

Review of Sulphuric Acid Plant Waste Heat Boiler System

Client: Technip Energies, Chennai

Project: IFFCO, Paradeep, Odisha

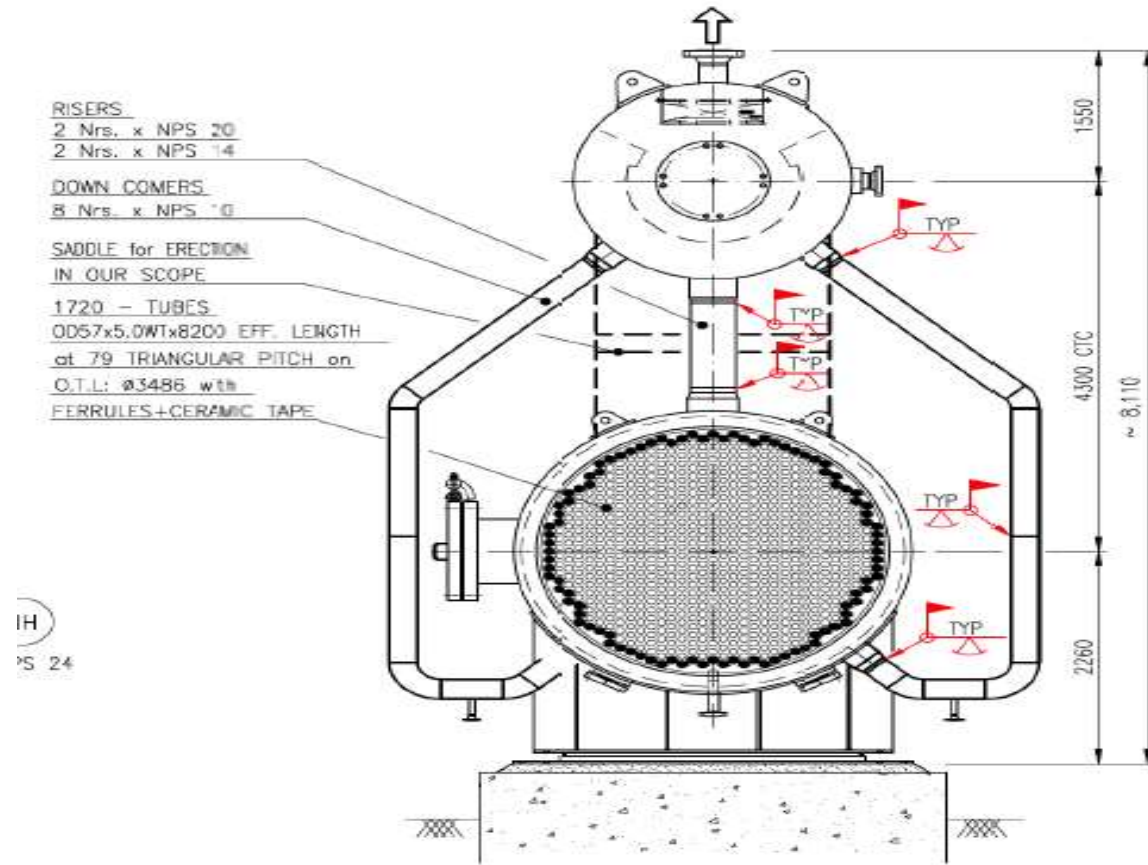
Scope Of Work:

- i) Technical Bid evaluation**
- ii) Thermal design verification**
- iii) Mechanical design verification**
- iv) Weight estimation of Pressure parts and non-pressure parts**
- v) Bill of material of Pressure parts and non-pressure parts**
- vi) Estimated cost and predicted price range**

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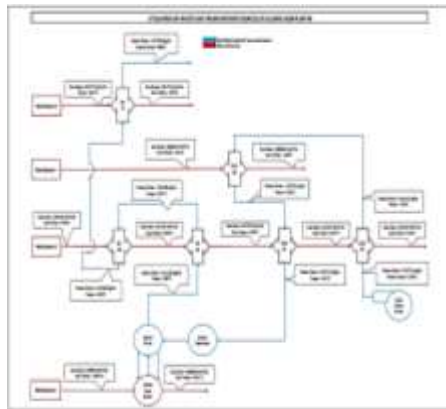
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ADVANCED ENGINEERING SERVICES			
WEIGHT COMPARISON SHEET			
Sl.No.	Description	AES Estimated Fabrication Weight in MT	TSPL provided Empty Weight in MT
1	WHB	280	280
2	Steam drum	81	85
3	Riser DC piping	6	5
4	Steam Separator	10	10
5	SUPERHEATER, 1C		
	Top Vestibule	4	4.5
	Top Tube bank	38	35
	Bottom Tube bank	43	40
	Bottom Vestibule	8	8
6	SUPERHEATER, 4B		
	Top Vestibule	4	3.5
	Tube bank	29	24
	Bottom Vestibule	5	20
7	SUPERHEATER, 5A		
	Top Vestibule	8	3.5
	Tube bank	21	28
	Bottom Vestibule	5	20
8	ECO 5C		
	Tube bank	61	60
9	ECO 5A		
	Tube bank	79	93
10	ECO 3B		
	Top Vestibule	4	3.5
	Top Tube bank	81	51
	Bottom Tube bank	29	71
	Bottom Vestibule	6	20

Project: IFFCO

Date: 08.12.2021



PROJECT NAME: IFFCO
BOILER PARAMETERS: 1 x 121 TPA @ 40 + 5 SuperStg @ 400 + 0 Deg C

SHELL THICKNESS CALCULATION - SA 191 GR. 1B

WASTE HEAT BOILER SHELL

Sl.No.	Description	Units	Value
1	Design pressure, MPa	MPa	15.1
2	Maximum Working Temperature, T1	°C	394
3	Water Temperature, T2 = T1 + 0.5 (Outside the Shell) °C	°C	394
4	WHD Shell (C)	mm	307
PROPOSED WORKING STRESS (σ = 0.7 S)			
5	σ = Allowable stress at 300 deg C	MPa	138
6	σ = Allowable stress at 250 deg C	MPa	138
7	σ = Allowable stress at water temperature	MPa	138.33
8	σ = Allowable Stress at Water temperature (From ASME Section II)	MPa	138.33
9	Thickness of WHB Shell, T1	mm	138
10	Permissible Working Stress (S)	MPa	138.33
CORROSION EFFICIENCY (CORROSIONAL CORRECTION OF BULK TUBES)			
11	C (Longitudinal) = (2 - 0.1) x		1.000
MINIMUM THICKNESS			
12	Treq. (Longitudinal) = (P x D) / (S x C)	mm	100.76
13	Rolling Allowance	mm	0.8
14	Corrosion Allowance	mm	0.8
15	Total Required thickness	mm	111.30
16	Thickness Provided, T2	mm	110
17	Allowance = T2 - Treq	mm	-1.298

ADVANCED ENGINEERING SERVICES				
THERMAL DESIGN CHECK COMPARISON				
Sl.No.	Description	Unit(s)	TSPL Provided Data	AES Output
1	WASTE HEAT BOILER SHELL			
	GAS VOLUME (includes gas bypass)	Nm ³ /hr	198984	198984
	GAS VOLUME (95% FLOW)	Nm ³ /hr	-	189034
	GAS DENSITY	kg/Nm ³	-	1.4454
	GAS FLOW (95% FLOW)	kg/hr	-	273236
	GAS INLET TEMPERATURE	°C	3094	3094
	GAS EXIT TEMPERATURE at WHB	°C	-	382
	GAS DUTY	Mkcal/hr	51.4	54.9
	BYPASS GAS FLOW (5% FLOW)	kg/hr	-	14362
	MIXED GAS TEMPERATURE	°C	405	407
	STEAM FLOW	kg/hr	121238	121238
	SATURATED STEAM INLET TEMP	°C	284	284
	SURFACE AREA	m ²	2526	2526
2	SUPER HEATER 1C			
	GAS FLOW	kg/hr	287990	287990
	GAS INLET TEMPERATURE	°C	611	611
	GAS EXIT TEMPERATURE	°C	435	435
	GAS DUTY	Mkcal/hr	12.9	12.7
	STEAM FLOW	kg/hr	121238	121238
	STEAM INLET TEMP	°C	320	320
	STEAM EXIT TEMPERATURE	°C	480	480
	STEAM DUTY	Mkcal/hr	12.9	12.7
	SURFACE AREA	m ²	2645	2637
3	SUPER HEATER 4B			
	GAS FLOW	kg/hr	212152	212152
	GAS INLET TEMPERATURE	°C	443	443
	GAS EXIT TEMPERATURE	°C	395	399
	GAS DUTY	Mkcal/hr	2.6	2.5
	STEAM FLOW	kg/hr	121238	121238
	STEAM INLET TEMP	°C	297	297
	STEAM EXIT TEMPERATURE	°C	320	318
	STEAM DUTY	Mkcal/hr	2.6	2.5
	SURFACE AREA	m ²	798	796
4	SUPER HEATER 5A			
	GAS FLOW	kg/hr	212147	212147
	GAS INLET TEMPERATURE	°C	395	395
	GAS EXIT TEMPERATURE	°C	356	359