ZEECO BURNER DATA SHEETS

Burner Design Criteria

Customer:	**Hydro-Chem**	
End User:	**Linde Gas / Wackler**	
Jobsite:	**Charleston, TN**	
Heater Tag Number:	**1101F01/A1NF**	
Type of Heater:	**Vertical, Cylindrical**	
Burner Designation:	**GLSF**	
Burner Description:	**Round Flame, Min-Emissions**	**w/ PSA**
Patent Info:	***US Patent # 6,394,792***	

Revision Table

Rev #	Issue	Description of Revision		Rev Date	Name
0	5	Issued for Project		28-Sep-11	Paula M Rogge
D	4	Changed Burner size to 15		26-Sep-11	Mike Grant
C	3	Revised per H-C comments, and omitted the damper blades and shaft		21-Sep-11	Mike Grant
B	2	Corrected Burner Size 14		18-Sep-11	Mike Grant
A	1	Original Issue.	15-Sep-11	Mike Grant	

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Rev. Rev.

GENERAL INFORMATION

Customer Name	Hydro-Chem
End User Name	Linde Gas / Wackler
Jobsite	Charleston, TN

FURNACE DATA / SITE CONDITIONS

Furnace Tag Number	1101F01/A1NF	Plant Site Elevation Above Sea Level, ft	600
Type of Furnace	Vertical, Cylindrical	Ambient Air Temperature (°F)	60
Refractory Thickness, in	8	Minimum Relative Humidity	0%
Heater Steel Thickness, in	0.25	Normal Relative Humidity	80%
Type of Draft	Forced	Maximum Relative Humidity	100%
Direction of Firing	Vertical, Up	Heater Height (to convective sec.), ft	38.3
Mounting Direction	Vertical, Up	Tube Circle Diameter (ft)	9.1

PROCESS DATA

	Total		
Maximum Heat Release (MM BTU/hr)	23.549	Available Combustion Air dP (in H2O)	2.0
Normal Heat Release (MM BTU/hr)	20.834	Combustion Air Temperature (°F)	70
Minimum Heat Release (MM BTU/hr)	5.436	Furnace Temperature (°F)	1850
Turndown	4.33 : 1	Combustion Test	Not Required
Required Fuel Pressure for Burner (psig)	25		
Design Excess Air	10%		
Low Fire & Light Off (MMBTU/Hhr)	2.178		

GENERAL BURNER DESCRIPTION

Burner Model / Size	GLSF 15	Flame Shape	Round Flame
Burner Description	Round Flame, Min-Emissions	Maximum Predicted Flame Length (ft)	25.3
Number Required	2	Maximum Predicted Flame Width (ft)	3.1
		Pilot Model	JM-1S-EF
		Pilot Ignition Method	Electric Ignition
		Pilot Heat release (Btu/hr)	90,000
		Pilot Operating Pressure (psig)	10
		Pilot Fuel	Natural Gas
		Flame / Ionization Rod Provided	Included

NOISE DATA (SINGLE BURNER BASIS)

Predicted @ 63 Hz (dB)	85	Predicted @ 2000 Hz (dB)	72
Predicted @ 125 Hz (dB)	89	Predicted @ 4000 Hz (dB)	74
Predicted @ 250 Hz (dB)	82	Predicted @ 8000 Hz (dB)	72
Predicted @ 500 Hz (dB)	86	Guar. Noise Level @ 3 ft from burner, dBa	85
Predicted @ 1000 Hz (dB)	76		

GENERAL BURNER COMMENTS

2-1. The above noise emissions are "Sound Pressure Level".

2-2. The above heat releases are based on the lower heating value 'LHV' of the fuel(s).

2-3. The burners are sized based on the maximum relative humidity case, as listed above.

ZEECO BURNER DATA SHEETS

FUEL GAS CHARACTERISTICS							OFF GAS CHARACTERISTICS		
Composition	Natural Gas % vol						PSA Gas % vol	Syn Gas % vol	
CH4 (methane)	97.34%						17.12%	6.77%	
C2H6 (ethane)	0.77%								
C3H8 (propane)	0.14%								
C4H10 (butane)	0.07%								
C5H12 (pentane)	0.03%								
C6H14 (hexane)	0.02%								
C5H10 (cyclopen)									
C6H12 (cyclohex)									
C2H4 (ethene)									
C3H6 (propene)									
C4H8 (butene)									
C5H10 (pentene)									
C6H6 (benzene)									
C5H8 (isoprene)									
CO2	0.55%						40.48%	16.01%	
H2O							0.47%	0.19%	
O2									
N2	1.09%						0.71%	0.28%	
SO2									
H2S									
CO							8.33%	3.29%	
NH3									
H2							32.89%	73.46%	
AR									
Total (vol%)	100%						100%	100%	
Excess O2 (vol%)	2.10%						1.83%	2.10%	
LHV (Btu/scf)	904						273	273	
S.G.	0.58						0.82	0.37	
TEMP (°F)	70.00						70.00	70.00	
M.W.	16.70						23.88	10.67	

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BASIS OF EMISSIONS INFORMATION

Rev.

Furnace Temperature (°F)	1,850			
Excess Combustion Air (%)	10% Gas			
Combustion Air Temperature (°F)	70			
Relative Humidity (%)	80%			
Heat Release for Guarantee (MM Btu/hr)	23.549	to	20.834 LHV	

EMISSIONS INFORMATION

	PREDICTED		GUARANTEED	
	(ppmv)	(#/MMBtu)	(ppmv)	(#/MMBtu)
NOx Natural Gas With PSA or SYN GAS	30	0.039	36	0.045
CO - Gas	0	0.000	50	0.039
UHC - Gas	1	0.001	15	0.007
Particulate - Gas	2	0.002	15	0.012
VOC - Gas	0	0.000	15	0.018

EMISSIONS COMMENTS

4-1 The above listed UHC emissions are based upon UHC being defined as free "methane" as the result of incomplete combustion due to the supplied combustion equipment as stated in these data sheets.

4-2 The above listed VOC emissions are based upon VOC being defined as free "propane" as the result of incomplete combustion due to the supplied combustion equipment as stated in these data sheets.

4-3 The above listed Particulate emissions are based upon Particulate being defined as free "ethane" as the result of incomplete combustion due to the supplied combustion equipment as stated in these data sheets. This excludes ash, sand and heavy metals in the fuel oil.

4-4 NOx guarantees are based on the furnace temperature, combustion air temperature, excess combustion air and the fuel gas compositions as specified the Zeeco Burner Data Sheets.

4-5 The emissions guarantees above are for operation between maximum and normal heat release.

4-6 The emissions guarantees as stated above are based upon operation with the % excess air, temperature, furnace temperature, and fuel temperatures as stated in these data sheets.

4-7 See Notes & Clarifications section for more information concerning noise emissions.

4-8 See Notes & Clarifications section for more information concerning the above emissions guarantees.

4-9 Zeeco takes exception to any SOx guarantees since SOx production is based upon the amount of Sulfur in the fuel stream and the equilibrium conditions in the furnace.

4-10 The above listed predictions & guarantees are based on the lower heating value 'LHV' of the fuel(s).

4-11 All ppmv and/or mg/Nm3 guarantees are corrected to 3% O2 dry basis.

4-12 All CO, UHC, Particulate and VOC emissions guarantees are based on the furnace local temperature at the burner being above 1100°F (593°C).

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BASIS OF SCOPE OF SUPPLY

		Rev.
Burner Plenum	Burners are supplied with individual, manufactured plenums (windboxes).	
Plenum General Description	Integral, round-shaped air plenum, fabricated construction	
Material	A-1011 Gr 30 Carbon Steel	
Thickness	10 gauge (3.58 mm) material	
Internal Insulation / thickness	Mineral Wool 1.00 (in)	
Method of Construction	Seal-Welded Construction	
Inlet Air Control	Not Applicable	
Mode of Operation	Not Applicable	
Tight Shutoff for Damper Blades	Not Applicable	
Mechanism Description	Not Applicable	
Bearing construction	None	
Burner Tile	Burner is supplied with a refractory tile assembly.	
Regen Tile Composition	Not Applicable	
Secondary Tile Composition	60% Al2O3	
Needle Construction Required	3% by weight, 310 stainless steel needles added to refractory	
Rated Service Temperature (°F)	3000	
Temperature of Pre-firing (°F)	500	
Noise Attenuation Method	Not Required	
Fuel Delivery System	Burners are supplied with a gas tip and manifold assembly, with a single point connection	
Gas manifold description	Manufactured pipe manifold, constructed from schedule 40 carbon steel pipe	
Gas Tip Material	310 or HK (ASTM A-297) stainless steel	
Gas Riser Material	1/2" (12.7 mm), schedule 40, carbon steel pipe	
Separate Off Gas Manifold	Not Required	
Off Gas Tip Material	310 or HK (ASTM A-297) stainless steel	
Off Gas Riser Material	6" (152.4 mm), schedule 40, 304 stainless steel pipe	
Pilot Material	Carbon Steel and / or Cast Equivalent - 310 SS or Cast equivalent tip	
Fuel Gas / Off Gas / Pilot Gas Connections	150#, Carbon Steel Flange, RFWN, A-105	
Oil Tip / Atomizer Material	Not Applicable	
Oil & Steam Connections	Not Applicable	
Painting Requirements	Zeeco Standard	
Carbon Steel Surface Preparation	SSPC-SP-2 // ST-2 - Hand Tool Cleaning	
Primer	Red Oxide Primer	
Primer Thickness	One (1) Shop Coat	
1st Paint Coat	Not required	
1st Paint Coat Thk.	Not required	
Top Coat	Not required	
Top Coat Thickness	Not required	
Tile Case Assembly / Mounting Plate	Burners are supplied with a tile case assembly	
Mounting Template - heater floor cutout	Not Required	
Lifting Lugs	Not Required	
Pressure Taps Required for Windbox	Not Required	
Scanner Connection	1" swivel connection, one (1) per burner	
Ignition / Sight Ports	Two (2) ports provided, 2" (50.8 mm), c/w threaded cap & glass	
Electrical Information	Pilot Fittings and Ship Loose Items	
Pilot Conduit Fittings	Not Applicable	
UV Scanners	Not Applicable	