

ERK Eckrohrkessel GmbH

2006-01-26

Date :
Lloyd Steel Sponge Iron (Max)
 Project-No. : 05_0188
 Drawing-No. : 9883_20_Arev2.dwg
 Filename : gmk2601D
 Name : Manoj Kumar Guthikonda

General boiler data

Steam flow : 12.7 t/h Steam temperature : 490.0 °C
 Drum pressure(abs) : 76.8 bar Outlet pressure (abs) : 75.5 bar
 Saturation temp. : 292.2 °C Feed water temp. : 140.0 °C

Conduction Radiation loss : 1.49 %
 Blow down : 1.00 %
 Calculated efficiency : 81.51 % (25°C) related to LHV

Fuel data

Fuel : Waste Heat

Flue gas data

Mass flow 10.01 kg/s standard volume flow 27000 Nm³/h
 Gas density (0°C, 1.013bar) : 1.3350 kg/Nm³
 Flue gas pressure : 1013 mbar
 Composition : Volume contents Mass contents

CO ₂	17.00	25.18
H ₂ O	12.00	7.23
N ₂	67.70	63.73
O ₂	3.00	3.21
SO ₂	0.30	0.66

mean Gas- Velocity head Draft loss

	velocity [m/s]	at inlet [mbar]	Draft loss [mbar]
Economizer	11.09	0.181	0.079
Superheater 2	10.56	0.176	0.208
Superheater 1	9.49	0.165	0.425
Evaporator 1	8.22	0.180	1.108
Evaporator 2	6.51	0.128	0.861
Economizer 3	10.06	0.317	1.314
Economizer 2	9.03	0.302	4.699
Economizer 1	9.82	0.379	3.115

Project-No. : 05_0188
Filename: gmk2601D
Lloyd Steel Sponge Iron (Max)

Page 02

Temperatures after

Fouling

Fouling $k_{fouling}$
factor $[W/m^2K]$

Temp. at Gas Entr.	1000.0 °C		
Economizer	964.6 °C	0.78	300
Superheater 2	884.4 °C	0.76	300
Superheater 1	721.1 °C	0.77	300
Evaporator 1	434.0 °C	0.81	300
Evaporator 2	341.5 °C	0.83	300
Economizer 3	312.4 °C	0.77	300
Economizer 2	220.9 °C	0.78	300
Economizer 1	190.0 °C	0.77	300

Transferred heat

	Heat transfer $[W/m^2K]$	Transferred heat to			
		Heating surface		Wall surface	
		[KW]	[m ²]	[KW]	[m ²]
Economizer	64.1	397.77	8.8	66.42	1.5
Superheater 2	68.0	838.26	26.3	202.76	4.6
Superheater 1	65.8	1711.37	61.3	368.46	10.7
Evaporator 1	55.3	3105.67	219.7	382.59	27.2
Evaporator 2	50.2	952.00	219.7	116.99	27.2
Economizer 3	68.5	324.04	57.5	7.33	3.4
Economizer 2	65.1	1022.74	229.8	-0.00	13.4
Economizer 1	67.9	336.70	93.4		

Heating surfaces

	Gas pass		Pitch		Tubes Number		Tube arrangement
	length [mm]	width [mm]	cross [mm]	long. [mm]	per row	of rows	
Economizer	2076	2169	93	90	22.0	2	in line
Superheater 2	2076	2169	93	90	22.0	6	in line
Superheater 1	2076	2169	93	90	22.0	14	in line
Evaporator 1	2076	2169	93	80	23.0	40	in line
Evaporator 2	2076	2169	93	80	23.0	40	in line
Economizer 3	2070	1280	80	90	16.0	18	in line
Economizer 2	2070	1280	80	90	16.0	72	in line
Economizer 1	2070	1045	80	90	13.0	36	in line

Tubes

	Diameter [mm]	Wall thickness [mm]	Parallel Tubes	Effective Length mm
Economizer	31.75	3.66	5.0	1995.0
Superheater 2	31.75	4.50	22.0	1995.0
Superheater 1	31.75	4.50	22.0	1995.0
Evaporator 1	38.10	3.66	*****	1995.0
Evaporator 2	38.10	3.66	*****	1995.0
Economizer 3	31.75	3.66	16.0	2000.0
Economizer 2	31.75	3.66	16.0	2000.0
Economizer 1	31.75	3.66	13.0	2000.0

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Steam data

	Steam temp. [°C]		Tube wall temp. [°C]		mean veloc. [m/s]	mean spec. w. [kg/m ³]	Pressure drop [bar]
	Inlet	Outlet	Inlet	Outlet			
Superheater 2 paral. flow	398.1	490.0	424.8	513.4	16.1	24.50	0.497
Superheater 1 counterflow	292.2	448.1	469.7	307.5	12.8	29.17	0.847

Preheater

	Water temp. [°C]		Tube wall temp. [°C]		mean veloc. [m/s]	mean spec. w. [kg/m ³]	Pressure drop [bar]
	Inlet	Outlet	Inlet	Outlet			
Economizer counterflow	251.0	273.5	281.0	259.3	2.0	765.38	0.294
Economizer 3 paral. flow	231.0	251.3	232.9	252.6	0.6	813.19	0.053
Economizer 2 counterflow	163.2	231.0	232.3	164.5	0.5	874.14	0.194
Economizer 1 counterflow	140.0	163.2	164.1	141.1	0.6	919.25	0.141