

## COMBUSTION CHAMBER DATA SHEET

Project	UHV Plant Project	Project No.	14640
Client	IRPC Public Company Limited	Doc. No.	DS - TR - 100
Contractor	Consortium of GS E&C and SK E&C	Date	2013. 11. 29.
Code/Standard	ASME Sec. I <span style="color: red;">1</span>	ASME Stamp	Yes
Service of Unit	Thermal Reactor	Revision	0 <span style="color: red;">1</span>
		Item No.	72 B 101 / 201 / 301
		No. of Units	3 set(s)
		Sheet No.	1 of 1

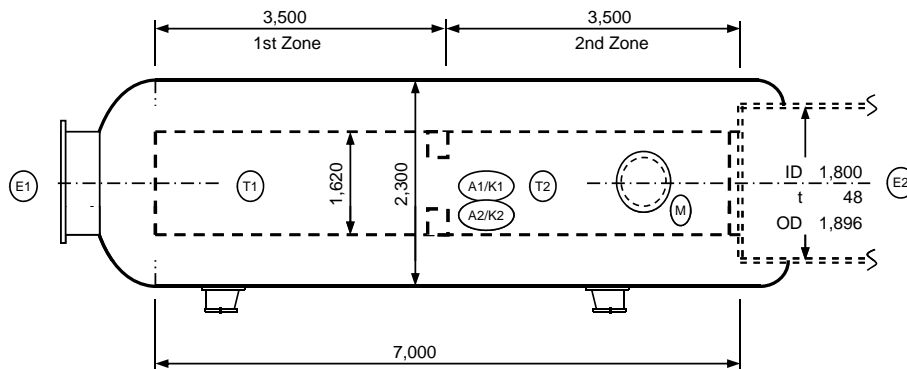
### PROCESS DATA

Medium	Process gas		
Operating Temperature Nor. / Max. °C	1,450 <span style="color: red;">1</span>	/	
Operating Pressure Nor. / Max. bar.g	0.52	/	5 (Design Pressure) <span style="color: red;">1</span>
Minimum Design Metal Temperature °C	5		
Design Temperature Lining / Shell °C	1,760 <span style="color: red;">1</span>	/	350
Design Pressure bar.g	5		
Test Pressure Hydrostatic bar.g	6.5		
Density, Process gas kg/Nm3	1.38		
Orientation	Horizontal		
Diameter, ID with / without Refractory mm	1,620	/	2,300
Length, TL-to-TL mm	7,000		
Volume with / without Refractory m3	15.2	/	31.1 <span style="color: red;">1</span>
Retention Time (Actual) <span style="color: red;">1</span> sec	1.54		*Minimum Required : 1.35 <span style="color: red;">1</span>
Cyclic Loading	No		
Corrosive Components	SO2, H2S		
Sour Gas Service / Lethal Service	No	/	No
H2 Partial Pressure bar.g	- N/A -	at	°C
R.T. Shell / Head	Full	/	Full
Corrosion Allowance Shell / Head mm	3	/	3
Refractory Brick	340	t	
Castable	- N/A -		* Only for Nozzle Lining
Heat Treatment for Process Reasons	Yes		
Insulation	No		* Thermal Shroud : Al 1 t

### MATERIALS

Shell / Head	ASME SA 516-60N	13 t	/	SA 516-60N	19 t	* 2:1 Ellipsoidal
Nozzle Neck	ASME SA 106-B					
Flange	ASME SA 105N					

### SKETCH



### NOZZLE LIST

MK	Service	Qty	Size	Type	Rating	Remark
E1	Burner Mounting Flange	1	42"	Flanged	150 lb	
E2	WHB Connection	1	- N/A -	- N/A -	- N/A -	<span style="color: red;">1</span>
T1-T2	Pyrometers Connections	2	6"	Flanged	150 lb	*1)
A1	Acid Gas	1	6"	Flanged	150 lb	
A2	Acid Gas	1	6"	Flanged	150 lb	
K1	Nozzle A1 Connection	1	10"	Flanged	150 lb	*1)
K2	Nozzle A2 Connection	1	10"	Flanged	150 lb	*1)
M	Manhole (W / Davit) <span style="color: red;">1</span>	1	24"	Flanged	150 lb	Blind

### ACCESSORIES

Ladder & Platform		by Others	
	Lifting Lug		Provided
	Name Plate		Provided
	Earth Lug		Provided
	Anchor Bolts / Nuts		Provided

LOADING DATA			
Weight	Steel Part	10,212	kg
Weight	Refractory	48,691	kg
Weight	Empty	58,902	kg
Weight	Operating	58,908	kg
Weight	Full of Water, excl. Refractory	41,303	kg

### Notes

- \*1) Refractory Lined.
- \*2)
- \*3)
- \*4)
- \*5)

## WASTE HEAT BOILER SPECIFICATION SHEET

1	Project	UHV Plant Project	Project No.	14640	
2	Client	IRPC Public Company Limited	Doc. No.	SS - WHB - 100	
3	Contractor	Consortium of GS E&C and SK E&C	Date	2013. 11. 29.	
4	Code/Standard	ASME Sec. I *1) / TEMA	ASME Stamp	Yes	
5	Service of Unit	Waste Heat Boiler	Type	Elevated Drum	
6	Size	Shell 1800 ID x 6700 L	Installation	Horizontal	
7	Surface/Unit, Eff.	258.2 Gross	263.7 m <sup>2</sup> Load	Design Case	
				Special Service	- N/A -

### PERFORMANCE of ONE UNIT

9	Fluid Allocation	Shell Side		Tube Side	
		BFW	SSH Steam	Process Gas	
		Inlet	Outlet	Inlet	Outlet
10	Fluid Name				
11	Fluid Quantity, Total	8,120	kg/h	12,074	kg/h
12	Vapor	0	7,875	12,074	12,074
13	Liquid	8,120	0	0	0
14	Blowdown		245		
15	Temperature	154	263	1,246	334
16	Density	915.7	24.92	0.36	0.94
17	Viscosity	0.179	0.018	0.05	0.03
18	Molecular Weight	18.0152		29.45	31.03
19	Specific Heat	1.029	1.050	0.42	0.28
20	Thermal Conductivity	0.590	0.047	0.09	0.04
21	Latent Heat	393.3		- N/A -	
22	Pressure, Inlet / Oper. / Inlet	48	48	0.52	
23	Velocity, i / m / o			31.7	21.9
24	Pressure Drop, Allow. / Cal'd			0.011	0.010
25	Fouling Resistance	0.0002		0.0006	
26	Heat Duty	4,060,000 kcal/h	4.06 Gcal/h	MTD	374.0
27	H. T. Rate, Clean, *1	46.2 kcal/m <sup>2</sup> .h	H. T. Area, Req., *2	234.8 m <sup>2</sup>	Cleanliness Factor
28	H. T. Rate, Service	42.0 kcal/m <sup>2</sup> .h	H. T. Area, Act., *2	258.2 m <sup>2</sup>	H. T. Area Margin
29					10.0 %

### DESIGN, MATERIALS and CONSTRUCTION of ONE UNIT

31	Design / Test Press.	Shell Side		Tube Side		SKETCH
		52	F/V	5	7.5	
32	Design Temperature ( In / Out )	295		350	(Wall)	Please refer to " General Assembly "
33	No. Passes per Shell			1		
34	Corrosion Allowance	3		3	* Tube 0	
35	Size	2"	6"	2300	22"	
36	Connections *4) Type	Flanged	Flanged	Butt W.	Flanged	
37	Rating	600 lb	600 lb	***	150 lb	

38	Tube No.	259	STR's	OD	48.3	mm	Thk, Min.	5.08	mm	Length, Eff.	6,640	mm	Pitch	80	mm
39	Tube Type	Plain		Material		SA 210-A1									
40	Shell	SA 516-60N	ID	1800	Thk	48	mm								
41	Channel	SA 516-60N	ID	2300	Thk	19	mm	Channel Cover	SA 516-60N	Thk	13	mm			
42	Tubesheet	SA 266 2		Thk	30	Inlet Tubesheet - Ferrules and Refractory : Yes									
43	Supports-Tube	SA 283-C	Q'ty	2	Thk	20	Spacing : c/c					2,250	mm		
44	Saddle	SA 283-C													

45	Expansion Joint	Channel Inlet	- N/A -	Channel Outlet	- N/A -
46	Gaskets-Shell Side	Non-asbestos			
47	Gaskets-Tube Side	Non-asbestos			
48	Insulation-Shell Side	Rockwool	150	t	Outlet Channel
49					Al
50					1 t

51	Code Requirements	ASME		TEMA Class	R
52	Weight	Empty	32,934	Operating	43,647
53	incl. Steam Drum	Empty	47,792	Operating	61,177
54				Filled with Water	46,680
55				Filled with Water	68,185

- Notes**
- \*1) ASME Sec. VIII Div. 1 is applied to tube side.
  - \*2) based on Tube Outside
  - \*3) No CA for Tube but for tube sheet 4.5mm, 3mm for process side + 1.5mm for shell side
  - \*4) Further more information refers to "General Assembly"
  - \*5)
  - \*6)
  - \*7)

## STEAM DRUM DATA SHEET

1	Project	UHV Plant Project	Doc. No.	DS - SD - 100
2	Client	IRPC Public Company Limited	Date	2013. 11. 29.
3	Contractor	Consortium of GS E&C and SK E&C	Revision	0   1
4	Code	ASME Sec. VIII Div. 1	ASME Stamp	Yes
5	Service of Unit	WHB Steam Drum	Type	Cylindrical
6	Size	ID 1250 x TL 5000	Installation	Horizontal
7		Volume, LALL ~ NOL	1.2 Full	6.6 m3

### DESIGN DATA

Load	Design Case						Shell	Head
Flowrate	Sat. Steam Out	Steam to S/H	Cont. B/D	Int. B/D	R.T.		Full	Full
kg/h	7,875	0	245	0	Joint Efficiency		1	1
	Pressure		Temperature		PWHT		Yes	
	bar.g		°C		Corrosion Allowance		3	3
Design	52		295		MDMT	°C	0	
Vacuum	F/V							
Operating	48.0		263	1	Density	Vapor	24.92	1
Test / Method	78		Hydro.			Liquid	779.3 kg/m3	
Feedwater			154					

### MATERIALS

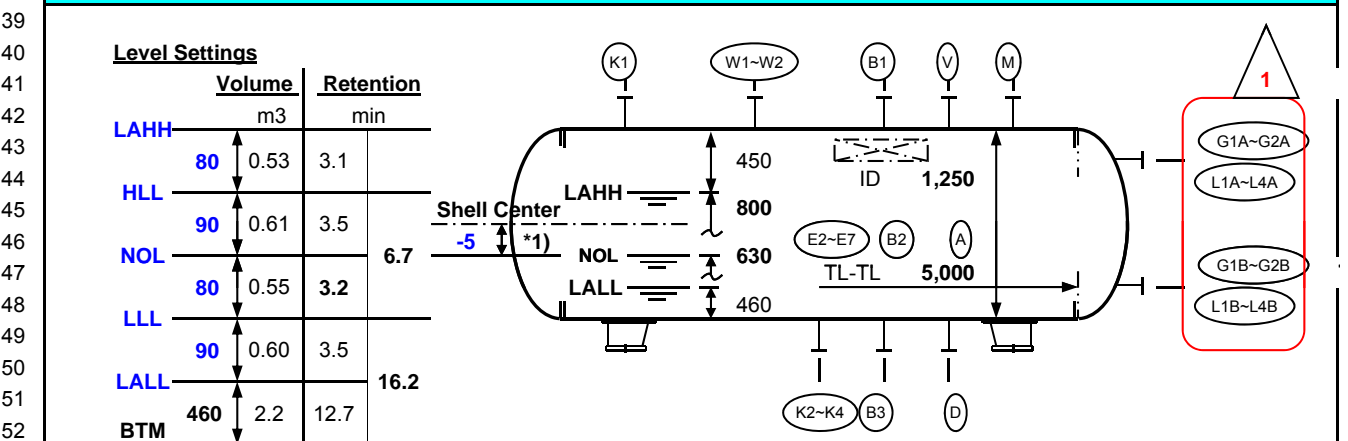
### NOZZLE LIST

Shell	SA 516-60	35 t	MK	Service	Q'ty	Size	Type	Rating
Head	SA 516-60	2:1 Ellipsoidal	40 t	A	BFW Inlet	1	2"	Flanged 600 lb
Saddle	SA 283-C			B1	Sat. Steam Out	1	6"	Flanged 600 lb
Nozzle Neck	SA 106-B			K1	Spare	1	2"	Flanged 600 lb
Nozzle Flange	SA 105			E2~E7	Downcomers	6	6"	Butt W. ***
Bolts / Nuts	SA 193-B7 / SA 194-2H			K2~K4	Risers	3	6"	Butt W. ***
Gasket	Non-asbestos			B2	Cont. B/D	1	1 1/2"	Flanged 600 lb
				B3	Int. B/D	1	1 1/2"	Flanged 600 lb
Separator	Demister	Provided	Cyclone	- N/A -	W1	PSV	1	2"
Distributor	Feedwater	Provided	Chemical Feed	- N/A -	W2	PSV	1	2"
Collector	B/D Water	Provided			G1-G2 A/B	Level Gauge	4	2"
					L1-L4 A/B	Level Transmitter	8	2"

### ACCESSORIES

Ladder	by Others	Platform	by Others				
Lifting Lug	Provided	Earth Lug	Provided				
Name Plate	Provided			V	Vent	1	3" Flanged 600 lb
Setting B/N	Provided			D	Drain	1	2" Flanged 600 lb
				M	Manhole	1	24" Flanged 600 lb

### SCHEMATIC DIMENSIONAL OUTLINE



Surf. Prep.	Inside - N/A -	Outside Sand Blasting	LOADING DATA		
Painting	Inside - N/A -	Outside Primer	Weight, Empty	11,779	kg
Insulation	by Others	Rockwool 150 t	Weight, Operating	14,396	kg
Lagging	by Others	***	Weight, Full Water	18,427	kg

57	<b>Notes</b>
58	*1) NOL is located above Shell Center line.
59	*2)
60	*3)

## STEAM DRUM DATA SHEET

1	Project	UHV Plant Project	Project No.	14640	
2	Client	IRPC Public Company Limited	Doc. No.	DS - SD - 100	
3	Contractor	Consortium of GS E&C and SK E&C	Date	2013. 11. 29.	
4			Revision	0	1
5	Service of Unit	WHB Steam Drum	Item No.	72 D 101 / 201 / 301	
6					
7			Sheet No.	2	of 2

### BOILER DESIGN DATA

9	Operating	Pressure	48	bar.g	
10		Temperature	263	°C	

### QUALITY for FEEDWATER

13	pH	8.3	~	10	
14	Dissolved Oxygen	max.	0.007	ppm	
15	Total Iron	max.	0.025	ppm	
16	Total Copper	max.	0.02	ppm	
17	Total Hardness	max.	0.2	ppm	
18	Nonvolatile TOC	max.	0.5	ppm	
19	Oily Matter	max.	0.5	ppm	

### QUALITY for BOILER WATER

22	TDS	max.	1,000	ppm	
23	Total Alkalinity, CaCO3	max.	200	ppm	
24	Suspended Solids	max.	3	ppm	
25	Silica as SiO2	max.	30	ppm *1)	
26	PO <sub>4</sub> <sup>3-</sup>	20	~	40	ppm *2)

### QUALITY for STEAM

29	TDS	max.	1	ppm *3)	
30	Quality, Dryness	max.	99.9	%	
31	Silica	max.	0.2	ppm	

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#### Notes

- 51 \*1) from ASME.
- 52 \*2) from JBMA.
- 53 \*3) The value is that corresponding to max. BW TDS. The actual value is directly proportional to the actual value of BW TDS.
- 54 \*4) Max. Allowable TDS in Feedwater, Fmax
- 55 
$$F_{max} = (B \times Rd + S \times 100) / (Rd + 100) = 31 \text{ ppm} \rightarrow \text{Divided by } 0.7 = 43.8 \text{ } \mu\text{S/cm}$$
- 56 Where, TDS Boiler Water B 1,000 ppm Steam S 0.5 ppm
- 57 Design Blowdown Rate Rd 3.11 %
- 58 \*5)
- 59 \*6)
- 60 \*7)