



HEAT EXCHANGER SPECIFICATION SHEET
NON-ANODICALLY PROTECTED SHELL & TUBE

Project MEN:

Cooler MEN:

Customer XXX

Address

Proposal No. 5X301.19-011

Plant Location Martinez CA

Date 2/22/2019

Service of Unit Dry Acid Cooler

Item No. X-12

Size 23 x 384 inch

Type NEN Horizontal

Connected In 1 Parallel 1 Series

Surf/Unit (Gross/Eff) 1847.3 / 1838.8 ft2

Shell/Unit 1

Surf/Shell (Gross/Eff) 1847.3 / 1838.8 ft2

PERFORMANCE OF ONE UNIT

Fluid Allocation		Shell Side		Tube Side	
Fluid Name		93% H2SO4		Cooling Water	
Fluid Quantity, Total		888,000		1,123,000	
Fluid Quantity, Total		996		2,254	
Temperature (In/Out)		136	113	85	92
Viscosity		7.1704	9.8799	0.8068	0.7439
Specific Heat		0.3827	0.3800	1.0083	1.0083
Thermal Conductivity		0.2157	0.2139	0.3550	0.3582
Velocity		1.03		7.37	
Pressure Drop, Allow/Calc		10.000	3.489	7.000	6.999
Fouling Resistance (min)		0.0043			

Heat Exchanged 7.8572 MM Btu/hr MTD (Corrected) 35.4 F

Transfer Rate, Service 120.85 Btu/ft2-hr-F

CONSTRUCTION OF ONE SHELL

Sketch (Bundle/Nozzle Orientation)

		Shell Side	Tube Side
Design/Test Pressure		115.00 / Per Code	100.00 / Per Code
Design Temperature		275	275
No Passes per Shell		1	1
Corrosion Allowance		0.04	0.06 / excludes tubes
Connections	In	10" 150# RFSO	10" 150# RFSO
Size &	Out	10" 150# RFSO	10" 150# RFSO
Rating	Standard	ANSI	ANSI

COUNTERCURRENT

Tube No. 294 OD 0.7500 inch Thk(Avg) 0.0490 inch Length 32.000 ft Pitch 1.0938 inch

Tube Type Plain Layout 30

Shell ID 23.000 inch OD inch

MATERIALS OF CONSTRUCTION

ACID COOLER DETAILS

TUBES (Welded ZeCor-Z) BAFFLES ZeCor-Z CODE REQUIREMENTS: ASME VIII, DIV I STAMPED

SHELL ZeCor-Z CHANNEL 304L SS CODE CLASS (IF APPLICABLE):

TUBESHEET ZeCor-Z CH. COVER CS w/304L liner TEMA CLASS - 'C'

REMARKS OR NON STANDARD FEATURES

ESTIMATED WEIGHTS:

1. Acid Pressure must exceed water pressure throughout cooler. ONE SHELL - DRY 10,200 lb

2. Anodic protection not required ONE SHELL - FULL OF WATER 17,900 lb

PAINT SPECIFICATION:

STAINLESS STEEL : NONE

CARBON STEEL : PRIMER PER 362-104

0 22-Feb-19 TLD Proposal

NO. DATE BY BY DESCRIPTION



HEAT EXCHANGER SPECIFICATION SHEET NON-ANODICALLY PROTECTED SHELL & TUBE

Project MEN:

Cooler MEN:

Customer XXX

Proposal No. 5X301.19-011

Address

Date 2/22/2019

Plant Location Martinez CA

Item No. X-13

Service of Unit Interpass Absorbing Acid Cooler

Size 23 x 384 inch

Type NEN Horizontal

Connected In 1 Parallel 1 Series

Surf/Unit (Gross/Eff) 2211.7 / 2200.9 ft2

Shell/Unit 1

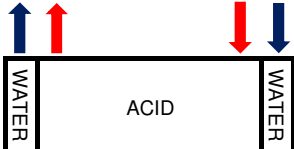
Surf/Shell (Gross/Eff) 2211.7 / 2200.9 ft2

PERFORMANCE OF ONE UNIT

Fluid Allocation		Shell Side		Tube Side	
Fluid Name		98% H2SO4		Cooling Water	
Fluid Quantity, Total		1,101,000		1,123,000	
Fluid Quantity, Total		1,266		2,258	
Temperature (In/Out)		245	176	95	120.9
Viscosity		3.5023	5.3862	0.7194	0.5526
Specific Heat		0.3903	0.3820	1.0083	1.0094
Thermal Conductivity		0.2187	0.2162	0.3595	0.3698
Velocity		1.82		6.19	
Pressure Drop, Allow/Calc		10.000	7.153	6.000	5.144
Fouling Resistance (min)		0.0043			
Heat Exchanged		29.334	MM Btu/hr	MTD (Corrected)	94.8 F
Transfer Rate, Service		140.66	Btu/ft2-hr-F		

CONSTRUCTION OF ONE SHELL

Sketch (Bundle/Nozzle Orientation)

		Shell Side	Tube Side	
Design/Test Pressure		115.00 / Per Code	100.00 / Per Code	
Design Temperature		275	200	
No Passes per Shell		1	1	
Corrosion Allowance		0.04	0.06 / excludes tubes	
Connections		10" 150# RFSO	10" 150# RFSO	
Size & Out		10" 150# RFSO	10" 150# RFSO	CO-CURRENT
Rating		ANSI	ANSI	

Tube No. 352 OD 0.7500 inch Thk(Avg) 0.0490 inch Length 32.000 ft Pitch 1.0000 inch

Tube Type Plain Layout 30


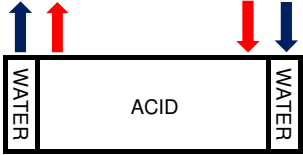
Shell ID 23.000 inch OD inch

MATERIALS OF CONSTRUCTION

ACID COOLER DETAILS

TUBES (Weldec ZeCor-Z)	BAFFLES ZeCor-Z	CODE REQUIREMENTS: ASME VIII, DIV I STAMPED
SHELL ZeCor-Z	CHANNEL 304L SS	CODE CLASS (IF APPLICABLE):
TUBESHEET ZeCor-Z	CH. COVER CS w/304L liner	TEMA CLASS - 'C'
REMARKS OR NON STANDARD FEATURES		ESTIMATED WEIGHTS:
1. Acid Pressure must exceed water pressure throughout cooler.		ONE SHELL - DRY 10,850 lb
2. Anodic protection not required.		ONE SHELL - FULL OF WATER 18,800 lb
		PAINT SPECIFICATION:
		STAINLESS STEEL : NONE
		CARBON STEEL : PRIMER PER 362-104

0	22-Feb-19	TLD		Proposal
NO.	DATE	BY	BY	DESCRIPTION

		HEAT EXCHANGER SPECIFICATION SHEET NON-ANODICALLY PROTECTED SHELL & TUBE			
		Project MEN:			
		Cooler MEN:			
Customer XXX		Proposal No. 5X301.19-011			
Address		Date 2/22/2019			
Plant Location Martinez CA		Item No. X-14			
Service of Unit Final Acid Cooler		Connected In 1 Parallel 1 Series			
Size 14.5 x 240 inch		Type NEN	Horizontal		
Surf/Unit (Gross/Eff) 345.57 / 343.95 ft2		Shell/Unit 1	Surf/Shell (Gross/Eff) 345.57 / 343.95 ft2		
PERFORMANCE OF ONE UNIT					
Fluid Allocation		Shell Side		Tube Side	
Fluid Name		98% H2SO4		Cooling Water	
Fluid Quantity, Total lb/hr		688,000		273,500	
Fluid Quantity, Total GPM		781		549	
Temperature (In/Out) F		207	176	85	114.7
Viscosity cP		4.2547	5.3858	0.8068	0.5864
Specific Heat Btu/lb-F		0.3857	0.3820	1.0083	1.0090
Thermal Conductivity Btu/hr-ft-F		0.2176	0.2162	0.3550	0.3675
Velocity ft/sec		3.12		6.01	
Pressure Drop, Allow/Calc psi		10.000	12.303	6.000	3.048
Fouling Resistance (min) ft2-hr-F/Btu		0.0010			
Heat Exchanged 8.1859 MM Btu/hr		MTD (Corrected) 88.3 F			
Transfer Rate, Service 269.55 Btu/ft2-hr-F					
CONSTRUCTION OF ONE SHELL				Sketch (Bundle/Nozzle Orientation)	
		Shell Side	Tube Side	 <p style="text-align: center;">CO-CURRENT</p>	
Design/Test Pressure psig		115.00 / Per Code	100.00 / Per Code		
Design Temperature F		275	200		
No Passes per Shell		1	1		
Corrosion Allowance inch		0.04	0.06 / excludes tubes		
Connections In		8" 150# RFSO	6" 150# RFSO		
Size & Out		8" 150# RFSO	6" 150# RFSO		
Rating Standard		ANSI	ANSI		
Tube No. 88		OD 0.7500 inch	Thk(Avg) 0.0490 inch	Length 20.000 ft	Pitch 1.0000 inch
Tube Type Plain		Layout 30			
Shell ID 14.500 inch		OD inch			
MATERIALS OF CONSTRUCTION			ACID COOLER DETAILS		
TUBES (Weldec ZeCor-Z)		BAFFLES ZeCor-Z	CODE REQUIREMENTS: ASME VIII, DIV I STAMPED		
SHELL ZeCor-Z		CHANNEL 304L SS	CODE CLASS (IF APPLICABLE):		
TUBESHEET ZeCor-Z		CH. COVER CS w/304L liner	TEMA CLASS - 'C'		
REMARKS OR NON STANDARD FEATURES			ESTIMATED WEIGHTS:		
1. Acid Pressure must exceed water pressure throughout cooler.			ONE SHELL - DRY 3,800 lb		
2. Anodic protection not required.			ONE SHELL - FULL OF WATER 5,700 lb		
			PAINT SPECIFICATION:		
			STAINLESS STEEL : NONE		
			CARBON STEEL : PRIMER PER 362-104		
0	22-Feb-19	TLD	Proposal		
NO.	DATE	BY	BY	DESCRIPTION	