

73t/hr Natural Gas / Syngas Fuelled Boiler Plant



Year of Manufacture: 2014
Condition: Unused
Operating Hours: 0 (Never Operated)
Status: Installed
Fuel: NG/Syngas

Basic Information:

The Boiler is equipped with selective catalytic reduction (SCR), where aqueous ammonia is injected for NOx reduction. Flue gases exiting the stack are continually monitored by way of the continuous emissions monitoring system (CEMS). The CEMS monitors compliance with environmental regulations.

Manufacturer: RENTECH

Year of Manufacture: 2014

Fuel: Syngas/Natural Gas

Steam Capacity: 73t/hr

Steam Temperature: 400 Deg C

Steam Pressure: 45 Bar



Furnace Input Data		Calculated Results	
Fuel Type	Gas	Heat Losses:	
Furnace Duty	193.20 MM Btu/h	Dry Gas Loss	4.47 %
Radiation Heat Loss	0.50 %	Air Moisture	0.12 %
Unaccountable Heat Loss	1.50 %	Fuel Moisture	10.32 %
Ambient Air Temperature	80 F	Radiation (input)	0.50 %
Relative Humidity	60.0 %	Unaccountable (input)	1.50 %
Excess Air	15.0 %	Efficiency -- LHV	91.81 %
Exit Gas Temperature	318 F	Efficiency -- HHV	83.09 %
Gas Recirculation	0.0 %	Flue Gas Analysis, by Volume:	
Steam Temperature	752 F	Carbon Dioxide	8.68 %
Steam Pressure	696.0 psig	Water Vapor	17.70 %
Steam Flow Rate	160937 pph	Nitrogen	71.15 %
Feed Water Temperature	219 F	Oxygen	2.46 %
Furnace Length	37.30 feet	Sulfur Dioxide	0.00 %
Furnace Height	11.00 feet	Furnace Volume	3077.2 cu.ft.
Furnace Width	7.50 feet	Furnace Surface	1523.9 sq.ft.
Tube Diameter	2.0 inch	Furnace Duty	63.39 MM Btu/h
		Furnace Temperature	2357 F
		Mixture Temperature	80 F
Fuel Analysis, by Volume:		Higher Heating Value	22050 Btu/lb
Methane	85.41 %	Lower Heating Value	19957 Btu/lb
Ethane	7.49 %	Higher Heating Value	1114 Btu/scf
Propane	2.67 %	Lower Heating Value	1008 Btu/scf
Butane	1.34 %	Fuel Flow Rate	10545 pph
Pentane	0.00 %	Air Flow Rate	194708 pph
Ethylene	0.00 %	Flue Gas Flow Rate	205252 pph
Propylene	0.00 %	FGR Flow Rate	0 pph
Butylene	0.00 %	Total Gas Flow Rate	205252 pph
Benzene	0.00 %	lb/lb Air	18.47
Tolyne	0.00 %	lb/lb Gas	19.47
Acetylene	0.00 %	Heat Release (HHV)	74046 Btu/cfh
Ammonia	0.00 %	Heat Release (HHV)	149522 Btu/sfh
Hydrogen Sulfide	0.00 %	Heat Release (LHV)	67018 Btu/cfh
Water Vapor	0.00 %	Heat Release (LHV)	135331 Btu/sfh
Nitrogen	1.05 %	Fuel HHV	232.51 MM Btu/h
Carbon Dioxide	2.04 %	Heat Flux	41594 Btu/sfh
Carbon Monoxide	0.00 %	ASME Surface	1920.1 sq.ft.
Hydrogen	0.00 %	Recirculation duct area	0.000 sq.ft.
Sulfur Dioxide	0.00 %	Recirculation duct diam	0.00 inches

Gas Data, Case 1

Boiler Input Data

Calculated Results

Gas Flow Rate In:	205252 pph	Gas Exit Temperature:	318 F
Gas Inlet Temperature:	2357 F	Gas Pressure Drop:	10.312 in H2O
Gas Inlet Pressure:	14.7 psia	Gas In Molecular Mass:	27.73
Gas Cleanness:	Clean		
Gas Inlet Composition by Volume:		Extra Gas-Side Pressure Drops:	
CO2: 8.680 %	H2S: 0.000 %	SCR/CO Pressure Drop:	0.000 in H2O
H2O: 17.700 %	H2: 0.000 %	Burner Pressure Drop:	0.000 in H2O
N2: 71.150 %	CO: 0.000 %	Stack Pressure Drop:	0.000 in H2O
O2: 2.460 %	CH4: 0.000 %	Misc. Pressure Drop:	0.000 in H2O
SO2: 0.000 %	SO3: 0.000 %	Total Gas-Side Extra	
HCl: 0.000 %	Ar: 0.000 %	Pressure Drop:	0.000 in H2O
Number of Groups:	1		
Burner Section:	0		

Group 1

Process Steam Flow Rate:	0 pph	Steam Exit Flow Rate:	160929 pph
Economizer Flow Rate:	0 pph	Steam Drum Flow Rate:	159385 pph
External Evap Flow Rate:	0 pph	Feedwater Flow Rate:	164315 pph
Blow Down Factor:	3.0 %	Blow Down Flow Rate:	4929 pph
Spray Temperature:	219 F	Spray Flow Rate:	1544 pph
Design Steam Temperature:	752 F	Steam Exit Temperature:	752 F
FW Inlet Temperature:	219 F	Saturation Temperature:	514 F
		Water Pressure Drop:	65.18 psi
Steam Pressure:	710.7 psia	Drum Operating Pressure:	769.3 psia
External Radiation Duty:	63.390 MMB/h	Total Radiation Duty:	0.000 MMB/h
Heat Loss:	0.0 %	Total Convection Duty:	128.849 MMB/h
Extra Water-Side Pressure Drops:		Total Group Duty:	192.239 MMB/h
Steam Drum to De-SH:	5.00 psi	Total Water-Side Extra	
De-SH Piping:	5.00 psi	Pressure Drop:	22.00 psi
De-SH:	5.00 psi		
Non-Return Valve:	7.00 psi	Number of Furnace Sections:	0
Number of Sections:	5	Number of Screens:	1
Spray Between Sections 2 & 3:	0	Number of Superheaters:	1
Water Enters from Section:	5	Number of Evaporators:	2
Water Exits from Section:	2	Number of Economizers:	1

Screen Section 1, , Group 1

Tube Outside Diameter:	2.000 in	Tube Inside Diameter:	1.706 in
Tube Min Wall Thickness:	0.135 in	Gas Inlet Temperature:	2357 F
Tube Length:	10.50 ft	Gas Outlet Temperature:	2272 F
Finned Tube Length:	10.50 ft	Water Inlet Temperature:	371 F
Tube ASME Material Group:	B	Water Outlet Temperature:	514 F
Number of Tubes Wide:	13	Max Tube Temp (gas in):	659 F
Number of Tubes Deep:	2	Mean Wall Temperature:	643 F
Fin Margin Temp Diff:	0 F	Max Fin Tip Temperature:	659 F
Transverse Pitch:	4.750 in	Gas PD Surface Area:	143 sft
Longitudinal Pitch:	4.000 in	Gas Pressure Drop:	0.194 in H2O
Tube Arrangement:	Inline	Water Pressure Drop:	0.000 psi
Flow Direction:		Maximum Gas Velocity:	135.1 ft/s
Number of Streams:	0	Gas Specific Heat:	0.338 B/lb-F
Outside Fouling Factor:	0.0010	Overall HT Coef (U):	22.91 B/h-sf-F
Inside Fouling Factor:	0.0010	Mean Temperature Dif:	1800 F
Number Fins per inch:	0.00	Gas HTC (hc):	20.00 B/h-sf-F
Fin Height:	0.000 in	Radiant HTC (hr):	4.75 B/h-sf-F
Fin Thickness:	0.000 in	Water HTC (hi):	2000.00 B/h-sf-F
Fin Serrated Factor:	0.000	Convection Duty:	5.895 MMB/h
Fin ASME Material Group:		Maximum Heat Flux:	49510 Btu/sf
Water In From Section:	5	Total Section Duty:	69.285 MMB/h
Water Out To Section:	2		

Superheater Section 2, Group 1

Tube Outside Diameter:	2.000 in	Tube Inside Diameter:	1.673 in
Tube Min Wall Thickness:	0.150 in	Gas Inlet Temperature:	2272 F
Tube Length:	4.75 ft	Gas Outlet Temperature:	1837 F
Tube ASME Material Group:	C	Water Inlet Temperature:	514 F
Number of Tubes Wide:	22	Water Outlet Temperature:	772 F
Number of Tubes Deep:	16	Max Tube Temp (gas out):	957 F
Fin Marginal Temp Diff:	0 F	Mean Wall Temperature:	944 F
Transverse Pitch:	4.500 in	Max Fin Tip Temperature:	957 F
Longitudinal Pitch:	4.000 in	Gas PD Surface Area:	875 sft
Tube Arrangement:	Inline	Gas Pressure Drop:	3.036 in H2O
Flow Direction:	Parallel	Water Pressure Drop:	36.552 psi
Number of Streams:	22	Maximum Gas Velocity:	188.3 ft/s
Outside Fouling Factor:	0.0010	Gas Specific Heat:	0.332 B/lb-F
Inside Fouling Factor:	0.0010	Overall HT Coef (U):	24.46 B/h-sf-F
Number Fins per inch:	0.00	Mean Temperature Dif:	1383 F
Fin Height:	0.000 in	Gas HTC (hc):	24.14 B/h-sf-F
Fin Thickness:	0.000 in	Radiant HTC (hr):	4.38 B/h-sf-F
Fin Serrated Factor:	0.000	Water HTC (hi):	406.55 B/h-sf-F
Fin ASME Material Group:		Convection Duty:	29.614 MMB/h
Water In From Section:	3	Water Velocity:	109.3 ft/s
Water Out To Section:	0		

Evaporator Section 3, Group 1

Tube Outside Diameter:	2.000 in	Tube Inside Diameter:	1.706 in
Tube Min Wall Thickness:	0.135 in	Gas Inlet Temperature:	1837 F
Tube Length:	10.50 ft	Gas Outlet Temperature:	885 F
Finned Tube Length:	10.50 ft	Water Inlet Temperature:	371 F
Tube ASME Material Group:	B	Water Outlet Temperature:	514 F
Number of Tubes Wide:	13	Max Tube Temp (gas in):	600 F
Number of Tubes Deep:	60	Mean Wall Temperature:	590 F
Fin Margin Temp Diff:	0 F	Max Fin Tip Temperature:	600 F
Transverse Pitch:	4.750 in	Gas PD Surface Area:	4288 sft
Longitudinal Pitch:	4.000 in	Gas Pressure Drop:	3.722 in H2O
Tube Arrangement:	Inline	Water Pressure Drop:	0.000 psi
Flow Direction:		Maximum Gas Velocity:	110.2 ft/s
Number of Streams:	0	Gas Specific Heat:	0.310 B/lb-F
Outside Fouling Factor:	0.0010	Overall HT Coef (U):	18.82 B/h-sf-F
Inside Fouling Factor:	0.0010	Mean Temperature Dif:	749 F
Number Fins per inch:	0.00	Gas HTC (hc):	17.47 B/h-sf-F
Fin Height:	0.000 in	Radiant HTC (hr):	2.57 B/h-sf-F
Fin Thickness:	0.000 in	Water HTC (hi):	2000.00 B/h-sf-F
Fin Serrated Factor:	0.000	Convection Duty:	60.452 MMB/h
Fin ASME Material Group:		Maximum Heat Flux:	29184 Btu/sf
Water In From Section:	5		
Water Out To Section:	2		

Evaporator Section 4, Group 1

Tube Outside Diameter:	2.000 in	Tube Inside Diameter:	1.706 in
Tube Min Wall Thickness:	0.135 in	Gas Inlet Temperature:	885 F
Tube Length:	10.50 ft	Gas Outlet Temperature:	764 F
Finned Tube Length:	9.55 ft	Water Inlet Temperature:	371 F
Tube ASME Material Group:	B	Water Outlet Temperature:	514 F
Number of Tubes Wide:	12	Max Tube Temp (gas in):	565 F
Number of Tubes Deep:	9	Mean Wall Temperature:	560 F
Fin Margin Temp Diff:	0 F	Max Fin Tip Temperature:	633 F
Transverse Pitch:	4.750 in	Gas PD Surface Area:	1947 sqft
Longitudinal Pitch:	4.000 in	Gas Pressure Drop:	1.271 in H2O
Tube Arrangement:	Inline	Water Pressure Drop:	0.000 psi
Flow Direction:		Maximum Gas Velocity:	75.1 ft/s
Number of Streams:	0	Gas Specific Heat:	0.291 B/lb-F
Outside Fouling Factor:	0.0010	Overall HT Coef (U):	12.18 B/h-sf-F
Inside Fouling Factor:	0.0010	Mean Temperature Dif:	307 F
Number Fins per inch:	2.00	Gas HTC (hc):	14.03 B/h-sf-F
Fin Height:	0.500 in	Radiant HTC (hr):	0.93 B/h-sf-F
Fin Thickness:	0.105 in	Water HTC (hi):	2000.00 B/h-sf-F
Fin Serrated Factor:	0.000	Convection Duty:	7.270 MMB/h
Fin ASME Material Group:	B	Maximum Heat Flux:	19128 Btu/sf
Water In From Section:	5		
Water Out To Section:	2		

Economizer Section 5, Group 1

Tube Outside Diameter:	1.500 in	Tube Inside Diameter:	1.173 in
Tube Min Wall Thickness:	0.150 in	Gas Inlet Temperature:	764 F
Tube Length:	11.00 ft	Gas Outlet Temperature:	318 F
Tube ASME Material Group:	B	Water Inlet Temperature:	219 F
Number of Tubes Wide:	23	Water Outlet Temperature:	371 F
Number of Tubes Deep:	14	Max Tube Temp (gas in):	481 F
Fin Marginal Temp Diff:	0 F	Mean Wall Temperature:	469 F
Transverse Pitch:	3.500 in	Max Fin Tip Temperature:	620 F
Longitudinal Pitch:	4.500 in	Min Tube Temperature:	247 F
Tube Arrangement:	Inline	Min Fin Tip Temperature:	282 F
Flow Direction:	Counter	Gas PD Surface Area:	16294 sqft
Number of Streams:	23	Gas Pressure Drop:	2.089 in H2O
Outside Fouling Factor:	0.0010	Water Pressure Drop:	6.626 psi
Inside Fouling Factor:	0.0010	Maximum Gas Velocity:	56.2 ft/s
Number Fins per inch:	5.00	Gas Specific Heat:	0.279 B/lb-F
Fin Height:	0.750 in	Overall HT Coef (U):	7.37 B/h-sf-F
Fin Thickness:	0.060 in	Mean Temperature Dif:	213 F
Fin Serrated Factor:	0.172	Gas HTC (hc):	12.20 B/h-sf-F
Fin ASME Material Group:	B	Radiant HTC (hr):	0.41 B/h-sf-F
Water In From Section:	0	Water HTC (hi):	1756.34 B/h-sf-F
Water Out To Section:	3	Convection Duty:	25.618 MMB/h
		Water Velocity:	4.8 ft/s











