Biogas Open Flare Design Data Form

1.1 Quote Information

Customer Information			
Name		Company	
Business Title			
Email		Phone Number	

Equipment Information			
Quantity		Ship to Location (City, State, Zip)	
Proposal Due Date		Freight Terms	☐ EXW ☐ FCA ☐ FOB ☐ CIF ☐ Other ____________________
Potential Order Date		Preferred Ship Date	

Rank (1-4) Importance of the Following:							
Price		Spec Compliance		Delivery		Quality/Reliability	

Additional Comments

1.2 Process Conditions

Process Data	Typical	Custom	Custom
Case Description		CASE 1	CASE 2
Inlet Fluid Composition and Conditions (recommended for most accurate sizing)			
Methane (CH_4)	50%		
Carbon dioxide (CO_2)	50%		
Water Vapor (H_2O)			
Hydrogen Sulfide (H_2S) **(PPMV)**			
Gas Inlet Pressure (inches WC)	5-6		
Gas Inlet Min/Max Temp (°F)	100		
Gas Inlet Flowrate (SCFM)	300-5500		

Emissions Required		
	Typical	Custom
Destruction Efficiency Required [%]	98%	
CO Emissions (lb./MMBtu)	0.2	
NO_x Emissions (lb./MMBtu)	0.06	

Fuel Gas Characteristics for Pilot		
	Typical	Custom
Inlet Fluid Composition	Natural gas / Propane	Attach Composition
Gas Inlet Pressure (PSIG)	20	
Gas Inlet Min/Max Temp (°F)	100	

1.3 Environmental/Structural Conditions

Site Conditions	
Site Elevation (Ft)	
Ambient Temperature	
Humidity [%]	
Design Wind Speed	
Seismic Parameters	

1.4 Electrical Design

Electrical Design		
	Typical	Customer Requirement
Area Classification	Unclassified	
Power	120V/1ph/60hZ	
Programmable Logic Controller	Allen Bradley Compact Logix / Siemens	
HMI	4 INCH Color Display	
Panel Box	NEMA 4- Ship Loose	
Communication	Ethernet	
Operation	Local/Remote	

1.5 Open Flare Details

Open Flare Design		
	Typical	Customer Requirement
Stack Material of Construction	Carbon Steel	
Windshield	304 Stainless Steel	
Flare Tip Thermocouple	Dual Type-K	
Flare Tip Pilot	Automatic / Electronic Spark	
Pilot Thermocouple	Dual Type-K	
Controls Enclosure	NEMA 4 / Painted Carbon Steel	
Flare Inlet Shutoff Valve	Automatic / Butterfly	
Flame Arrestor	Eccentric	
Paint	Inorganic Zinc Primer	
Ship Loose Accessories		
	Typical	Customer Requirement
Pilot gas Train	Included	
Waste Gas Shutoff Valve	Included	
Waste Gas Flame Arrester	Included	
Waste Gas Flowmeter	Included	

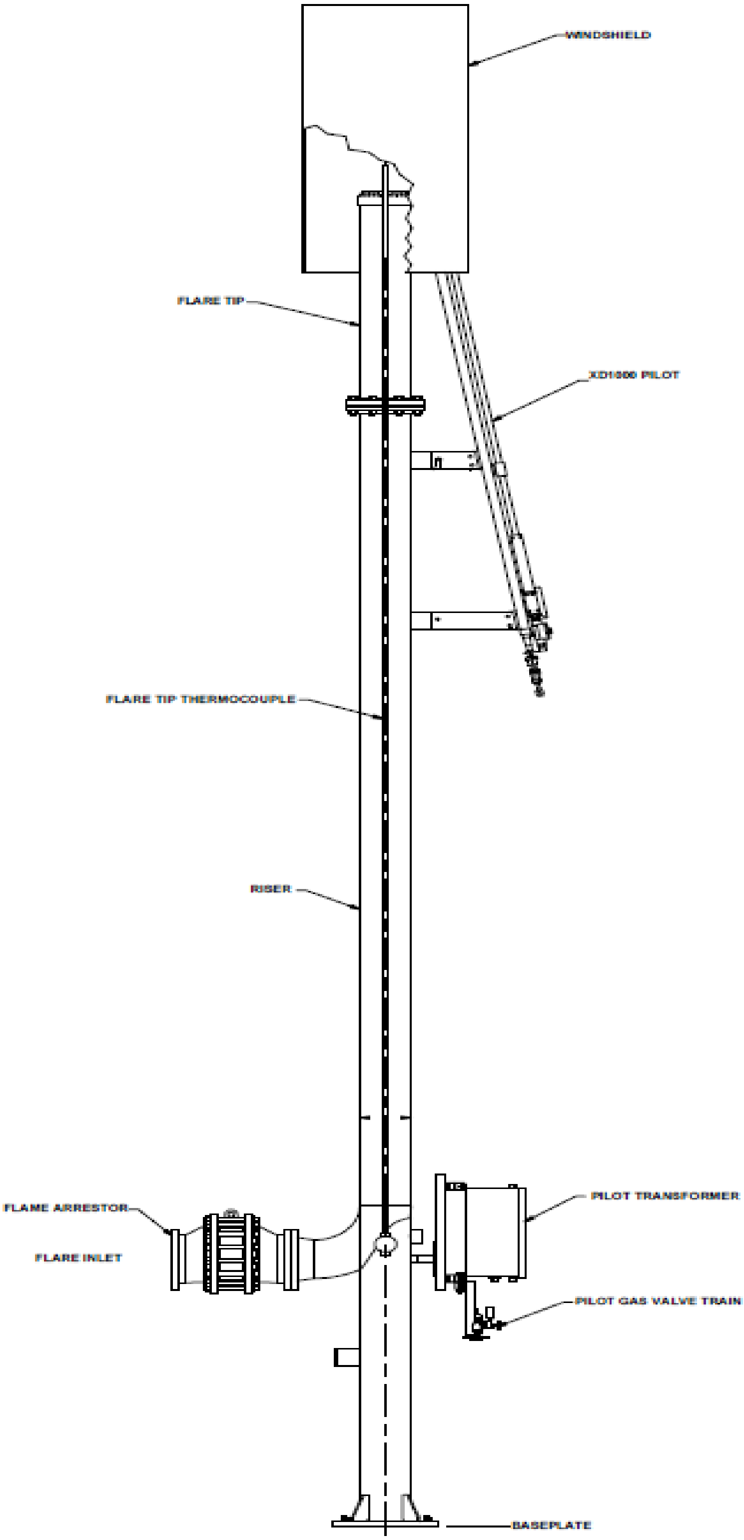
Moisture Separator	If Required	
Waste Gas Blower	If Required	

1.6 Gas Blower Skid (if required)

Process Data	Typical	Custom	Custom
Case Description		CASE 1	CASE 2
Inlet Fluid Composition and Conditions (recommended for most accurate sizing)			
Methane (CH_4)	50%		
Carbon dioxide (CO_2)	50%		
Water Vapor (H_2O)			
Gas Inlet Pressure (inches WC)	SPECIFY		
Gas Inlet Min/Max Temp (°F)	100		
Gas Inlet Flowrate (SCFM)	300-5500		
Turndown	10-1		
Redundancy	100%		
Skid Mounted	Yes		
Area Classification	Unclassified		
VFD	Included		
Power	480V/3ph/60hZ		

1.7 Application Guidance

<u>Open Flare</u>



EMISSIONS

Elevated (Open) Flare

Per AP-42 Industrial Flares

Nox = 0.068 lb/MMBTU

CO = 0.37 lb/MMBTU

Per 40 CFR 60.18

NMOC = 98% DRE

Typical Biogas Open Flare Applications and Features:

- Relatively low flowrate capacity for Landfills, Digesters, Dairy Farms, and other Biogas related applications
- Flare diameter is sized based on EPA 40 CFR 60.18 guidelines for exit velocity
- **Blowers** are used to provide positive pressure to the flare system in negative pressure applications. Multiple Blowers are typically used in Landfill applications and are controlled via a VFD and the Control System
- **Moisture Separators** are used in place of traditional Knockout Drum Vessels in applications where moisture and liquids are a concern. Highly recommended in applications where Blowers are used
- **Windshield** used to shield flame from crosswinds and to help stabilize the low-BTU, low-velocity flame
- **Flare Pilot** provides the source of flame for the Open Flare system. Once Pilot is lit and proof of flame is verified by the Flare Tip Thermocouple and Control System, a signal is sent to the Solenoid valve on the pilot gas valve train to turn off the pilot fuel and the Control System turns off the sparking feature of the pilot. If flame is not sensed by the Flare Tip Thermocouple, then the system turns on the sparking feature of the pilot and opens the Solenoid valve to provide fuel gas
- **Flare Inlet Shutdown Valve** is normally closed and provides isolation between the Flare and upstream piping. It is linked in communication to the upstream Flow Transmitter or Pressure Transmitter via the Control System. Once incoming flow is detected, the Control System then sends a signal to the Inlet Shutdown Valve to open. When no flow is detected, the Control System then sends a signal to the Inlet Shutdown Valve to close
- **Flame Arrestors** are used to protect any piping and equipment upstream of the Flare System inlet from potential flashback. When the Flare is not in operation, ambient air can sink into the Open Flare Tip and fill the flare stack. When the Flare System is turned back on and the pilot is lit, the combination of ambient air and incoming Biogas can potentially cause a flashback through the system
- **The Control System** is typically mounted on the Blower Skid for Landfill applications, or on an independent pole stand for non-landfill applications. Typical Control System includes a simple PLC for communication and is provided within a NEMA 3R, NEMA 4, NEMA 4X, or NEMA 4X with purge enclosure, depending on the application and electrical area classification requirements

1.8 Open Flare Sizing Chart:

Open Flare Sizing Chart						
OD x Height	Gas Composition	Gas Temp [°F]	Gas Flow [SCFM]	Gas Flow [MMSCFD]	Est. Pressure Drop [inH2O]	Est. Pressure Drop [psig]
4” x 15'	50% CH_4 / 50% CO_2	100	395	0.57	4.98	0.18
6” x 20'	50% CH_4 / 50% CO_2	100	480	0.69	1.66	0.06
8” x 25'	50% CH_4 / 50% CO_2	100	1020	1.47	2.21	0.08
10” x 30'	50% CH_4 / 50% CO_2	100	1920	2.76	2.77	0.10
12” x 35'	50% CH_4 / 50% CO_2	100	3000	4.32	3.05	0.11
14” x 40'	50% CH_4 / 50% CO_2	100	3680	5.29	2.49	0.09
16” x 45'	50% CH_4 / 50% CO_2	100	5120	7.37	4.43	0.16

Notes:

- Sizing chart based on calculations per EPA 40 CFR 60.18 exit velocity requirements
- Pressure-drop listed in chart is estimated and does not include any accessories such as Moisture Separator or Flame Arrestor
- Gas composition is listed as general Biogas composition. Flowrate and pressure drop results may change based on specific composition per application
- Gas temperature is listed as general Biogas temperature. Blower sizing will increase if temperature is elevated above what is listed in chart
- Consult Applications Engineering for sizing information