



“RENTECH Boilers for people who know and care.”®

## VI. Equipment Descriptions

### A. Turbine Exhaust Expansion Joint

The expansion joint will be internally insulated fabric type with dual overlapping high temperature tab design flow liner.

### B. Bypass System

Diverter Valve

<b>Damper Type:</b>	Multi-Blade Louver Diverter Damper
<b>Size (I.D.):</b>	72" ID Round Inlet - 78"W x 78"H Outlet & Bypass (Inside Insulation)
<b>Duct Orientation:</b>	Horizontal (HRSG) – Vertical Up (Bypass)
<b>Pressure:</b>	15" W.C.
<b>Design:</b>	15" W.C.
<b>Operating:</b>	15" W.C.
<b>Flow:</b>	462,051 PPH @ 904°F
<b>Frame:</b>	CORTEN – ¼" Thk. 6" Ceramic Fiber Internal Insulation w/ 14GA 304SS Liner System
<b>Bolt Pattern:</b>	Per Customer Request – Installation Fasteners & Gasket (by Others)
<b>Blades:</b>	5 per damper
<b>Quantity:</b>	304SS - Airfoil Shape, Monocoque Design OPPOSED,
<b>Type:</b>	Suitable for Modulating Operation
<b>Operation:</b>	
<b>Shaft(s):</b>	316SS
<b>Bearings:</b>	High Temperature Graphite Sleeve – Outboard Mounted
<b>Packing Glands:</b>	3 Wrap Compression w/ Graphite Packing
<b>Linkage:</b>	Adjustable
<b>Seal(s):</b>	316 SS Jamb Seals Top & Bottom Hybrid Step & Sweep Seal & Blade Seals (2.8.F.)
<b>Finish:</b>	SSPC SP-1, 2, 3 A/R – (1) Coat High Temp Black
<b>Exterior:</b>	Unfinished
<b>Interior:</b>	
<b>Actuator:</b>	TRIAC - Pneumatic Spring Return (3.0 S.F.) 4-20mA
<b>Model:</b>	w/ Feedback Transmitter
<b>Positioner:</b>	Air Pressure: 90 Psig Min – SS Tubing & Swagelok Fittings
<b>Supply:</b>	-- Fail-to-Bypass (Vertical Up) on loss of control signal or air -- Emergency Dump Valve for Rapid Return to Fail Position
<b>Limit Switches:</b>	(6) Allen Bradley Proximity Switches – SPDT
<b>Accessories:</b>	NEMA 4 Junction Box to terminate Solenoid & Limit Switches Bottom Drain Open/Closed Lockouts 20"x20" Inspection Door
<b>Electrical Requirements:</b>	Non-Hazardous – NEMA 4
<b>Pressure Drop:</b>	1" WC Outlet – 1.5" WC Bypass
<b>Leakage:</b>	.25% (2.8.D.)



“RENTECH Boilers for people who know and care.”®

**Bypass Stack & Silencer**

Component	Description
Stack height	~36' (50' overall including diverter) includes transition from square diverter
Stack geometry	78" ID
Stack liner	N/A
Stack casing	CORTEN w/ external lagging up to silencer height to meet acoustic requirements
Silencer	Included, shop installed
Platforms/Ladders	Option included: for test port access
Test Ports	Option included: two 4" sampling ports @ 90 deg. apart
Access Door	N/A
PE stamp	N/A
Anti-vortex	Not included
Lightning protection	Lugs at base per NFPA requirements, as required

**C. Duct Burner Inlet Transition**

Ductwork will be fabricated from carbon steel outer casing, internally insulated ceramic fiber insulation, and lined with stainless steel floating inner liner.

**D. Duct Burner**

Equipment	Description	
Steel Frame, ¼"	10'0" W x 9'0" H x 24" Depth(Inside lining	
SS Lining	12 Gauge, 309 SS	A/R
Insulation	8" 2300 F Ceramic Fiber	A/R
No. of Elements	HC Element w/ RA-253 SS HC Stabilizers	3
Gauge	Header Pressure Gauge	1
Scanner	UV, Self-checking with 1" swivel mount and 3/8" Cooling Air Flex Hose (shipped loose)	3
Pilot	Duct burner Pilot	3
Igniter	High Energy Igniter with prefab cable.	3
Exciter	Igniter Exciter mounted in NEMA 4	3



“RENTECH Boilers for people who know and care.”®

Dist. Grid	12 gauge 304 SS	1
Header	6" Main Gas	1
Header	1/2" Pilot Gas	1
Header	1-1/2" Cooling Air-SS	1

**Pilot Header Gas Train-1/2":**

Description	Qty
Inlet Manual Shutoff valve	2
Inlet Wye Strainer	1
Pilot Gas PRV	1
Solenoid Safety Shutoff Valve	2
Solenoid Vent Valve	1
Manual Shutoff Vent Valve with Locking handle	1
Pilot Gas Pressure Gauge w/isolation valve – 4-1/2" Dia. Dial	1

**Main Gas Train: 4"**

Description	Qty
Manual Shutoff valve	2
Automatic Shutoff w/ proof of closure switch	2
Automatic Vent Valve w/ proof of closure switch	1
Manual Ball Valve with Locking Handle	1
Flow Control Valve w/ Electro-Pneumatic Positioner and Low Fire Position Switch and position feedback	1
Fuel Gas Low Supply Pressure Switch	1
Fuel Gas High at header Pressure Switch	1
Inlet/Outlet Gas Pressure Gauges w/ isolation valves – 4-1/2" Dia. Dial	2



*"RENTECH Boilers for people who know and care."*®

---

**Piping/Valve Rack Notes:**

- Above fuel valve train components will be mounted on a rigid steel skid.
- Inter-connecting pipe between the skid and the upstream reducing station and the local burner valves is to be provided by others.
- All wiring on valve rack shall follow NEMA 4 requirements.
- Flange rating for all valves/gas header listed above (where applicable) shall be 150 lb. Class
- We have estimated a 0.5 psig (gas) loss in the interconnecting piping between the fuel valve skid and the duct burner gas header flanged inlet. Interconnecting piping shall be supplied and designed by others.
- Interconnecting wiring between junction boxes and the BMS shall be by others.
- Valve train components are selected per NFPA 85's recommendation (2019 Edition).
- Valve train components shall be per ANSI B31.1 requirement (i.e. carbon steel bodied valves and fittings, with welded or flanged connections, and minimized threaded connections)
- Rentech supplies the various components mounted on either a free-standing structural steel support, all pre-piped and pre-wired to the maximum extent possible.
- Gas piping shall be Schedule 80 for line sizes 1-1/2" and under and Schedule 40 for line sizes 2" and larger. Line sizes 1-1/2" and under will be of socket weld construction to the maximum extent feasible. Line sized of 2" and larger will be butt-welded and/or flanged. ALSTAM has not included for hydro- testing of the quoted valve trains.

**E. Cooling Air Blower Skid Equipment Supply**

The Dual Scanner Cooling Air Blower Skid for the scanners and three (3) boiler view ports @15 scfm each. The blower assembly will include:

1. Two (2) Regenerative Blowers
2. Two (2) 1 HP TEFC Motors
3. Two (2) Inlet Air Filter/Silencer
4. One (1) Manual Valves
5. One (1) Pressure Gauge
6. One (1) Pressure Switch



“RENTECH Boilers for people who know and care.”®

## F. Evaporator

The evaporator will be an O-type arranged for a single pass by the exhaust gasses with integral steam and mud drum. The evaporator will utilize membrane wall construction throughout the side walls of the unit. The tubes will be attached to the upper and lower drums via rolling and flaring. Each tube hole will be serrated with single or multiple grooves and will be carefully cleaned and polished just before tube installation. To further assure a good tube joint, the ends of each tube will also be polished just before installation. To assure that the tubes are rolled properly, the tube wall reduction will be measured on the first 20 tubes that are rolled and on each 50th tube thereafter.

The combustion chamber (furnace) is integral to the boiler structure and is formed from water-cooled surfaces utilizing membrane wall construction. The membrane wall will be 2” tubes on 4” centers connected via ¼” membranes. The duct burner is mounted on the boiler's front wall.

There will be ONE (1) 12” downcomer connecting the steam drum and the mud drums to provide an optimal circulation ratio.

The fin material will be carbon steel with alloy steel utilized only as required by the design conditions.

The membrane wall construction will be insulated with 4” of mineral fiber insulation and protected with 20-gauge pebble grain corrugated aluminum lagging.

## G. Integral Steam Drum

The steam drum is conservatively sized for the steam flow and pressure of the unit. The drum will be sized as follows:

<b>Inside Drum Diameter</b>	54 inches
<b>Drum Length</b>	30'-0" Weld/Weld
<b>Corrosion Allowance</b>	0.0625-inch
<b>Plate Material</b>	SA-516 GR 70

<b>Water Level</b>	<b>Location from Center Line (inches)</b>	<b>Hold Time From NWL</b>
High Water Alarm (HWA)	3	1.1 min
Normal Water Level (NWL)	-2	- - -
Low Water Alarm (LWA)	-14	2.6 min
Low Water Cut Off (LWCO)	-17	3.1 min
Empty Drum	N/A	4.3 min

All other drum internal piping is also furnished as needed to make the unit operational.



*"RENTECH Boilers for people who know and care."*<sup>®</sup>

---

#### **H. Evaporator Outlet Expansion Joint**

A fabric type expansion joint will be provided at the boiler exit.

#### **I. Economizer Inlet Transition**

Ductwork will be fabricated from 1/4" carbon steel and will be externally shop insulated and lagged

#### **J. Economizer**

The finned tube economizer/heater will be arranged for a single pass by the exhaust gases. The number of flow streams will be selected to maintain high water side velocities consistent with good design practices. Economizer headers will be constructed of SA-106-B materials and the tubes will be SA-178A. Economizer assemblies will include high point vents and low point drains as required by the final design.

#### **K. Economizer Outlet Transition**

Ductwork will be fabricated from 1/4" carbon steel and will be externally shop insulated and lagged.



“RENTECH Boilers for people who know and care.”®

## L. Thermal Insulation and Casing Details

The following describes materials utilized in various portions of the heat recovery system (listed from hot face to cold face).

DUCTS AND CASING SUMMARY	Operating Temp (Hot Face)	Inner Liner		Insulation			Outer Casing		Operating Temp (Cold Face)
	Degree F	Thk	Material	Thk	Material	Density	Thk	Material	Degree F
		Inch	Type	Inches	Type	lbs/cu ft	Inch	Type	
Inlet Ducting	1050	12 Gauge	409SS	6	Ceramic	8	1/4"	Carbon Steel	140
Evaporator Section	2200	Membrane Wall		3	Mineral Fiber	8	0.04"	Corrugated Aluminum	140
Economizer Inlet	440	1/4"	CS	2	Mineral Fiber	8	0.04"	Corrugated Aluminum	140
Economizer	440	1/4"	CS	2	Mineral Fiber	8	0.04"	Corrugated Aluminum	140
Economizer Outlet	290	1/4"	CS	---	---	---	---	---	Expanded Metal Personnel Protection.

### NOTES:

1. All materials will be first quality products suitable for the surface and temperature where installed. All joints will be staggered with tight fitting butt joints. All ducts and casings are designed to withstand an internal pressure of 20" W.C. Outer surface temperature calculations are based on 100°F ambient in 0 mph wind.

The following small localized areas can be expected to exceed the average design surface temperature requirement:

- Large and small bore piping penetrations
- Test connections and wall sleeve penetrations
- Turbine exhaust expansion joint interface with the inlet duct.



*“RENTECH Boilers for people who know and care.”®*

## M. Main Stack

<b>Stack Height Above Grade:</b>	50'-0"
<b>Stack Diameter:</b>	76"
<b>Shell Material:</b>	3/16" Min. A-36 Carbon Steel
<b>Breeching Opening:</b>	One (±48" Wide x 132" High) C.L Elevation ±8'-0" A.G.
<b>False Bottom:</b>	Yes, With Drain
<b>Access Door:</b>	One at Base
<b>Test and Instrument Ports:</b>	Four 4" Diameter with Blind Flanges
<b>Vibration Isolation (Vortex Shedding Control):</b>	Not required
<b>Ground System (lightning Protection):</b>	Lugs at Base Per NFPA Requirements
<b>Corrosion Allowance:</b>	1/16" Included in Calculated Plate Thickness
<b>Inspection and Testing:</b>	100% Visual and Spot Radiograph Per ASME STS-1
<b>Windload:</b>	115 MPH ASCE 7-10/Risk Category II
<b>Seismic Load:</b>	Seismic Loads Do Not Control Design
<b>Exterior Surface Coating:</b>	SSPC-SP6 Blast and Apply 2-3 Mils of Carbozinc 11
<b>Interior Surface:</b>	None
<b>Platforms and Ladders:</b>	360° x 42" Wide Galvanized Test Platform with one 30 Ft. Galvanized Ladder With Fall Arrest System
<b>Insulation:</b>	None

## N. Ladders and Platforms

Will be provided at the following locations.

- Along Length of the Steam Drum.
- Steam Drum Ends.
- Main Stack Test Ports.





“RENTECH Boilers for people who know and care.”®

## O. Trim and Instrumentation

### Safety Relief Valves

2	Boiler		Drip pan elbows
	Superheater		Vent stacks
	Economizer		Silencer(s)
	Gags		Silencer supports
	Spring covers		

### Water Columns

1	Qty.	Level Switches			
X	Probe Type	Float Type	Column 1		Column 2
	Valves		HI-HI		HI-HI
	Process block		X HI		HI
2	Drain		X LO		LO
	Vent		X LO-LO		LO-LO

### Aux. LWCO

1	Qty.		Valves
X	Probe type		Process block
	Float type	X	Drain
			Vent

### Water Level Gage Glass

	Glass 1	Glass 2
Prismatic	1	
Flat glass		
Bi-Color		
Illuminator		
Direct vision hood		
Remote viewing hood with mirrors		
Fiber optic remote		
Valves		
Water gage	X	
Drain	2	
Vent		

### Remote Level Indicator

Probe Type	
Number of remote indicators	
Number of lights per indicator	
Valves	
Process block	
Drain	
Vent	

### Controllers / Analyzers

	Drum level controller		Conductivity analyzer (steam)
	Desuperheater controller		Conductivity analyzer (water)
	Desuperheater		PH analyzer (water)
	O2 Analyzer		COe (Combustibles)

### Flow Elements

Service	Orifice Plate	Flow Nozzle	Venturi	Piezometer
Steam	1	0	0	0
Water	1	0	0	0
Combustion air	0	0	0	0
Flue gas	0	0	0	0
Fuel gas	1	0	0	0
Fuel oil	0	0	0	0

Flow elements on steam, water or fuel lines are supplied loose for installation in customer's piping.



“RENTECH Boilers for people who know and care.”®

**Sootblowers – Qty.**

Service	Retractable	Manual Rotary	Electric Rotary	Controls
Boiler	0	0	0	Motor starters
Superheater	0	0	0	Piping
Economizer	0	0	0	

Description	PG	PT	TG	TT	TC/TW	PS	LT	FT
<b>Flue Gas</b>								
GT Outlet	1				1	1		
Fresh Air Fan inlet								
Fan discharge								
Burner outlet					1			
Across HRSG		1dP						
HRSG outlet								
SH inlet								
SH intermediate								
SH outlet								
HRSG outlet								
Economizer inlet	1				1			
Economizer outlet	1	1			1			
Across SCR								
<b>Water</b>								
Upstream control valve station			1			1		1
Downstream control valve station								
Upstream economizer	1				1			
Downstream economizer			1		1			
<b>Steam</b>								
Boiler outlet								1
SH Interstage								
SH outlet								
Steam drum	1	1				2	1	
<b>Continuous blowdown</b>								
<b>SH Tubes</b>								
<b>Fuel</b>								
Gas					1			1
Oil								

PG = Pressure Gauge  
 PT = Pressure Transmitter  
 TG = Temperature Gauge  
 TT = Temperature Transmitter

TC/TW = Thermocouple/Thermowell  
 PS = Pressure Switch  
 LT = Level Transmitter  
 FT = Flow Transmitter



“RENTECH Boilers for people who know and care.”®

Valves	Qty.	Manual	Actuated
Feedwater			
Stop	1	X	
Check	1	X	
Level control	1		X
Control valve block	2	X	
Control valve by-pass	1	X	
Control valve drain	2	X	
Economizer block			
Economizer by-pass			
Steam non-return	1	X	
Steam stop	1	X	
Free blow drain	1	X	
Continuous blowdown control	1	X	
Continuous blowdown block	1	X	
Intermittent blowdown	4	X	
Boiler vent	1	X	
Chemical feed block	1	X	
Chemical feed check	1	X	
Superheater start-up			
Start-up block			
Superheater vent			
Superheater drain			
Economizer vent	1	X	
Economizer drain	2	X	
Sootblower steam block			
Desuperheater spray water			
Control valve			
Control valve block			
Control valve drain			
Power operated block			
Stop valve			
Check valve			
Boiler drain			
Steam sample	2	X	
Water sample	1	X	
Acid clean			



*“RENTECH Boilers for people who know and care.”®*

## **P. HRSG BMS/BCS Control System**

The control system will provide the following features:

- UL508A listing for the US and Canada (UL certification file# E330791)
  - UL listing for hazardous locations is available; see option D.2.b below
- Wiring will be per the NEC, the latest edition for industrial machinery
- System design is per NFPA 85 and FM Global, the latest editions
- Wiring will be permanently labeled using Brady wire markers.
- All I/O cards are individually fused with blown fuse indicators.
- Boiler Control
  - Burner Management System (BMS) is designed for the following:
    - PLC-based Burner Management System (BMS)  
BMS safety limits are 120Vac, 1oo1 discrete
    - Ethernet communication to the plant control system
    - Six elements (unison fired) HRSG
      - (1) Single double block and bleed for the pilot
      - (2) Single double block and bleed for the main gas
      - (3) Elements are not individually controlled
      - (4) Loss of flame on any element shuts down all of the elements
    - Single fuel (natural gas)
    - Gas turbine interface for safety shutdowns and purge timing
    - Current burner status and flame signal
    - 1<sup>st</sup> out annunciation and graphic display of the interlock initiating a trip
    - Watchdog timer for processor validation
    - Master fuel trip
  - Combustion Control System (CCS) is designed for the following:
    - Steam pressure control
    - Hardwired interface to the DCS
    - Ethernet communication to the plant control system
    - Duct burner gas valve control
    - Three-element drum level
  - HMI touch screen with the following screens (minimum):
    - Comprehensive control functions
    - Equipment displays with dynamic graphics
    - All interlocks
    - First out annunciation, events, and alarms will be displayed on the HMI
- Full control simulation setup for FAT in Wentworth, NH
- Documentation scope of supply:
  - Submittal & O&M
    - Cabinet general arrangement drawing
    - Bill of materials
    - Electrical schematics
    - A system I/O list



“RENTECH Boilers for people who know and care.”®

- A written sequence of operations/control narrative
- BMS Shutdown Key
- SAMA diagram
- FAT procedure
- O&M
  - DCS interface map (arrays) with IP addresses
  - HMI screenshots

**Equipment Manufacturer List:**

Panel components manufacturer listing:

1.	Enclosure & Subpanel	Hoffman
2.	PLC	Allen Bradley / Rockwell
3.	HMI	Allen Bradley / Rockwell
4.	Field terminals	Allen Bradley / Rockwell
5.	Circuit Protection	Allen Bradley / Rockwell
6.	Lights & Switches	Allen Bradley / Rockwell
7.	Relays	Allen Bradley / Rockwell
8.	Conductivity Relays	SSAC
9.	Alarm horn and strobe	Federal
10.	Wiring ducts	Panduit
11.	Wire	MTW tinned copper conductors sized for circuit amperage



“RENTECH Boilers for people who know and care.”®

### Boiler Control Equipment List:

Boiler control selected options:

1.	System:	Saturated Steam Unison Fired 6-Element HRSG
2.	Misc Panel Components:	GFCI outlet for laptop use, LED enclosure light, field terminals, wiring ducts (segregated by voltage), 24Vdc power supply, and circuit protection
3.	Mounting Style:	Free Standing - Type 4 (approx. 74" oah x 48" w x 18" d)
4.	Flame Scanner:	One per element (6 total)
5.	I/O - Discrete:	120 Vac
6.	Processor CCS:	CompactLogix hardware – preliminary (1) 1769-L27ER w/ 4AI, 2AO, 16DI, 16DO (2) 1769-IA16 (1) 1769-OW8I
7.	Processor BMS:	CompactLogix hardware – preliminary (1) 1769-L27ER w/ 4AI, 2AO, 16DI, 16DO (2) 1769-IF4XOF2
8.	HMI:	10" PV+ (series 7, B)
9.	Ethernet Switch:	Unmanaged Switch
10.	DCS Interface:	Ethernet/IP
11.	Pushbuttons, 30mm:	1. E-Stop (Push-Pull) 2. Burner start (green) 3. Burner stop (red) 4. Alarm Silence
12.	Selector Switches, 30mm:	None
13.	Pilot Lights, 30mm:	Lockout Light (Push to Reset)
14.	Water Level Conductivity Relays:	High water alarm, low water alarm, low water cutout, and aux. low water cutout
15.	Alarm System:	Alarm horn and silence pushbutton



“RENTECH Boilers for people who know and care.”®

**Field device interface list:**

Burner Management System Interface:

	Qty	Description	BMS Input	BMS Output	Notes
<b>Water and Steam Limits</b>					
1.	1	Excess boiler pressure	120V		
2.	1	High boiler pressure	120V		
3.	1	High water alarm	120V		Alarm only
4.	1	Low water alarm	120V		Alarm only
5.	1	Low water cutout	120V		
6.	1	Aux. low water cutout	120V		
7.	1	Low water cutout momentary bypass for boiler blowdown	120V		Trip after 2 minutes
<b>Ignition</b>					
8.	1	Ignition transformer		120V	Each output status is always monitored
9.	3	Pilot gas valves, double block, and bleed		120V	
<b>Main Gas Train</b>					
10.	1	Gas FCV low fire	120V		
11.	1	High main gas pressure	120V		
12.	1	Low main gas pressure	120V		
13.	2	Gas safety shutoff valve proof of closures	120V		
14.	3	Main gas valves, double block, and bleed with proof of closures		120V	Each output status is always monitored
<b>Gas Turbine Interface</b>					
15.	1	Turbine exhaust flow	4-20mA		
16.	1	Turbine running	120V		
17.	1	Waste heat ready	120V		
18.	1	Turbine start permissive		Relay	
19.	1	Turbine ignition permissive		Relay	
20.	1	Turbine shutdown		Relay	
<b>Flue Gas</b>					
21.		None			
<b>Misc. Limits</b>					
22.	1	Low scanner cooling air pressure	120V		
23.	1	Remote emergency stop	120V		
24.	1	Low instr. air pressure	120V		
25.	6	Flame scanner	120V		The scanners need to have dry contacts for flame proving



“RENTECH Boilers for people who know and care.”®

Combustion Control System Interface:

	Qty	Description	BCS Input	BCS Output	Low Fire Switch	Purge Switch	Notes
Plant Master or DCS interface							
1.	1	Firing-rate demand	4-20mA	---	---	---	From DCS
2.	1	Remote Burner start	24Vdc	---	---	---	From DCS
3.	1	Duct burner firing	---	Relay	---	---	To DCS
Water and Steam Monitoring and Control							
4.	1	Steam pressure	4-20mA	---	---	---	
5.	1	Water level	4-20mA	---	---	---	
6.	1	Steam flow	4-20mA	---	---	---	
7.	1	Feedwater flow	4-20mA	---	---	---	
8.	1	Feedwater valve	---	4-20mA	---	---	
Natural Gas Train							
9.	1	Main gas FCV	---	4-20mA	Y	N	
Flue Gas							
10.		None					
Misc. Monitoring							
11.	6	Flame intensity	4-20mA				From the scanners





“RENTECH Boilers for people who know and care.”®

## VII. Performance Guarantees

### A. HRSG Thermal Performance

DESCRIPTION	UNITS	59 °F Ambient - 100% GT Load - Fired	59 °F Ambient - 100% GT Load - Unfired
<b>HP Steam and Water Side</b>			
Steam Flow *	lb/hr	200,000	64,600
Steam Pressure after NRV	Psig	150	150
Steam Temperature *	°F	Sat.	Sat.
<b>Feedwater Water Side</b>			
Feedwater Inlet	°F	228	228
<b>Gas Turbine Performance</b>			
Gas Turbine Flow	lb/hr	414,604	414,604
Gas Turbine Temperature	°F	923	923
<b>Combustion Turbine Exhaust Analysis</b>			
CO2	(% volume)	3.00	3.00
H2O	(% volume)	6.82	6.82
N2	(% volume)	74.99	74.99
O2	(% volume)	14.28	14.28
Ar	(% volume)	0.9	0.9
Gas Side Pressure Drop *	(inches W.C.)	9.0	9.0
Duct Burner Heat Input *	MMBtu/hr	137.3	---
Burner NOx *	Lb/MMBtu-HHV	0.08	---
Burner CO *	Lb/MMBtu-HHV	0.08	---
Burner VOC *	Lb/MMBtu-HHV	0.01	---
PM-10	LB/MMBtu-HHV	0.01	---

#### Notes:

1. The blowdown rate is 2%.
2. Performance is calculated at site ambient pressure for guarantee point.
3. Feedwater analysis based on suggested Water Quality Limits per latest edition of ASME.
4. The steam conditions are at the RENTECH terminal points.
5. The RENTECH Guarantees are marked with an asterisk (\*).
6. Performance Tests – **By Others**
7. Based on 0 °C Ambient Condition and LHV basis.