HEATRAN HEAT TRANSFER TECHNOLOGY

TUBULAR HEAT EXCHANGER

SHEET 1 OF 3

		REV	MADE BY	CHECKED BY	APPROVED BY	DATE
CUSTOMER	ASIAN ACETYLS CO., LTD	0	J. H. CHOI	C. Y. PARK	J. C. CHOI	JAN. 21, 2010
LOCATION	Ulsan, Korea	1	J. H. CHOI	C. Y. PARK	J. C. CHOI	JAN. 28, 2010
JOB NO.		2	J. H. CHOI	C. Y. PARK	J. C. CHOI	FEB. 18, 2010
SERVICE	HEADING COLUMN REBOILER					
ITEM NO.	E-5211					

Total ONE Shells, Connected in ONE Parallel ONE Series Shells	Install ☐ Hor. ■ Vert.	Size	1,215 ID – 3,000 L
Code ASME Sec.VIII Div.1	TEMA Type BEM	TEMA Class R	Effective Area 272.9 m²/Shell

PERFORMANCE OF ONE BATTERY

			SHELL SIDE		TUBE SIDE	
			INLET	OUTLET	INLET	OUTLET
Fluid Circulated			LLP STEAM		VINYL ACETATE	
Total Fluid	kg/hr		5,684		188,600	
Vapor	kg/hr	MW				37,720
Liquid	kg/hr	MW			188,600	150,880
Steam	kg/hr		5,684			
Water	kg/hr			5,684		
Noncondensable	kg/hr	MW				
Operating Temperature	°C		111.0	111.0	88.5	88.6
Operating Pressure	kg/cm²G		0.50		0.67	
Density	kg/m³	V	0.864		841.8	4.78
		L		950.2		841.8
Viscosity	cP	V	0.0127		0.2264	0.0099
		L		0.2524		0.2264
Thermal Conductivity	kcal/hr m °C	V	0.0224		0.1106	0.0147
		L		0.5864		0.1106
Specific Heat	kcal/kg °C	V	0.5086		0.4927	0.2699
		L		1.011		0.4927
Latent Heat	kcal/kg		532		82	
Bubble / Dew Point	°C		/		/	
Critical Press. / Temp.	kg/cm²A / °C		/		/	
Velocity	m/sec		4.57		0.98	
Pressure Drop	kg/cm²		Allow. –	Calc. 0.03	Allow. T-SIPHON	Calc. 0.299 (incl.piping)
Fouling Resistance	hr m²°C/kcal		0.00008		0.0002	
Film Coefficient	kcal/hr m²°C		6,164		1,306	
Overall Coefficient	kcal/hr m²°C		Clean 803.6	Calc. 639.2	Design 549.0	
Heat Duty	kcal/hr		3,022,100		LMTD °C	MTD 20.2 °C

CONSTRUCTION

Design Pressure / Design Temperature	5.0 / F.V kg/cm²G / 160 / 120 for F.V °C	4.0 / F.V kg/cm²G / 150 / 82 for F.V *1)C	
No. of Passes	ONE	ONE	
Tubes No. 1,180 / Shell, Size 25.4 mm OD, Thickness 2.11 (min.) mm (BWG 14) Length 3,000 mm			
Shell 1,215 mm ID | Tube Pitch 31.75 mm , Layout angle 30° , Leffective 2,898 mm			
Baffles Cross Baffle 5 ea / Shell , Type SEGMENTAL , Cut HOR. 34.2 % Dia., Spacing c/c 460 mm, End mm			
ρv² Inlet Nozzle 1,350 , Entrance 1,080 , Outlet Nozzle 360 kg/m sec² | Impingement Plate 400 x 400 mm			
Material Tube A-213 TP304L | Shell & Cover A-285 Gr.C | Channel & Cover A-240 TP304L *5)			
Material Tube Sheet A-182 F304L | Baffle A-285 Gr.C | Expansion Joint			
Estimated Weight | Empty Weight kg, Bundle Weight kg, Full Water Weight kg			
Corrosion Allowance | Shell side 3.0 mm, Tube side 0.0 mm | Tube Joints : Strength Weld with Light Expanding			
Insulation | Shell side Ih , Tube side Ih			

MEAN METAL TEMPERATURE	Temperature, °C		Pressure, kg/cm²G	
	Shell	Tube	Shell side	Tube side
Normal Operating				
Startup				

NOZZLE	SHELL SIDE				TUBE SIDE			
	Tag	No	DN	Remarks	Tag	No	DN	Remarks
Inlet	S1	1	250A	150# WN RF	T1	1	300A	150# WN RF
Outlet	S2	1	65A	150# WN RF	T2	1	600A	150# WN RF
Vent	S3	1	50A	(LT)150# WN RF				
Drain	S4	1	50A	(LT)150# WN RF				
Steam out					T3	1	*	150# WN RF
RATING								

Remarks

1. Tube design temperature is 150 °C for steam out.
2. Area design margin : 15% oversurface.
3. Vinyl acetate in tube side is flammable / explosive / toxic and corrosive / erosive due to acetic acid.
4. Quality level : 2.
5. Material spec. : VM2.

6. The pressure and metal temp. for the tubesheet and bellows design.

Case	Temperature, °C		Pressure, kg/cm²G		Stress limit
	Shell	Tube	Shell	Tube	
1	111.0	106.1	0.5	0.67	Design
2	111.0	15.0	0.5	0.0	Design
3	–19.0	81.4	0.0	0.67	Design
4	–19.0	150.0	0.0	0.0	Design
5	15.0	15.0	0.0	Test	Test **
6	15.0	15.0	Test	0.0	Test **
7	15.0	150.0	0.0	4.0	Design

** Stress limitations are those of the governing pressure vessel code.

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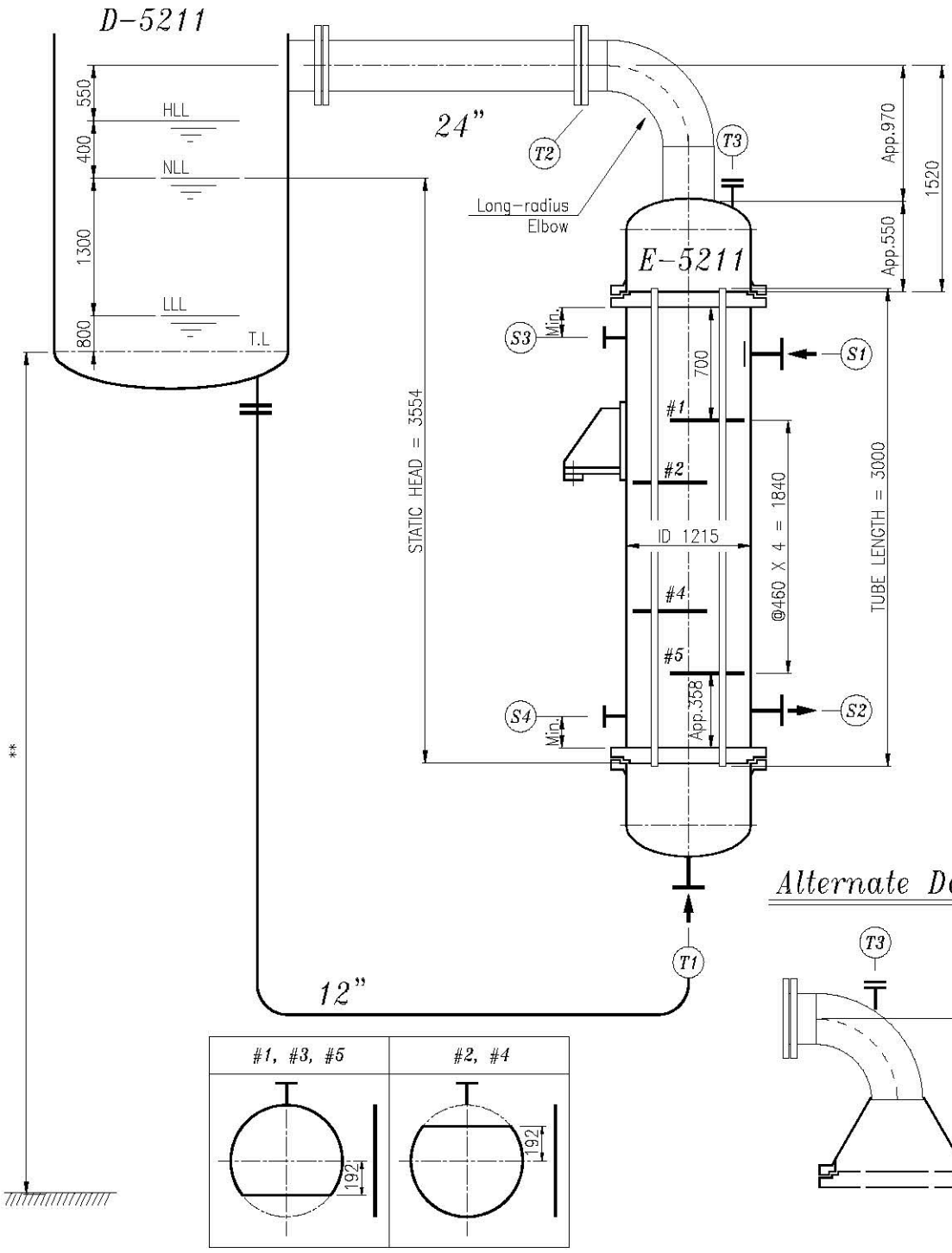
TUBULAR HEAT EXCHANGER

SHEET 2 OF 3

CUSTOMER	*ASIAN ACETYLS CO., LTD*
LOCATION	*Ulsan, Korea*
JOB NO.	
SERVICE	*HEADING COLUMN REBOILER*
ITEM NO.	*E-5211*

REV	MADE BY	CHECKED BY	APPROVED BY	DATE
0	*J. H. CHOI*	*C. Y. PARK*	*J. C. CHOI*	*JAN. 21, 2010*
1	*J. H. CHOI*	*C. Y. PARK*	*J. C. CHOI*	*JAN. 28, 2010*
2	*J. H. CHOI*	*C. Y. PARK*	*J. C. CHOI*	*FEB. 18, 2010*



Remarks

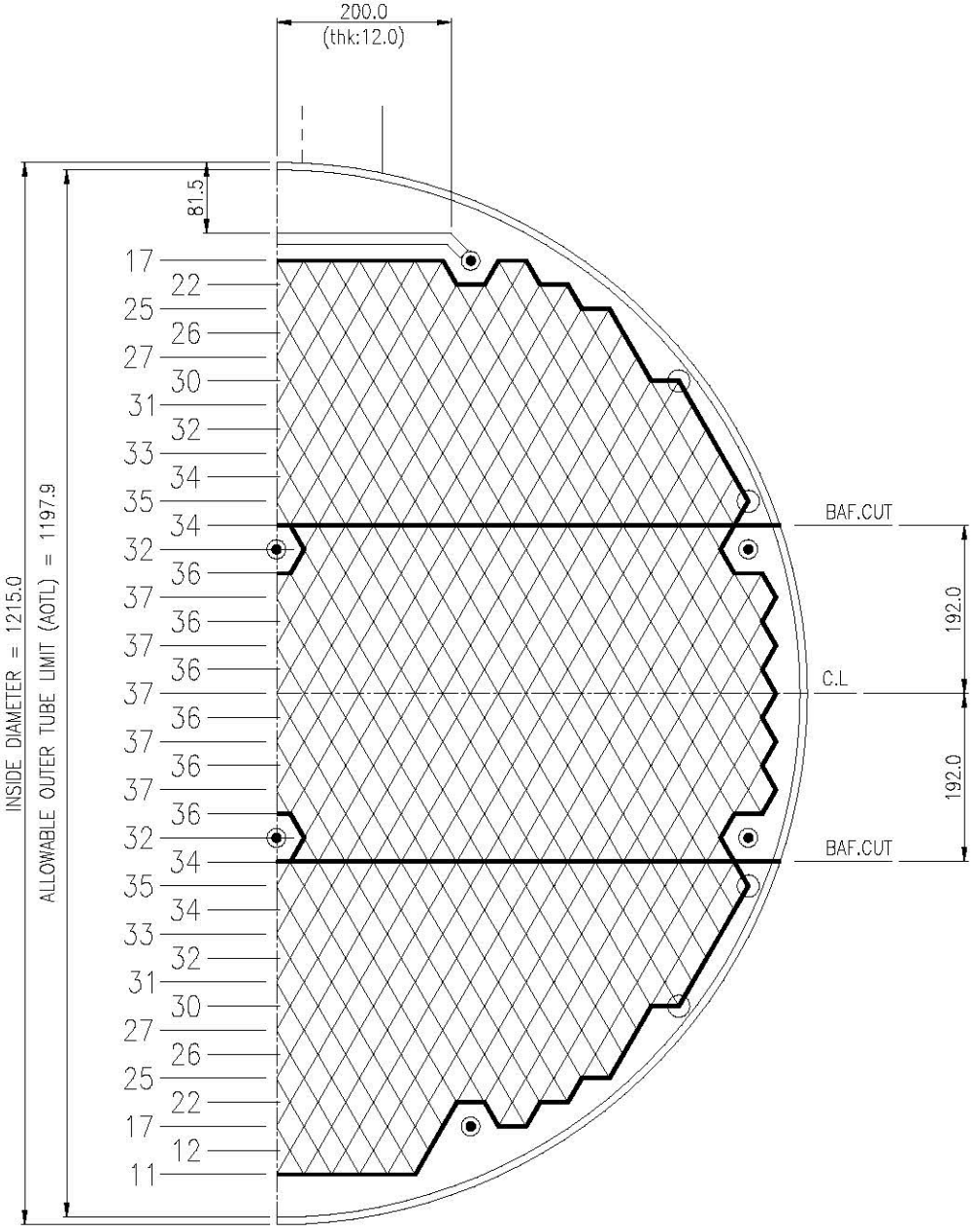
HEATRAN HEAT TRANSFER TECHNOLOGY

TUBULAR HEAT EXCHANGER

SHEET 3 OF 3

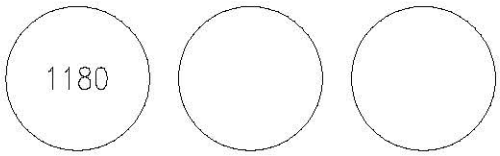
		REV	MADE BY	CHECKED BY	APPROVED BY	DATE
CUSTOMER	*ASIAN ACETYLS CO., LTD*	*0*	*J. H. CHOI*	*C. Y. PARK*	*J. C. CHOI*	*JAN. 21, 2010*
LOCATION	*Ulsan, Korea*	*1*	*J. H. CHOI*	*C. Y. PARK*	*J. C. CHOI*	*FEB. 17, 2010*
JOB NO.						
SERVICE	*HEADING COL.REBOILER*					
ITEM NO.	*E-5211*					

COORD. OF TIE-ROD
(222.3 , 494.9)
(539.8 , 165.0)
(0.0 , 165.0)
(539.8 , -165.0)
(0.0 , -165.0)
(222.3 , -494.9)
SPACER O.D : 21.7



I.D.-SHELL 1215.0(BEM)
ALLOWABLE O.T.L 1197.9
ACTUAL O.T.L 1191.1

PASS PARTITION ARRANGEMENT



NUMBER OF TUBE HOLES | FRONT END CHANNEL | REAR END CHANNEL

TOTAL 1180 HOLES FOR 25.40 OD TUBES ON 31.75 TRIANGULAR PITCH.
1 - PASS. BAFFLE CUT SINGLE SEGM. 34.2 % DIA.