



HEAT EXCHANGER SPECIFICATION SHEET

5	Customer	MAN Turbo & Diesel SE	Job No.	
6	Address		Reference No.	
7	Plant Location	JOHNCO	Proposal No.	914066
8	Service of Unit	Cooler 2.1 - 2-S	Date	03.06.2014 Rev 2
9	Size	900 x 3200 mm	Type	BEP Horizontal
10	Surf/Unit (Gross/Eff)	130,49 / 122,33 m2	Shell/Unit	1
			Connected In	1 Parallel 1 Series
			Surf/Shell (Gross/Eff)	130,49 / 122,33 m2

PERFORMANCE OF ONE UNIT

		Shell Side		Tube Side	
12	Fluid Allocation	Water/Glycol 50/50		Wet CO2	
13	Fluid Name	Water/Glycol 50/50		Wet CO2	
14	Fluid Quantity, Total	63,874		61,107	
15	Vapor (In/Out)			61,107	61,107
16	Liquid	63,874	63,874		
17	Steam				
18	Water				
19	Noncondensables				
20	Temperature (In/Out)	26,70	36,50	81,60	50,00
21	Density	1058,7	1052,6	57,545	66,161
22	Viscosity	3,0335	2,2936	0,0182	0,0169
23	Molecular Weight, Vapor				
24	Molecular Weight, Noncondensables				
25	Specific Heat	3,3483	3,3911	1,0686	1,1294
26	Thermal Conductivity	0,4130	0,4102	0,0235	0,0213
27	Latent Heat			2167,1	2166,7
28	Inlet Pressure	6,000		35,400	
29	Velocity x/w	0,50 / 0,57		6,06	
30	Pressure Drop, Allow/Calc	1,000	0,278	0,060	0,056
31	Fouling Resistance (min)	0,000090		0,000000	
32	Heat Exchanged	2111, kW	MTD (Corrected) 32,6 C	Overdesign 7,46 %	
33	Transfer Rate, Service	529,36 W/m2-K	Calculated 568,84 W/m2-K	Clean 599,54 W/m2-K	

CONSTRUCTION OF ONE SHELL

Sketch (Bundle/Nozzle Orientation)

		Shell Side	Tube Side	
36	Design/Test Pressure	10,000 /	45,000 /	
37	Design Temperature	100,00	120,00	
38	No Passes per Shell	1	1	
39	Corrosion Allowance	3,000	0,000	
40	Connections	1 @ 10"	1 @ 20"	
41	Size & Out	1 @ 10"	1 @ 20"	
42	Rating	@	1 @	
42	Liq. Out	@	1 @	

43	Tube No.	649	OD	20,000 mm	Thk(Avg)	1,000 mm	Length	3,200 m	Pitch	mm	
44	Tube Type	Plain	Material			SS316L	Tube pattern				
45	Shell	Carbon steel	ID	OD	mm	Shell Cover					
46	Channel or Bonnet	SS316L	Channel Cover								
47	Tubesheet-Stationary	SS316L	Tubesheet-Floating SS316L								
48	Floating Head Cover		Impingement Plate Rectangular plate								
49	Baffles-Cross	SS316L	Type	%Cut (Diam)	Spacing(c/c)	Inlet	mm				
50	Baffles-Long		Seal Type None								
51	Supports-Tube		U-Bend								
52	Bypass Seal Arrangement		Tube-Tubesheet Joint								
53	Expansion Joint		Type								
54	Rho-V2-Inlet Nozzle	1489,0	kg/m-s2	Bundle Entrance		457,50	Bundle Exit		314,61	kg/m-s2	
55	Gaskets-Shell Side		Tube Side								
56	-Floating Head										
57	Code Requirements	ASME VIII, Div. 1; U-Stamp				TEMA Class C					
58	Weight/Shell	7400,7	kg	Filled with Water		10652	kg	Bundle		2270,6	kg

59 Remarks:

60 MDMT -17,78 °C

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5	Customer	MAN Turbo & Diesel SE	Job No.	
6	Address		Reference No.	
7	Plant Location	JOHNCO	Proposal No.	914066
8	Service of Unit	Cooler 2.1 - 2-I	Date	03.06.2014 Rev 2
9	Size	900 x 3200 mm	Type	BEP Horizontal
10	Surf/Unit (Gross/Eff)	130,49 / 122,33 m2	Shell/Unit	1
			Connected In	1 Parallel 1 Series
			Surf/Shell (Gross/Eff)	130,49 / 122,33 m2

PERFORMANCE OF ONE UNIT

	Shell Side		Tube Side	
	Water/Glycol 50/50		Wet CO2	
12 Fluid Allocation				
13 Fluid Name	Water/Glycol 50/50		Wet CO2	
14 Fluid Quantity, Total kg/s	63,892		61,120	
15 Vapor (In/Out)			61,120	
16 Liquid	63,892	63,892		61,120
17 Steam				
18 Water				
19 Noncondensables				
20 Temperature (In/Out)	26,70	36,50	81,60	50,00
21 Density kg/m3	1058,7	1052,6	57,561	66,181
22 Viscosity cP	3,0335	2,2936	0,0182	0,0169
23 Molecular Weight, Vapor				
24 Molecular Weight, Noncondensables				
25 Specific Heat kJ/kg-C	3,3483	3,3911	1,0686	1,1295
26 Thermal Conductivity W/m-C	0,4130	0,4102	0,0235	0,0213
27 Latent Heat kJ/kg			2175,0	2172,9
28 Inlet Pressure bar	6,000		35,410	
29 Velocity x/w m/s	0,50 / 0,57		6,06	
30 Pressure Drop, Allow/Calc bar	1,000	0,278	0,060	0,056
31 Fouling Resistance (min) m2-K/W	0,000090		0,000000	
32 Heat Exchanged 2111, kW	MTD (Corrected) 32,6 C		Overdesign 7,33 %	
33 Transfer Rate, Service 529,17 W/m2-K	Calculated 567,95 W/m2-K		Clean 598,55 W/m2-K	

CONSTRUCTION OF ONE SHELL

Sketch (Bundle/Nozzle Orientation)

	Shell Side		Tube Side		Sketch (Bundle/Nozzle Orientation)
36 Design/Test Pressure barG	10,000 /		45,000 /		
37 Design Temperature C	100,00		120,00		
38 No Passes per Shell	1		1		
39 Corrosion Allowance mm	3,000		0,000		
40 Connections In mm	1 @ 10"		1 @ 20"		
41 Size & Out mm	1 @ 10"		1 @ 20"		
42 Rating Liq. Out mm	@		@		

43 Tube No.	649	OD	20,000 mm	Thk(Avg)	1,000 mm	Length	3,200 m	Pitch	mm
44 Tube Type	Plain			Material	SS316L	Tube pattern			
45 Shell	Carbon steel	ID		OD	mm	Shell Cover			
46 Channel or Bonnet	SS316L					Channel Cover			
47 Tubesheet-Stationary	SS316L					Tubesheet-Floating SS316L			
48 Floating Head Cover						Impingement Plate Rectangular plate			
49 Baffles-Cross	SS316L	Type		%Cut (Diam)		Spacing(c/c)		Inlet	mm
50 Baffles-Long						Seal Type None			
51 Supports-Tube						U-Bend Type			
52 Bypass Seal Arrangement						Tube-Tubesheet Joint			
53 Expansion Joint						Type			
54 Rho-V2-Inlet Nozzle	1489,8	kg/m-s2		Bundle Entrance	457,76	Bundle Exit	314,79	kg/m-s2	
55 Gaskets-Shell Side						Tube Side			
56 -Floating Head									
57 Code Requirements	ASME VIII, Div. 1; U-Stamp					TEMA Class C			
58 Weight/Shell	7400,7	kg	Filled with Water	10652	kg	Bundle	2270,6	kg	

59 Remarks:
60 MDMT -17,78 °C
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HEAT EXCHANGER SPECIFICATION SHEET

5	Customer	MAN Turbo & Diesel SE	Job No.	
6	Address		Reference No.	
7	Plant Location	JOHNCO	Proposal No.	914066
8	Service of Unit	Cooler 2.1 - 2-W	Date	03.06.2014 Rev 2
9	Size	900 x 3200 mm	Type	BEP Horizontal
10	Surf/Unit (Gross/Eff)	130,49 / 122,33 m2	Shell/Unit	1
			Connected In	1 Parallel 1 Series
			Surf/Shell (Gross/Eff)	130,49 / 122,33 m2

PERFORMANCE OF ONE UNIT

		Shell Side		Tube Side	
12	Fluid Allocation	Water/Glycol 50/50		Wet CO2	
13	Fluid Name	Water/Glycol 50/50		Wet CO2	
14	Fluid Quantity, Total	63,892		61,124	
15	Vapor (In/Out)			61,124	61,124
16	Liquid	63,892	63,892		
17	Steam				
18	Water				
19	Noncondensables				
20	Temperature (In/Out)	26,70	36,50	81,60	50,00
21	Density	1058,7	1052,6	57,545	66,161
22	Viscosity	3,0335	2,2936	0,0182	0,0169
23	Molecular Weight, Vapor				
24	Molecular Weight, Noncondensables				
25	Specific Heat	3,3483	3,3911	1,0686	1,1294
26	Thermal Conductivity	0,4130	0,4102	0,0235	0,0213
27	Latent Heat			2167,1	2166,7
28	Inlet Pressure	6,000		35,400	
29	Velocity x/w	0,50 / 0,57		6,06	
30	Pressure Drop, Allow/Calc	1,000	0,278	0,060	0,056
31	Fouling Resistance (min)	0,000090		0,000000	
32	Heat Exchanged	2111, kW	MTD (Corrected) 32,6 C	Overdesign 7,30 %	
33	Transfer Rate, Service	529,16 W/m2-K	Calculated 567,79 W/m2-K	Clean 598,36 W/m2-K	

CONSTRUCTION OF ONE SHELL

Sketch (Bundle/Nozzle Orientation)

		Shell Side		Tube Side		
36	Design/Test Pressure	10,000 /		45,000 /		
37	Design Temperature	100,00		120,00		
38	No Passes per Shell	1		1		
39	Corrosion Allowance	3,000		0,000		
40	Connections	In	mm	1 @ 10"		1 @ 20"
41	Size & Rating	Out	mm	1 @ 10"		1 @ 20"
42		Liq. Out	mm	@	1 @	

43	Tube No.	649	OD	20,000 mm	Thk(Avg)	1,000 mm	Length	3,200 m	Pitch	mm	
44	Tube Type	Plain		Material		SS316L	Tube pattern				
45	Shell	Carbon steel	ID	OD	mm	Shell Cover					
46	Channel or Bonnet	SS316L	Channel Cover								
47	Tubesheet-Stationary	SS316L	Tubesheet-Floating SS316L								
48	Floating Head Cover	Impingement Plate Rectangular plate									
49	Baffles-Cross	SS316L	Type	%Cut (Diam)	Spacing(c/c)	Inlet	mm				
50	Baffles-Long	Seal Type None									
51	Supports-Tube	U-Bend					Type				
52	Bypass Seal Arrangement	Tube-Tubesheet Joint									
53	Expansion Joint	Type									
54	Rho-V2-Inlet Nozzle	1489,8	kg/m-s2	Bundle Entrance	457,75	Bundle Exit	314,78	kg/m-s2			
55	Gaskets-Shell Side	Tube Side									
56	-Floating Head										
57	Code Requirements	ASME VIII, Div. 1; U-Stamp				TEMA Class	C				
58	Weight/Shell	7400,7	kg	Filled with Water	10652	kg	Bundle	2270,6	kg		

59 Remarks:

60 MDMT -17,78 °C



HEAT EXCHANGER SPECIFICATION SHEET

5 Customer	MAN Turbo & Diesel SE		Job No.		
6 Address			Reference No.		
7 Plant Location	JOHNCO		Proposal No.	914066	
8 Service of Unit	Cooler 2.1 - Min. Pressure		Date	03.06.2014	Rev 2
9 Size	900 x 3200 mm	Type	BEP Horizontal	Connected In	1 Parallel 1 Series
10 Surf/Unit (Gross/Eff)	130,49 / 122,33 m2	Shell/Unit	1	Surf/Shell (Gross/Eff)	130,49 / 122,33 m2

PERFORMANCE OF ONE UNIT					
		Shell Side		Tube Side	
12 Fluid Allocation		Water/Glycol 50/50		Wet CO2	
13 Fluid Name		Water/Glycol 50/50		Wet CO2	
14 Fluid Quantity, Total	kg/s	68,237		45,321	
15 Vapor (In/Out)				45,321	45,306
16 Liquid		68,237	68,237		0,0153
17 Steam					
18 Water					
19 Noncondensables					
20 Temperature (In/Out)		26,70	35,70	81,40	38,50
21 Density	kg/m3	1058,7	1053,1	46,418	55,816 V/L 996,85
22 Viscosity	cP	3,0335	2,3436	0,0184	0,0169 V/L 0,6528
23 Molecular Weight, Vapor					
24 Molecular Weight, Noncondensables					
25 Specific Heat	kJ/kg-C	3,3483	3,3877	1,0236	1,0828 V/L 4,1847
26 Thermal Conductivity	W/m-C	0,4130	0,4104	0,0237	0,0204 V/L 0,6111
27 Latent Heat	kJ/kg			2313,6	2314,4
28 Inlet Pressure	bar	6,000		28,660	
29 Velocity x/w	m/s	0,53 / 0,60		5,42	
30 Pressure Drop, Allow/Calc	bar	1,000	0,315	0,060	0,044
31 Fouling Resistance (min)	m2-K/W	0,000090		0,000000	
32 Heat Exchanged	2070, kW	MTD (Corrected) 24,5 C		Overdesign 5,76 %	
33 Transfer Rate, Service	689,86 W/m2-K	Calculated 729,61 W/m2-K		Clean 780,89 W/m2-K	

CONSTRUCTION OF ONE SHELL				Sketch (Bundle/Nozzle Orientation)	
		Shell Side	Tube Side		
36 Design/Test Pressure	barG	10,000 /	45,000 /		
37 Design Temperature	C	100,00	120,00		
38 No Passes per Shell		1	1		
39 Corrosion Allowance	mm	3,000	0,000		
40 Connections	In mm	1 @ 10"	1 @ 20"		
41 Size & Rating	Out mm	1 @ 10"	1 @ 20"		
42	Liq. Out mm	@	1 @		

43 Tube No.	649	OD	20,000 mm	Thk(Avg)	1,000 mm	Length	3,200 m	Pitch	mm	
44 Tube Type	Plain	Material			SS316L	Tube pattern				
45 Shell	Carbon steel	ID	OD	mm	Shell Cover					
46 Channel or Bonnet	SS316L	Channel Cover								
47 Tubesheet-Stationary	SS316L	Tubesheet-Floating SS316L								
48 Floating Head Cover		Impingement Plate Rectangular plate								
49 Baffles-Cross	SS316L	Type	%Cut (Diam)	Spacing(c/c)	Inlet	mm				
50 Baffles-Long		Seal Type None								
51 Supports-Tube		U-Bend					Type			
52 Bypass Seal Arrangement		Tube-Tubesheet Joint					Type			
53 Expansion Joint		Type								
54 Rho-V2-Inlet Nozzle	1699,3 kg/m-s2	Bundle Entrance	522,13	Bundle Exit	358,88	kg/m-s2				
55 Gaskets-Shell Side		Tube Side								
56	-Floating Head									
57 Code Requirements	ASME VIII, Div. 1; U-Stamp					TEMA Class C				
58 Weight/Shell	7400,7 kg	Filled with Water	10652 kg	Bundle		2270,6 kg				

59 Remarks:

60 MDMT -17,78 °C

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HEAT EXCHANGER SPECIFICATION SHEET

5	Customer	MAN Turbo & Diesel SE	Job No.	
6	Address		Reference No.	
7	Plant Location	JOHNCO	Proposal No.	914066
8	Service of Unit	Cooler 2.1 - Max. Pressure	Date	03.06.2014 Rev 2
9	Size	900 x 3200 mm	Type	BEP Horizontal
10	Surf/Unit (Gross/Eff)	130,49 / 122,33 m ²	Shell/Unit	1
			Connected In	1 Parallel 1 Series
			Surf/Shell (Gross/Eff)	130,49 / 122,33 m ²

PERFORMANCE OF ONE UNIT

		Shell Side		Tube Side	
		Water/Glycol 50/50		Wet CO2	
12	Fluid Allocation				
13	Fluid Name				
14	Fluid Quantity, Total	89,880		61,110	
15	Vapor (In/Out)			61,110	61,110
16	Liquid	89,880	89,880		0,0002
17	Steam				
18	Water				
19	Noncondensables				
20	Temperature (In/Out)	26,70	36,70	85,60	42,70
21	Density	1058,7	1052,4	72,549	90,457
22	Viscosity	3,0335	2,2813	0,0192	0,0180
23	Molecular Weight, Vapor				
24	Molecular Weight, Noncondensables				
25	Specific Heat	3,3483	3,3920	1,0983	1,2468
26	Thermal Conductivity	0,4130	0,4101	0,0253	0,0225
27	Latent Heat			2282,1	2283,0
28	Inlet Pressure	6,000		43,130	
29	Velocity x/w	0,70 / 0,80		4,74	
30	Pressure Drop, Allow/Calc	1,000	0,512	0,060	0,043
31	Fouling Resistance (min)	0,000090		0,000000	
32	Heat Exchanged	3031, kW	MTD (Corrected) 28,0 C	Overdesign 8,72 %	
33	Transfer Rate, Service	885,61 W/m ² -K	Calculated 962,83 W/m ² -K	Clean 1054,2 W/m ² -K	

CONSTRUCTION OF ONE SHELL

		Shell Side	Tube Side	Sketch (Bundle/Nozzle Orientation)
36	Design/Test Pressure	10,000 /	45,000 /	
37	Design Temperature	100,00	120,00	
38	No Passes per Shell	1	1	
39	Corrosion Allowance	3,000	0,000	
40	Connections	1 @ 10"	1 @ 20"	
41	Size & Rating	1 @ 10"	1 @ 20"	
42		@	1 @	

43	Tube No.	649	OD	20,000 mm	Thk(Avg)	1,000 mm	Length	3,200 m	Pitch	mm
44	Tube Type	Plain								Tube pattern
45	Shell	Carbon steel	ID	OD	mm					Shell Cover
46	Channel or Bonnet	SS316L								Channel Cover
47	Tubesheet-Stationary	SS316L								Tubesheet-Floating SS316L
48	Floating Head Cover									Impingement Plate Rectangular plate
49	Baffles-Cross	SS316L	Type		%Cut (Diam)		Spacing(c/c)		Inlet	mm
50	Baffles-Long									
51	Supports-Tube					Seal Type	None			
52	Bypass Seal Arrangement					U-Bend				Type
53	Expansion Joint					Tube-Tubesheet Joint				
54	Rho-V2-Inlet Nozzle	2948,2	kg/m-s ²			Type				
55	Gaskets-Shell Side					Bundle Entrance	905,86	Bundle Exit	623,02	kg/m-s ²
56	-Floating Head					Tube Side				
57	Code Requirements	ASME VIII, Div. 1; U-Stamp				TEMA Class	C			
58	Weight/Shell	7400,7	kg	Filled with Water	10652	kg	Bundle	2270,6	kg	

59 Remarks:
60 MDMT -17,78 °C
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