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670-X

March 22, 2013

Mr. David F. Garcia
Acting Director
Multimedia Planning and Permitting Division
U.S. Environmental Protection Agency – Region 6
1445 Ross Avenue
Suite 1200
Dallas, TX 75202-2733

**Re: Supplemental Information - Response to February 12, 2013 Discussions with EPA Staff
Application Completeness Determination for Corpus Christi Liquefaction, LLC
Greenhouse Gas Prevention of Significant Deterioration Permit
Corpus Christi Liquefaction Terminal**

Dear Mr. Garcia:

On August 31, 2012, Corpus Christi Liquefaction, LLC (CCL) submitted a Greenhouse Gas (GHG) Prevention of Significant Deterioration (PSD) permit application to the U.S. Environmental Protection Agency (EPA) Region 6 for the CCL Terminal. On December 20, 2012, the EPA sent an "incompleteness letter" to CCL, which included comments on the GHG Application for the CCL Terminal. On January 14, 2013, CCL provided a response to the EPA comments on the GHG Application.

On February 12, 2013, CCL representatives met with EPA Region 6 staff to discuss the incompleteness letter and CCL's responses. During the meeting, EPA staff verbally requested additional information and clarification on some of CCL's responses. The attachment to this letter includes supplemental information to address questions and comments provided by EPA staff during the subject meeting. With the filing of this supplemental information, CCL believes that it has provided the EPA with all necessary information to declare the above-referenced permit application administratively complete.

Should you have any questions about this filing, please feel free to contact the undersigned at (713) 375-5000.

Respectfully submitted,

Andrew J. Chartrand
Corpus Christi Liquefaction, LLC

Attachment

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Comment 2

Being mindful of EPA's PSD and Title V Permitting Guidance for GHG dated March, 2011 on page 17 which states the following:

"The CAA and corresponding implementing regulations require that a permitting authority conduct a BACT analysis on a case-by-case basis, and the permitting authority must evaluate the amount of emissions reductions that each available emissions-reducing technology or technique would achieve, as well as the energy, environmental, economic and other costs associated with each technology or technique. Based on this assessment, the permitting authority must establish a numeric emissions limitation that reflects the maximum degree of reduction achievable for each pollutant subject to BACT through the application of the selected technology or technique. However, if the permitting authority determines that technical or economic limitations on the application of a measurement methodology would make a numerical emissions standard infeasible for one or more pollutants, it may establish design, equipment, work practices or operational standards to satisfy the BACT requirement."

In addition to the proposed tons per year emission limit provided in the permit application, please propose output based or efficiency based limits for all GHG emission sources (e.g., lb or ton CO₂/Bscf natural gas processed or Heat Required (MMBtu)). Please provide an analysis that substantiates any reasons for infeasibility of a numerical emission limitation. For the emission sources where numerical emission limitations are infeasible, please propose an operating work practice standard that can be practically enforceable.

Response

For the 18 refrigerator compressor turbines, Corpus Christi Liquefaction, LLC (CCL) proposes an emission limit of 0.058 ton CO₂/MMBtu. CCL has reviewed short-term limits from approved GHG permits and has found that the limit of 0.058 ton CO₂/MMBtu is consistent with the limits in other approved permits. CCL believes that this limit is practically enforceable on a short-term basis. Therefore, CCL is proposing to maintain the limit of 0.058 ton CO₂/MMBtu in addition to the hourly and annual CO₂ emission limits proposed in the permit application.

For the thermal oxidizers, CCL proposes an emission limit of 57.8 ton CO₂/MMscf burned in the thermal oxidizer. This value includes the volume of the fuel gas and waste gas streams. Compliance monitoring for the thermal oxidizers will be provided by measurement of fuel gas and waste gas volumetric flow rates. Heat input in MMBtu/hr (based on gas quality analyses) will be used to calculate CO₂, CH₄ and N₂O emissions. The thermal oxidizer combustion and exhaust temperatures, as well as exhaust oxygen content, will be monitored to ensure proper operation of the thermal oxidizers. Additional information is provided in the response to Comment 7.

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Compliance monitoring for the flares will be provided by measurement of fuel gas and waste gas volumetric flow rates. Heat input in MMBtu/hr (based on gas quality analyses) will be used to calculate CO₂, CH₄ and N₂O emissions, in accordance with 40 CFR §98.253. On a monthly basis, operator records will be used to verify the measured flow rates and calculations. The flares shall be designed and operated in accordance with 40 CFR §60.18.

Fugitive emissions of GHG, primarily methane, have been estimated based on the preliminary count of components in methane service and emission factors provide from the TCEQ document entitled "Air Permit Technical Guidance for Chemical Sources: Equipment Leak Fugitives, October 2000", using SOCMI average emission factors. Compliance assurance for fugitive emissions will be provided by implementation of a modified form of TCEQ 28M leak detection and repair (LDAR) program of methane, as discussed in the response to Comment 9.

As indicated in the application, the standby generators and firewater pumps are intermittent sources that will operate for maintenance and testing purposes no more than 52 hours/year each. As stated on pages 9-19 and 9-20 of the permit application, air/fuel ratio controllers and oxygen trim will be used to monitor operational efficiency.

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Comment 6

On page 6-1 of the permit application, it is stated that "Because these gas turbines will be used for compression, they will have variable operating characteristics and hotter exhaust temperatures and cannot be compared to turbines used in electric generation." Will there be heat recovery utilization on the gas turbines exhaust? If so, please supplement the process description with the details of this heat recovery and how it will enhance efficiency. What is the proposed monitoring, recordkeeping and compliance strategy to ensure heat transfer efficiency?

Response

Waste heat recovery is provided on the ethylene gas turbines exhaust (two turbines in each train for a total of six turbines). The waste heat recovery units (WHRUs) provide needed process heat to:

- *regenerate the amine solution which is used to remove CO₂ from the inlet gas;*
- *regenerate the molecular sieves used to remove water (dehydration) from the inlet feed gas; and*
- *provide heat to the reboiler for the Heavies Removal Unit (HRU) which is used to remove heavies from the feed gas that could freeze in the cryogenic sections of the trains.*

By using WHRUs, additional fired heaters are not required. The WHRUs enhance efficiency of the trains by reducing overall energy requirements and eliminating emissions by not utilizing fired heaters.

Attachment 6 provides a sketch of the instrumentation and control philosophy for the WHRUs. Data is routinely stored on the Distributed Control System (DCS) data logger for historical analysis if required. Heat transfer effectiveness of the WHRU will be routinely monitored by plant operations personnel. Any loss of performance of the WHRUs will be noted by a decrease in temperatures required for the gas dehydration, CO₂ removal and HRU systems. Overall train efficiency is continuously monitored and recorded. Any appreciable drop in overall train efficiency is immediately evaluated and corrective measures taken as appropriate to address the identified cause of efficiency loss.

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Comment 7

In the CO₂, CH₄, and N₂O BACT Analysis for the thermal oxidizers in the permit application, it is stated that "the thermal oxidizers will be designed with efficient burners." If "efficient" here refers to energy efficiency or lower relative GHG intensity, please provide comparative benchmark data on the efficiency of proposed burners to existing or similar burners used in thermal oxidizers. Also, it is stated that the control of O₂ will be based on O₂ analyzers to assure high efficiency combustion. Will there be continuous monitoring of CO₂? Also, it is stated that "design energy efficiency measures" may be included in the proposed thermal oxidizer to increase combustion efficiency. Please clarify if the "design energy efficiency measures" will or will not be included and what will it entail. Please provide comparative benchmark data of these design measures of the proposed thermal oxidizer to similar or existing sources.

Response

As stated in Section 7.2 of the application, the efficiency refers to benzene destruction which is 99.9 %. Attachment 7A includes a PFD showing the destruction efficiencies. CCL has selected a low NO_x burner which will ensure the destruction of benzene and is described in Attachment 7B. Benchmarking data for this thermal oxidizer is not currently available to our knowledge. Fuel and operational efficiency measures are incorporated into the plant monitoring and control computer system. There will be continuous monitoring of the oxidizers performance (by monitoring the firebox exit temperature and exhaust oxygen concentration) to ensure destruction of VOCs. There will not be continuous CO₂ monitoring. Attachment 7C depicts the arrangement of a typical regenerative thermal oxidizer. However, there will be periodic emissions testing to ensure compliance with applicable regulations. To further enhance the fuel efficiency of the oxidizer, there is waste heat recovery in the oxidizer exhaust to heat the hot system used in the liquefaction process.

There are no MACT standards for benzene applicable to the proposed CCL facility.

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Comment 9

On page 9-21 of the permit application, it is stated "the most stringent control technology, instrumented leak detection and repair (28 VHP), is selected as BACT and further evaluation under Step 4 is not required." The five-step BACT analysis requires the top control such as TCEQ 28LAER program along with other possibilities of reducing fugitives emissions and leaks to be considered. Was 28LAER considered as the highest control and if so, why was it eliminated?

Response

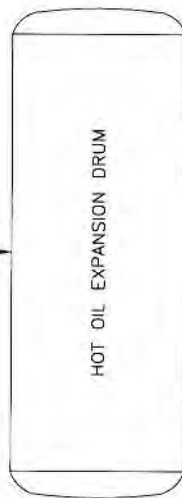
28LAER was not originally considered as it is not required by the TCEQ for control of VOC emissions from fugitive components. 28LAER will be implemented on the fugitive streams that contain greater than 10% VOC. For fugitive streams in methane service, a modified form of TCEQ 28M leak detection and repair (LDAR) program will be implemented for fugitive emissions of methane.

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ATTACHMENT 6

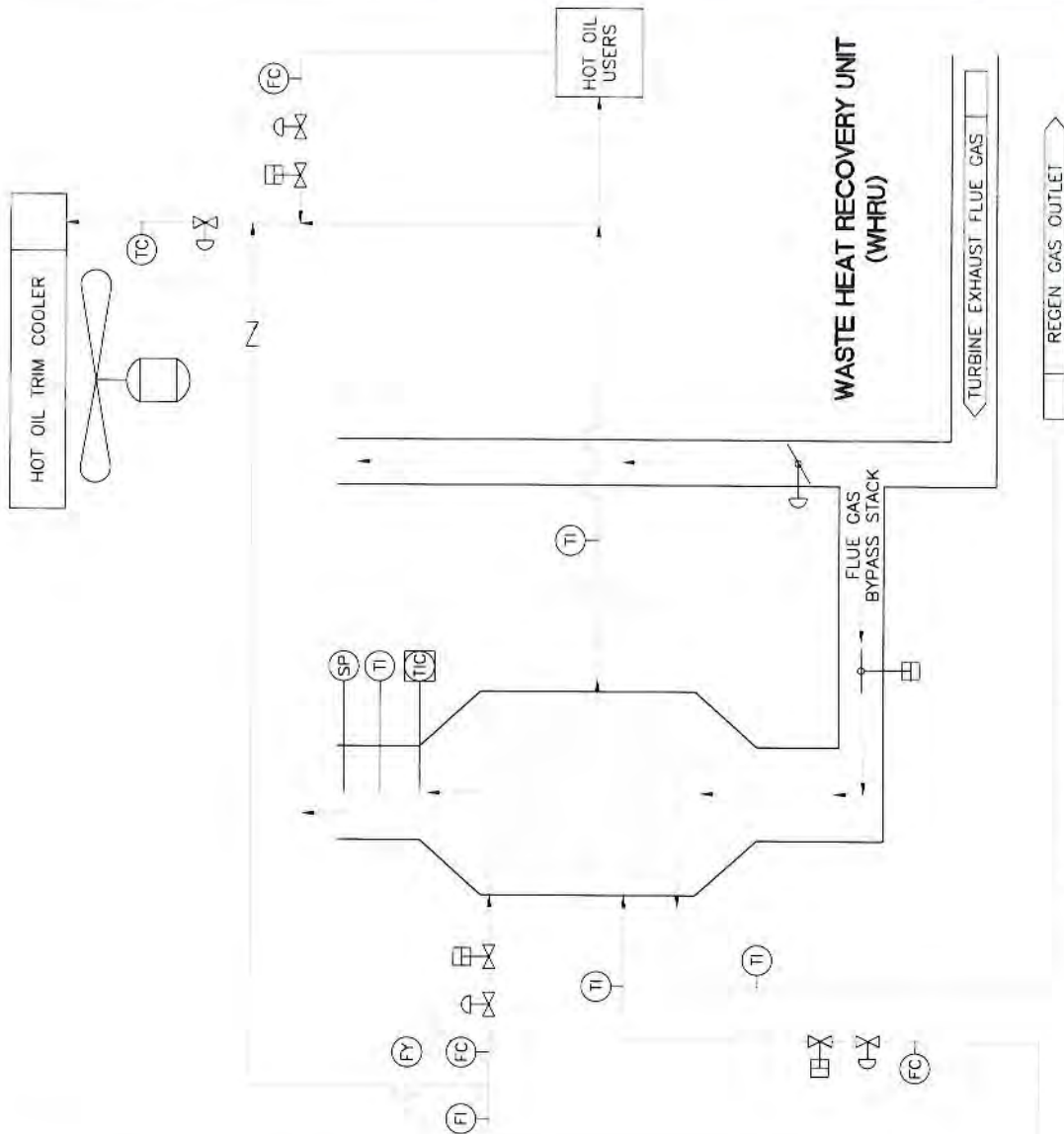
The Waste Heat Recovery Unit (WHRU) provides all process heating requirements within the LNG Trains. It is located on the exhaust stack of the Ethylene Compressor Gas Turbine Drivers, and utilizes a coil within the WHRU to heat oil as a heat medium to transfer heat to the process users, including the Feed Gas Heater, the Regenerator Reboilers, Pentane Heater, Stabilizer Reboiler, Debutanizer Reboiler and the Fuel Gas Heater. A separate coil is provided within the WHRU to heat the gas required to regenerate the molecular sieves within the Dehydration Unit.

A flow controller on the inlet of each of the heat recovery coils maintains a constant flow. The temperature of the hot oil leaving the WHRU is controlled by dampers in the turbine exhaust stack; excess flue gas is diverted away from the hot oil coil through a bypass stack. A minimum amount of hot oil flow is essential to protect the WHRU coil from overheating. This will be accomplished with a bypass flow orifice around the hot oil inlet control valve.



REGEN/GAS DRYER CONTROL UNIT

REGEN GAS INLET



RESOURCE
REPORT 9 AIR
DRAWN BY JLM DATE 3/13/13
CHECKED BY JH REV 3/13/13
SCALE: NOT TO SCALE

CORPUS CHRISTI LIQUEFACTION PROJECT
ATTACHMENT 6



TEXAS

SAN PATRICIO

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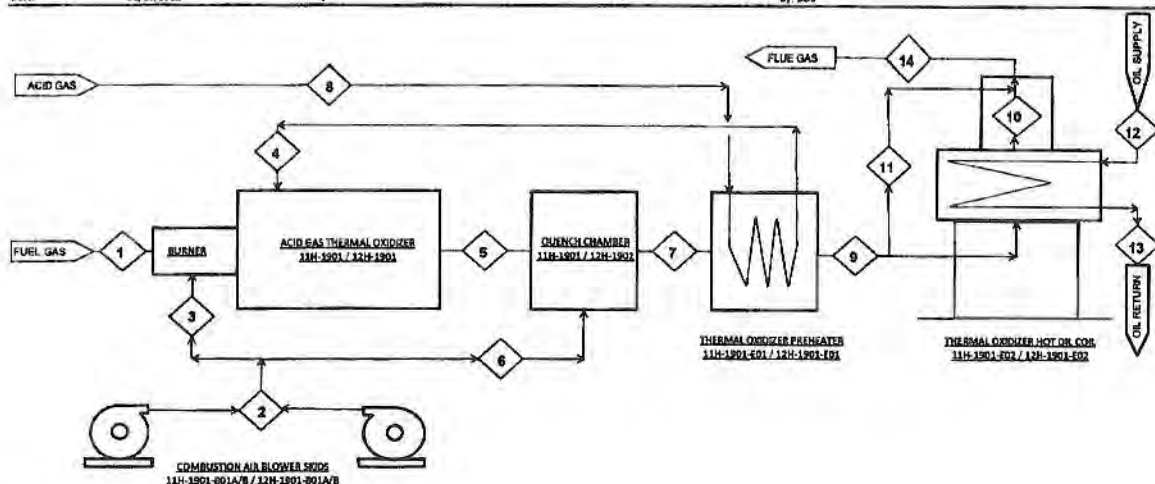
ATTACHMENT 7A

Customer: Bechtel
 User: Sabine Pass Liquefaction, LLC
 S.O. #: 21765
 Job Site: Cameron Parish, Louisiana
 Date: 11/28/2012



ZEECO, INC.
 Process Flow Diagram - Thermal Oxidizer

ZEECO Doc. No. 21745-1050
 BECHTEL Doc. No. 25497-140-V1A-MBTD-00297
 Revision 0
 By: CDS



Case 1: Design Case, 30 MM BTU/hr Oil Heater Duty

STREAM		1	2	3	4	5	6	7	8	9	10	11	12	13	14
DESCRIPTION		FUEL GAS	TOTAL AIR	BURNER AIR	HOT ACID GAS	FLUE GAS	QUENCH AIR	FLUE TO HEATER	COLD ACID GAS	FLUE GAS	FLUE GAS HEATER OUTLET	FLUE GAS BYPASS	OIL INLET	OIL OUTLET	FLUE GAS STACK EFFLUENT
	MW	Flow (lb/hr)	Flow (lb/hr)	Flow (lb/hr)	Flow (lb/hr)	Flow (lb/hr)	Flow (lb/hr)	Flow (lb/hr)	Flow (lb/hr)	Flow (lb/hr)	Flow (lb/hr)	Flow (lb/hr)	Flow (lb/hr)	Flow (lb/hr)	Flow (lb/hr)
CO2	44.01				78,797	86,594	-	86,594	78,797	86,594	56,258	30,338			86,594
H2O	18.02		3,988	2,362	2,248	10,667	1,634	12,321	2,248	12,321	8,006	4,316			12,321
N2	28.01		85,987	50,824	-	51,443	35,183	86,608	-	86,610	56,268	30,344			86,610
O2	32.00		26,031	15,388	-	4,356	10,645	15,001	-	15,001	9,746	5,255			15,001
CH4	16.04				81				81						
C2H6	30.07				12				12						
C3H8	44.1				9.7				9.7						
C4H10	58.12				10.4				10.4						
C5H12	72.15				5.1				5.1						
C6H14	86.18				2.3				2.3						
C7H16	100.2				2.1				2.1						
H2S	34.08				0.7				0.7						
C6H6	78.11				30.9				30.9						
SO2	64.06				-	1.27	-	1.27	-	1.3	-	-			-
Fuel Gas	18.42	3,314			-	-	-	-	-	-	-	-			-
Oil													229,741	229,741	
Total, lb/hr		3,314	118,014	68,572	81,199	163,082	47,442	200,524	81,199	200,527	130,273	70,253	229,741	229,741	200,528
Total, Btu/hr		180	4,105	2,428	1,921	4,533	1,876	5,838	1,821	5,838	3,854	2,080			5,838
MW		18.42	28.28	28.28	42.26	33.77	28.28	33.77	42.26	33.77	33.77	33.77			33.77
Temperature, °F		77	97	97	780	1,742	97	1,400	118	1,184	333	1,188	264	482	626
Pressure, psig															
Heat Release, MMBTU/hr		58.44			3.12										

System Performance at Stack Conditions

Emissions at Stack Conditions	Guaranteed
Thermal Oxidizer Temperature	1,724°F
NOx, ppmv at vol% dry oxygen	≤ 60
H2S, DRE	≤ 99%
Hydrocarbon (as total BTEX), DRE	≤ 99%
Benzene, DRE	≤ 99.99%
CO, ppm at vol% dry oxygen	≤ 125
Particulate, lb/MM Btu (Note 1)	≤ 0.02
VOC (non-methane HC), DRE	≥ 99

1. Combustion generated particulate only. Does not include any particulate which is carried in by the acid gas.

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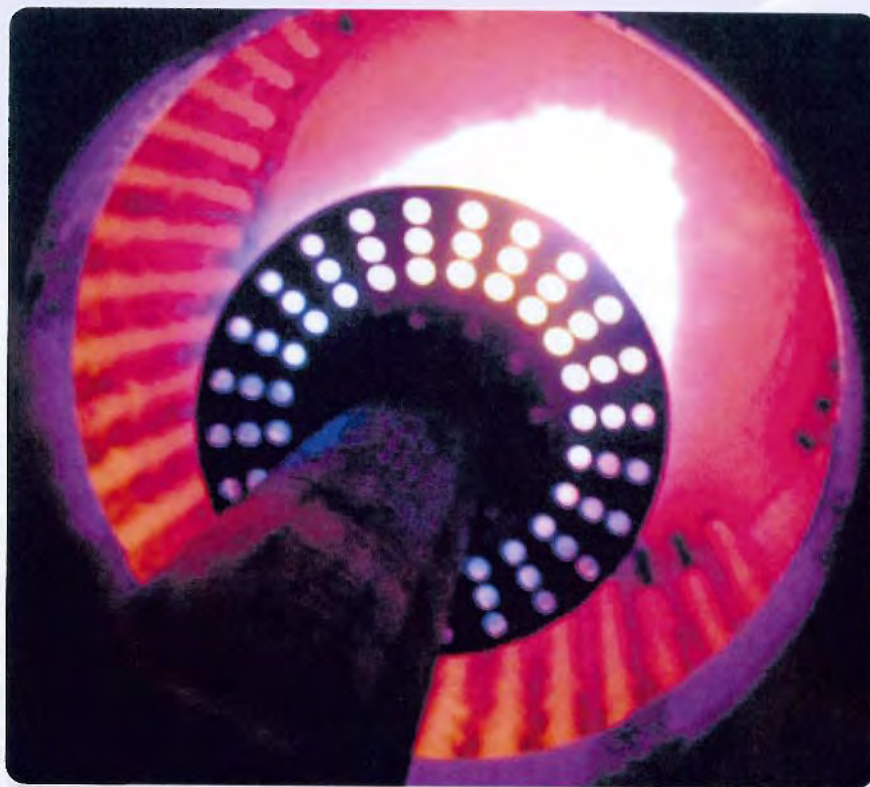
ATTACHMENT 7B



LOW NO_x STAGED AIR BURNER

COMBUSTION AND ENVIRONMENTAL SOLUTIONS.
PURE AND SIMPLE.®

GB Series



GB Staged Air Burner

DESCRIPTION

The ZEECO® GB staged air/staged fuel burner is designed with a staged fuel gas tip and a staged air annulus which utilizes only one gas tip and provides lower NO_x emissions than conventional raw gas designs. With a greater flame stability, the burner provides consistent heat distribution and reduces maintenance costs. This staged air method is designed to offer turndown of 10:1 or greater which is an extreme improvement over other low NO_x designs.

TECHNOLOGY

The GB burner utilizes one tip to produce the primary combustion zone and the secondary combustion zone which produces inert products of combustion which are induced into the staged fuel gas ejected straight up from the center of the gas tip. Used in conjunction with staged air, a true staged fuel and staged air effect is achieved. The use of one tip allows for lower NO_x production, vastly increased flame stability, and much greater turndown.



BURNERS



FLARES



INCINERATORS



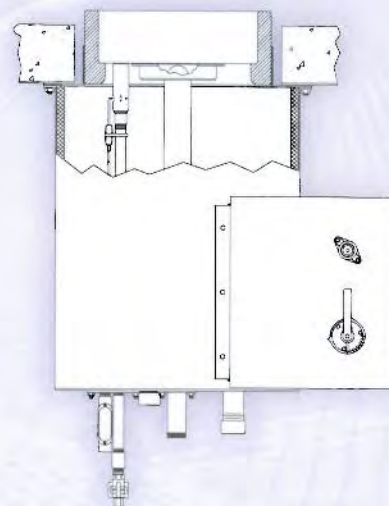
PARTS & SERVICE

COMBUSTION AND ENVIRONMENTAL SOLUTIONS.
PURE AND SIMPLE.®

Low NO_x Staged Air Burner

DESIGN FEATURES

- Stable flame over a wide range of conditions
- Turndown of 10:1 or greater for most cases
- Compact flame shape
- Reasonable cost and great value
- Combustion air is controlled by gears for precise control
- Bearings are used for the combustion air dampers for smooth, precise operation
- Configurations available: plenum mounted or individual windbox
- One (1) primary gas tip with staged fuel gas port
- 316 Stainless Steel (Type HK) gas tips
- Staged air annulus around burner tile assembly



GB Staged Air Burner

DESIGN INFORMATION

Burner Model:	GB Staged Air Burner
Fuels:	Gas Only
Description:	Staged Air, Round Flame Burner
NO _x Reduction Method:	Staged Air
Predicted NO _x Emissions Range (Natural Draft):	35 ppmv to 70 ppmv
Predicted NO _x Emissions Range (600° F Air Preheat):	50 ppmv to 90 ppmv
Combustion Air Induction:	Natural, Forced, Induced & Balanced Draft
Mounting Options:	Up-fired, Side-fired, and Down-fired
Natural Draft Heat Release Range:	1 MM to 20 MM Btu/hr [0.293 to 5.860 MW]
Forced Draft Heat Release Range:	1 MM to 50 MM Btu/hr [0.293 to 14.650 MW]
Turndown:	10:1
Typical Excess Air Range:	10% to 25%

CERTIFICATIONS APPLY TO ZEECO HEADQUARTERS ONLY.



CERTIFIED
NSRI



CERTIFIED
ASME



CERTIFIED
ASME



REGISTERED
ISO 9001: 2008

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ATTACHMENT 7C

Regenerative Thermal Oxidizer

