
ITEM NO.	3A-E-327 (Start-up Case)					

Total	1	Shells, Connected in	1	Parallel	1	Series Shells	Install	<input type="checkbox"/> Hor. <input checked="" type="checkbox"/> Vert.	Size	670.0 ID - 3,658.0 L
Code	ASME Sec.VIII Div.1 (STAMP), TEMA, API660	TEMA Type	NEN	TEMA Class	R	Effective Area	74.83 (Note 1)	m ² /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		13413.1				134146			
Vapor		kg/hr		MW		13413.1					
Liquid		kg/hr		MW				134146		134146	
Steam		kg/hr		13413.1							
Water		kg/hr						13413.1			
Noncondensable		kg/hr		MW							
Operating Temperature °C				185.00		184.40		40.00		100.00	
Operating Pressure kPa.G				1123.02				994.015			
Density		kg/m3		L / v		5.7481		882.26		1078.40	
Viscosity		cP		L / v		0.0152		0.1463		4.6610	
Thermal Conductivity		W/m· °C		L / v		0.0363		0.6726		0.3277	
Specific Heat		kJ/kg· °C		L / v		2.7790		4.4231		3.2231	
Latent Heat		kJ/kg								3.4381	
Bubble / Dew Point °C				/		/		/		/	
Critical Press. / Temp. kPa.G / °C				/		/		/		/	
Velocity m/sec				3.07				2.23			
Pressure Drop kPa.				Allow. 18.000		Calc. 2.400		Allow. 112.002		Calc. 110.986	
Fouling Resistance m2· °C/kW				0.18				0.18			
Film Coefficient W/m2·K				8,897.59				4,179.17			
Overall Coefficient W/m2·K				Clean 2263.03		Calc.		1193.66		Design 887.08	
Heat Duty KW				7,445.00				LMTD °C		MTD 112.2 °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 °	Effective	mm		
Baffles	Cross Baffle	ea / Shell, Type	Cut	% Dia.	Spacing c/c	mm	End	mm	
pv ²	Inlet Nozzle	514.84	Entrance	874.37	Outlet Nozzle	55.63	kg/m-sec ²	Impingement plate	
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, °C		Pressure, kPa.G	
TEMPERATURE	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								