



Hofung Sulphur  
Technology

**DATA SHEET**  
**SHELL-TUBE HEAT EXCHANGERS**

Project No. : HF220803

**Incinerator Waste Heat Boiler**

**E-0506**

1	29/06/2023	Final PDP				
0	24/03/2023	For PDP				
Rev.	Issue Data	Revision Description	Prepared by	Checked by	Approved by	Client approval
Client : Jiangsu Sopo (Group) Co., Ltd.						
Plant : Sulfur Recovery Unit						
Location : Zhenjiang, Jiangsu, P.R. China						
Equipment : Incinerator Waste Heat Boiler			Sheet 1 of 8			
			Equipment No. : E-0506			
			Data No. : HF220803-P07.2-EDS-13			



**GENERAL DATA**

Number required	: One	Case identification	: Design
Shell-and-Tube heat exchanger	: Horizontal Shell	Calculation type	: Design
TEMA type	: Special	Duty	: 1251 kW
Mech. cleaning required		Overcapacity on	
- shell side	: No	- duty	: - %
- tube side	: Yes	- surface	: - %

**PROCESS DATA**

Location	Shell side		Tube side		Unit
	BFW / Steam		Flue Gas		
Flow rate - total	2172 1) 2)		7217		kg/h
- liquid in / out	100	5	0	0	wt%
- vapour in / out	0	95	100	100	wt%
Temperature - in / out	125	253	800	300	°C
Pressure at inlet	41		0.11		bar g
Pressure drop - calculated / allowed	Negl.	Negl.	0.03	0.04	bar
Fouling resistance	0.00017		0.00090		m <sup>2</sup> .K/W
Average wall temperature	253		263		°C
Vapour properties	in	out	in	out	
- density			0.35	0.64	kg/m <sup>3</sup>
- viscosity			0.042	0.027	cp
- specific heat			1.363	1.2	kJ/kg.K
- therm. conductivity			0.087	0.049	W/m.K
Liquid properties	in	out	in	out	
- density					kg/m <sup>3</sup>
- viscosity					cp
- specific heat					kJ/kg.K
- therm. conductivity					W/m.K
Total heat duty	: 1251	kW	Total surface per unit	:	m <sup>2</sup>
Effective temperature difference	: 203.8	°C	Effective surface per unit	:	m <sup>2</sup>
Overall coefficient clean	:	W/m <sup>2</sup> .K	Required surface per unit	: 97.6	m <sup>2</sup>
Overall coefficient fouled	: 62.9 3)	W/m <sup>2</sup> .K	Number of tubes submerged	193	
Total number of shells per unit	: One				
Connected - in series	: -				
- in parallel	: -				

**NOTES**

- 1) BFW quantity includes 5% blow-down.
- 2) BFW / steam data refer to total duty of WHB after subtraction of heat losses.
- 3) Empirical value.

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**DATA SHEET**  
**SHELL-TUBE HEAT EXCHANGERS**

Project No. : HF220803

**CONSTRUCTION DATA PER SHELL**

Shell inside diameter	: 1850	mm	Num. of tube holes per tubesheet	: 193
Bundle diameter outer tube limit	: 939	mm	Type of tubes	: Bare
Number of passes shell side	: One		Tube OD (plain end)	: 38 mm
Number of passes tube side	: One		Tube wall thickness	: 5 mm
Baffle type	: Support		Tube length	: 4350 mm
Baffle cut	:	%	Tube pitch	: 57 mm
Baffle orientation	: Vertical		Tube lay-out angle	: 90 °
Tube attachment	: Strength welded		Tube sheet thickness	: ≤30 5) mm
Impingement protection below inlet nozzle	:		Baffle spacing central	: mm
	: No		Baffle spacing inlet/outlet	: mm
Number of cross passes	:			

**MAIN CONSTRUCTION MATERIAL 1)**

Part	Material	Part	Material
Shell	Carbon Steel	Channel flange - shell side	
Channel - shell	Carbon Steel	- cover side	
- head	Carbon Steel	Nozzles - shell side	Carbon Steel
Fixed tube sheet	Carbon Steel	- tube side	Carbon Steel
Tubes	Carbon Steel	Cladding / lining - shell side	
Shell flange - channel side		- tube side	see sheets 5, 6
Baffles and support plates	Carbon Steel	- tube sheets	see sheets 6, 7, 8

**DESIGN DATA**

	Shell side	Tube side	Tube sheets	Unit
Cladding / lining		See sheet 8,10	See sheet 8,10	
Corrosion allowance	1.5	3.0 2)	4.5 (3.0 + 1.5)	mm
Design pressure	48 / FV	3.0		bar g
Design temperature	290	290 3)		°C
Insulation required	Against heat loss	4)		

**NOTES**

- 1) For additional material requirements see 'Material Specification' doc.no. : HF220803-P04-MLS.
- 2) Except for tubes.
- 3) Design temperature of inlet, outlet channel and front tubesheet: 340 °C.
- 4) Insulation against heat loss of outlet channel only.
- 5) See note 1 on sheet 6 & 8.

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**NOZZLES DATA**

Mark	Number	Nom. Diameter	Service	Remarks
N1	1	ID 1150	Gas inlet	1) 4)
N2	1	ID 1000	Gas outlet	
N3	1	50	BFW inlet	2)
N4	1	80	Steam Outlet	
N5	1	50	Blow down	
N6	2	4)	Relief valve	
N7	1	50 x 20	Vent	
N8	1	50	Blow down / drain	3)
N9	1	50	Steam inlet	5)

**INSTRUMENT**

K1	2	4)	LC (H/L)	6)
K2	2	4)	LZ (LL)	6)
K3	2	4)	LG	6)
K4	2	4)	LG	6)
K5	1	4)	PG	6)

**MANHOLES ETC.**

A1	1	600	Manhole	Blinded with davit

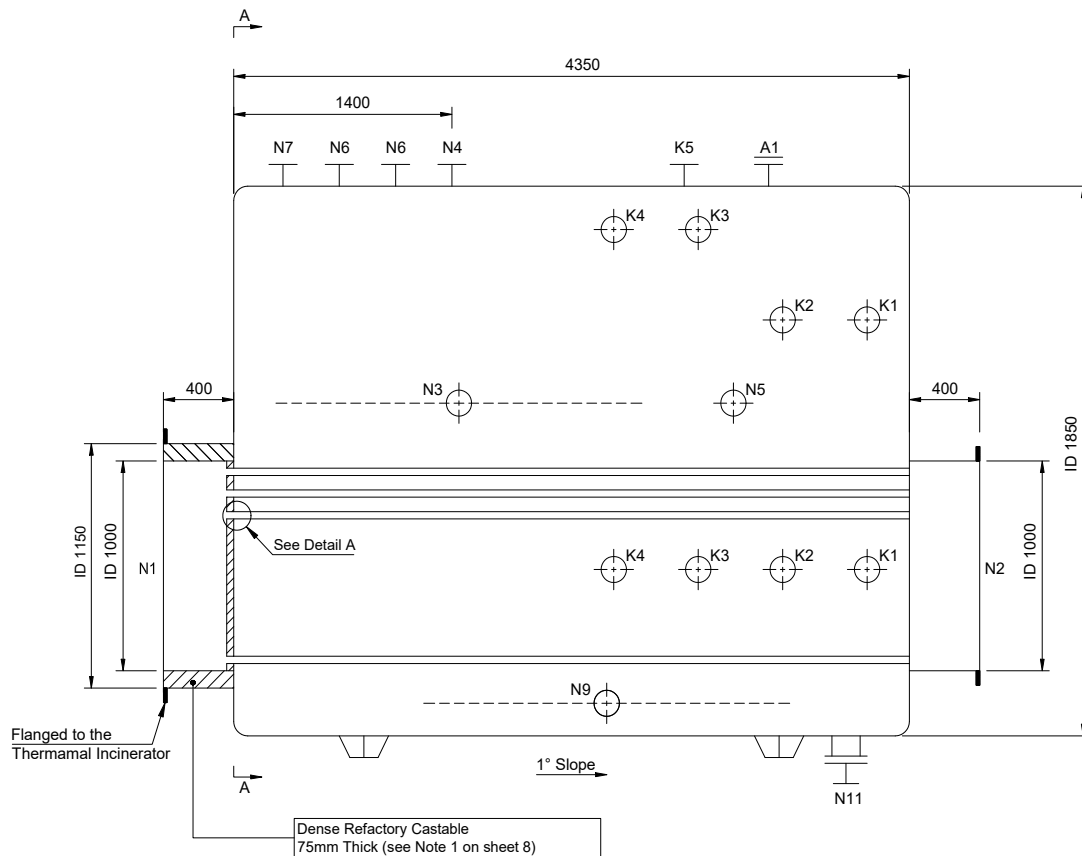
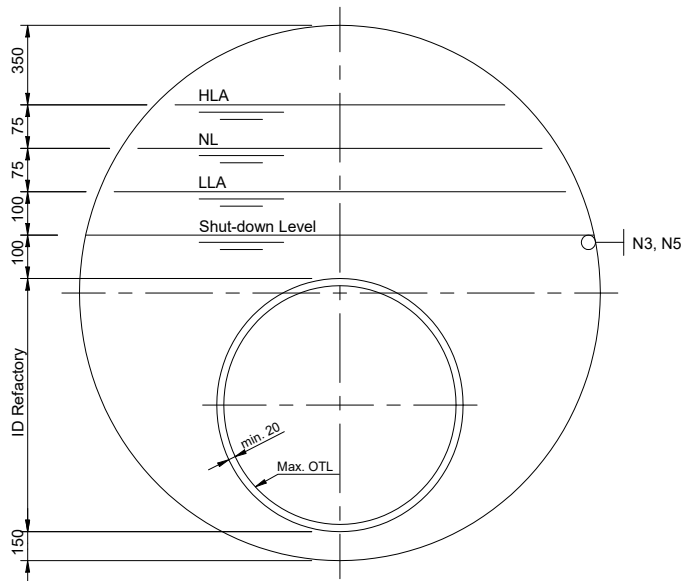
**NOTES**

- 1) Inside diameters of channel and refractory to be equal to those of the Thermal Incinerator.
- 2) With perforated distributor pipe (design by manufacturer).
- 3) On DN150 pad type nozzle.
- 4) To be determined during detailed engineering.
- 5) With perforated distributor pipe (design by manufacturer). For heating up only.
- 6) With stilling wells, located near the back end of the boiler.

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SECTION A-A



Hold for nozzle position.

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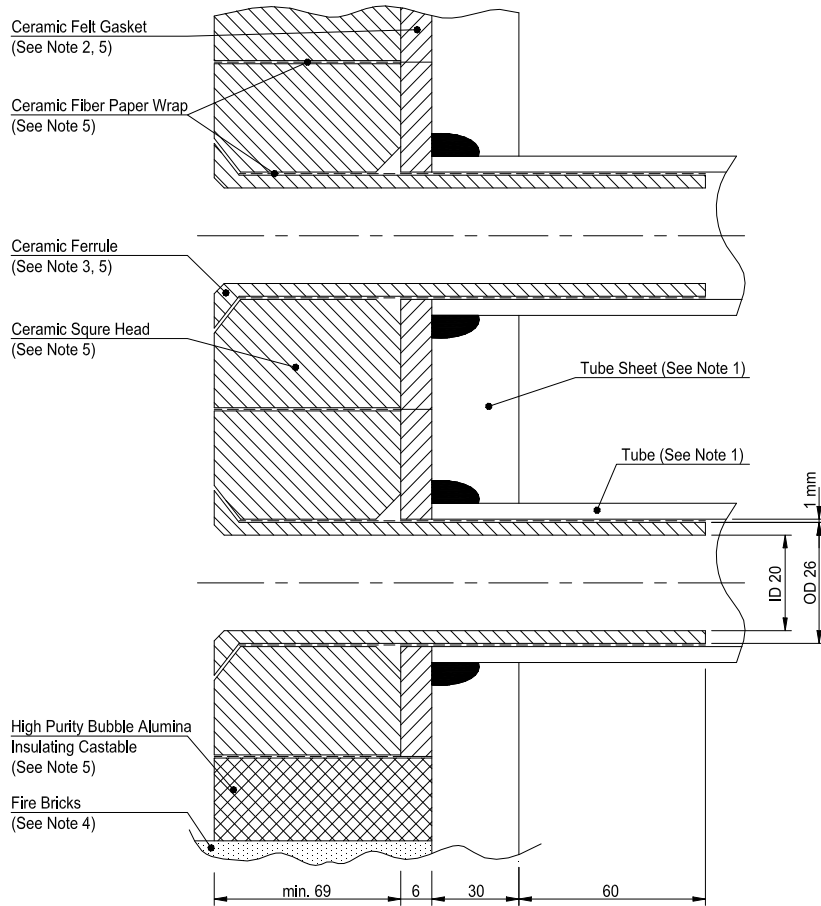
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RECOMMENDED TUBESHEET PROTECTION

Detail A  
(2-Piece Square Head Ferrule)



**NOTES**

- 1) The maximum inlet tube sheet thickness, including corrosion allowance should be 30 mm for the part covered with insulating lining. The maximum tube/tube sheet temperature shall not exceed 340 °C at specified operating data and specified protective materials. Any deviation from the above requirements shall be approved by Hofung Sulphur Technology.
- 2) The gaskets are part of supply ferrules.
- 3) The wall thickness of the ferrules shall be 3.0 mm.
- 4) Refractory identical to refractory of Thermal Incinerator..
- 5) Specification of the refractory materials as indicated on the sketch.
 

Tubesheet lining	: High purity bubble alumina insulating castable : $Al_2O_3 = 94 - 95\%$ Max. service temperature has to be min. 1750 °C
Ceramic ferrule	: Material : $Al_2O_3 = 85-94\%$ Max. service temperature has to be min. 1750 °C
Ceramic felt gasket	: Alumina-Silica fibres, density ca. 190 kg/m <sup>3</sup> Service temperature for continuous use has to be min. 1260 °C
Ceramic fibre paper	: Alumina-Silica fibres Service temperature for continuous use has to be min. 1260 °C
- 6) Recommended type of ferrule : 2 piece square head.

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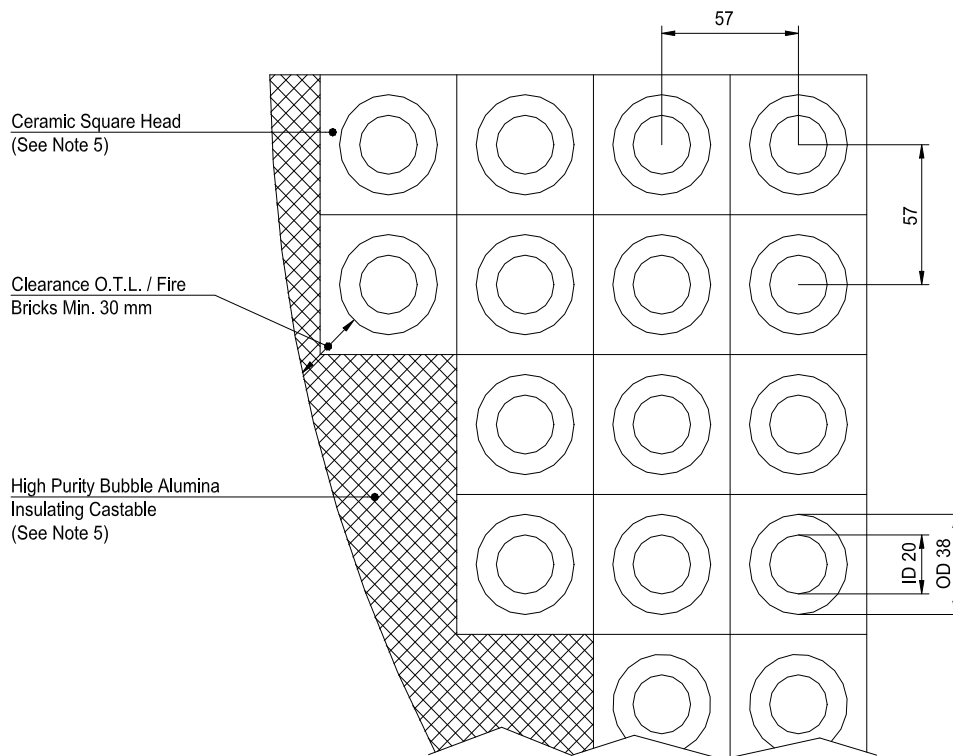
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2-PIECE SQUARE HEAD TUBE SHEET PROTECTION

Front Tube Sheet Detail



For Notes see sheet 6.

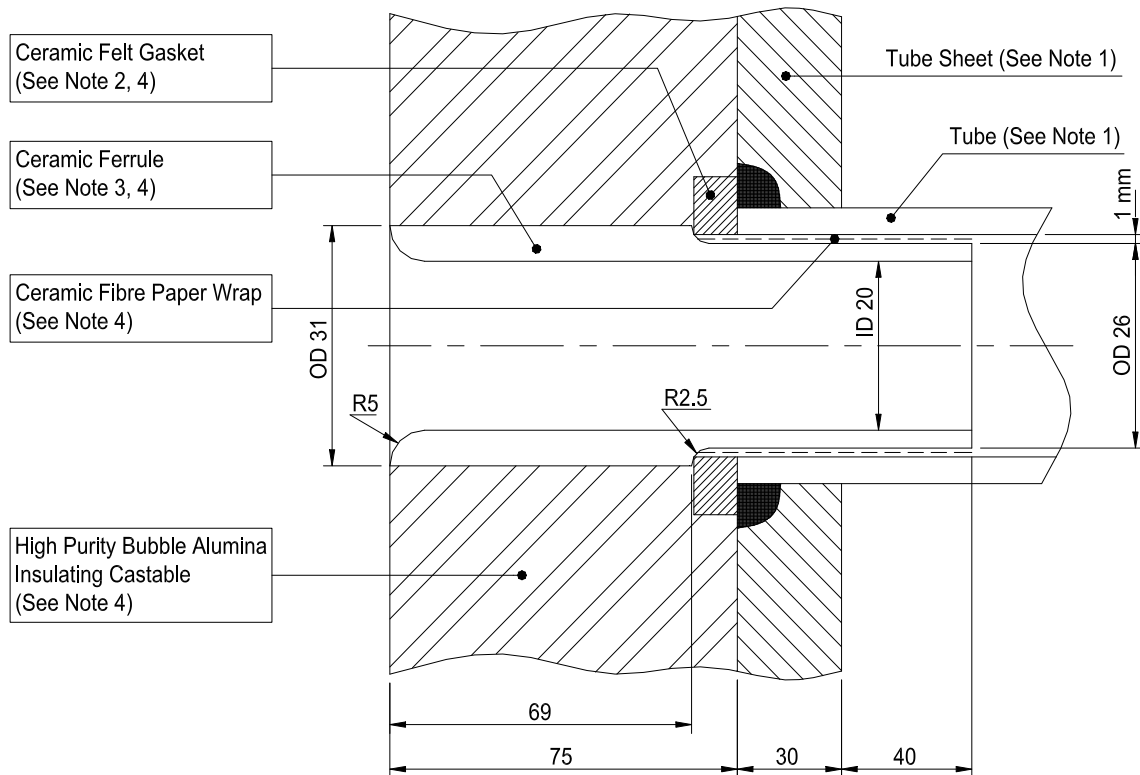
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ALTERNATIVE TUBE SHEET PROTECTION

**Detail A**

(Tube/Tube Sheet Protection at Thermal Incinerator Side)



**NOTES**

- 1) The maximum inlet tube sheet thickness, including corrosion allowance should be 30 mm for the part covered with insulating lining. The maximum tube/tube sheet temperature shall not exceed 340 °C at specified operating data and specified protective materials. Any deviation from the above requirements shall be approved by Hofung Sulphur Technology.
- 2) Dimensions of gaskets are 42 mm OD/ 28 mm ID and 6 mm thick. Any deviation from these requirements shall be approved by Hofung Sulphur Technology.
- 3) The wall thickness of the ferrules shall be 3.0 mm for the part inserted in the tubes.
- 4) Specification of the refractory materials as indicated on the sketch.
 

Tubesheet lining	: High purity bubble alumina insulating castable : $Al_2O_3 = 94 - 95\%$ Max. service temperature has to be min. 1750 °C
Ceramic ferrule	: Material : $Al_2O_3 = 85-94\%$ Max. service temperature has to be min. 1750 °C
Ceramic felt gasket	: Alumina-Silica fibres, density ca. 190 kg/m <sup>3</sup> Service temperature for continuous use has to be min. 1260 °C
Ceramic fibre paper	: Alumina-Silica fibres Service temperature for continuous use has to be min. 1260 °C

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