

RIPUC Use Only

Date Application Received: ___/___/___
Date Review Completed: ___/___/___
Date Commission Action: ___/___/___
Date Commission Approved: ___/___/___

GIS Certification #:

RENEWABLE ENERGY RESOURCES ELIGIBILITY FORM

The Standard Application Form

Required of all Applicants for Certification of Eligibility of Renewable Energy Resource
(Version 8 – December 5, 2012)

STATE OF RHODE ISLAND PUBLIC UTILITIES COMMISSION

Pursuant to the Renewable Energy Act

Section 39-26-1 et. seq. of the General Laws of Rhode Island

NOTICE:

When completing this Renewable Energy Resources Eligibility Form and any applicable Appendices, please refer to the State of Rhode Island and Providence Plantations Public Utilities Commission Rules and Regulations Governing the Implementation of a Renewable Energy Standard (RES Regulations, Effective Date: January 1, 2006), and the associated RES Certification Filing Methodology Guide. All applicable regulations, procedures and guidelines are available on the Commission's web site: www.ripuc.org/utilityinfo/res.html. Also, all filings must be in conformance with the Commission's Rules of Practice and Procedure, in particular, Rule 1.5, or its successor regulation, entitled "Formal Requirements as to Filings."

- Please complete the Renewable Energy Resources Eligibility Form and Appendices using a typewriter or black ink.
- Please submit one original and three copies of the completed Application Form, applicable Appendices and all supporting documentation to the Commission at the following address:

Rhode Island Public Utilities Commission
Attn: Luly E. Massaro, Commission Clerk
89 Jefferson Blvd
Warwick, RI 02888

In addition to the paper copies, electronic/email submittals are required under Commission regulations. Such electronic submittals should be sent to Res.filings@puc.ri.gov.

- In addition to filing with the Commission, Applicants are required to send, electronically or electronically and in paper format, a copy of the completed Application including all attachments and supporting documentation, to the Division of Public Utilities and Carriers and to all interested parties. A list of interested parties can be obtained from the Commission's website at www.ripuc.org/utilityinfo/res.html.
- Keep a copy of the completed Application for your records.
- The Commission will notify the Authorized Representative if the Application is incomplete.
- Pursuant to Section 6.0 of the RES Regulations, the Commission shall provide a thirty (30) day period for public comment following posting of any administratively complete Application.
- Please note that all information submitted on or attached to the Application is considered to be a public record unless the Commission agrees to deem some portion of the application confidential after consideration under section 1.2(g) of the Commission's Rules of Practice and Procedure.
- In accordance with Section 6.2 of the RES Regulations, the Commission will provide prospective reviews for Applicants seeking a preliminary determination as to whether a facility would be eligible prior to the formal certification process described in Section 6.1 of the RES Regulations. Please note that space is provided on the Form for applicant to designate the type of review being requested.
- Questions related to this Renewable Energy Resources Eligibility Form should be submitted in writing, preferably via email and directed to: Luly E. Massaro, Commission Clerk at Res.filings@puc.ri.gov.

SECTION I: Identification Information

1.1 Name of Generation Unit (sufficient for full and unique identification):

Narragansett Bay Commission Bucklin Point Biogas Engine I

1.2 Type of Certification being requested (check one):

Standard Certification Prospective Certification (Declaratory Judgment)

1.3 This Application includes: (Check all that apply)¹

APPENDIX A: Authorized Representative Certification for Individual Owner or Operator

APPENDIX B: Authorized Representative Certification for Non-Corporate Entities Other Than Individuals

APPENDIX C: Existing Renewable Energy Resource

APPENDIX D: Special Provisions for Aggregators of Customer-sited or Off-grid Generation Facilities

APPENDIX E: Special Provisions for a Generation Unit Located in a Control Area Adjacent to NEPOOL

APPENDIX F: Fuel Source Plan for Eligible Biomass Fuels

1.4 Primary Contact Person name and title: Thomas Uva, Director of Environmental Science and Compliance

1.5 Primary Contact Person address and contact information:

Address: One Service Road
Providence, RI 02905

Phone: 401-461-8848 x470

Fax: 401-461-6540

Email: tuva@narrabay.com

1.6 Backup Contact Person name and title: James McCaughey, ESTA Manager

1.7 Backup Contact Person address and contact information:

Address: One Service Road
Providence, RI 02905

Phone: 401-461-8848 x352

Fax: 401-461-6540

Email: jmcaughey@narrabay.com

¹ Please note that all Applicants are required to complete the Renewable Energy Resources Eligibility Standard Application Form and all of the Appendices that apply to the Generation Unit or Owner or Operator that is the subject of this Form. Please omit Appendices that do not apply.

1.8 Name and Title of Authorized Representative (*i.e.*, the individual responsible for certifying the accuracy of all information contained in this form and associated appendices, and whose signature will appear on the application): Raymond Marshall, Executive Director

Appendix A or B (as appropriate) completed and attached? Yes No N/A

1.9 Authorized Representative address and contact information:

Address: One Service Road
Providence RI 02905

Phone: 401-461-8848 x321 Fax: 401-461-6540

Email: rmarshall@narrabay.com

1.10 Owner name and title: Narragansett Bay Commission

1.11 Owner address and contact information:

Address: One Service Road
Providence, RI 02905

Phone: 401-461-8848 Fax: 401-461-6540

Email: rmarshall@narrabay.com

1.12 Owner business organization type (check one):

Individual

Partnership

Corporation

Other: Public Corporation

1.13 Operator name and title: Narragansett Bay Commission Bucklin Point Wastewater treatment facility

1.14 Operator address and contact information:

Address: 102 Campbell Avenue, Rumford, RI, 02916

Phone: 401-461-8848 x190 Fax: (401) 222- 2807

Email: mpariseault@narrabay.com

1.15 Operator business organization type (check one):

Individual

Partnership

Corporation

X Other: Public Corporation

SECTION II: Generation Unit Information, Fuels, Energy Resources and Technologies

2.1 ISO-NE Generation Unit Asset Identification Number or NEPOOL GIS Identification Number (either or both as applicable): NON121998 _____

2.2 Generation Unit Nameplate Capacity: _____ 0.644 _____ MW

2.3 Maximum Demonstrated Capacity: _____ N/A _____ MW

2.4 Please indicate which of the following Eligible Renewable Energy Resources are used by the Generation Unit: (Check ALL that apply) – *per RES Regulations Section 5.0*

- Direct solar radiation
- The wind
- Movement of or the latent heat of the ocean
- The heat of the earth
- Small hydro facilities
- Biomass facilities using Eligible Biomass Fuels and maintaining compliance with all aspects of current air permits; Eligible Biomass Fuels may be co-fired with fossil fuels, provided that only the renewable energy fraction of production from multi-fuel facilities shall be considered eligible.
- Biomass facilities using unlisted biomass fuel
- Biomass facilities, multi-fueled or using fossil fuel co-firing
- Fuel cells using a renewable resource referenced in this section

2.5 If the box checked in Section 2.4 above is “Small hydro facilities”, please certify that the facility’s aggregate capacity does not exceed 30 MW. – *per RES Regulations Section 3.32*

- ← check this box to certify that the above statement is true
- N/A or other (please explain) _____

2.6 If the box checked in Section 2.4 above is “Small hydro facilities”, please certify that the facility does not involve any new impoundment or diversion of water with an average salinity of twenty (20) parts per thousand or less. – *per RES Regulations Section 3.32*

- ← check this box to certify that the above statement is true
- N/A or other (please explain) _____

2.7 If you checked one of the Biomass facilities boxes in Section 2.4 above, please respond to the following:

A. Please specify the fuel or fuels used or to be used in the Unit: _____
Anaerobic Digester Biogas and Natural Gas

B. Please complete and attach Appendix F, Eligible Biomass Fuel Source Plan.
Appendix F completed and attached? Yes No N/A

- 2.8 Has the Generation Unit been certified as a Renewable Energy Resource for eligibility in another state's renewable portfolio standard?
 Yes No If yes, please attach a copy of that state's certifying order.
 Copy of State's certifying order attached? Yes No N/A

SECTION III: Commercial Operation Date

Please provide documentation to support all claims and responses to the following questions:

- 3.1 Date Generation Unit first entered Commercial Operation: 04/ 30 / 2018 at the site.

If the commercial operation date is after December 31, 1997, please provide independent verification, such as the utility log or metering data, showing that the meter first spun after December 31, 1997. This is needed in order to verify that the facility qualifies as a New Renewable Energy Resource.

Documentation attached? Yes No N/A

- 3.2 Is there an Existing Renewable Energy Resource located at the site of Generation Unit?

Yes
 No

- 3.3 If the date entered in response to question 3.1 is earlier than December 31, 1997 or if you checked "Yes" in response to question 3.2 above, please complete Appendix C.

Appendix C completed and attached? Yes No N/A

- 3.4 Was all or any part of the Generation Unit used on or before December 31, 1997 to generate electricity at any other site?

Yes
 No

- 3.5 If you checked "Yes" to question 3.4 above, please specify the power production equipment used and the address where such power production equipment produced electricity (attach more detail if the space provided is not sufficient):

SECTION IV: Metering

- 4.1 Please indicate how the Generation Unit's electrical energy output is verified (check all that apply):

ISO-NE Market Settlement System
 Self-reported to the NEPOOL GIS Administrator
 Other (please specify below and see Appendix D: Eligibility for Aggregations):
 Meter readings to be independently verified (see Fuel Source Plan)

Appendix D completed and attached?

Yes No N/A

SECTION V: Location

5.1 Please check one of the following that apply to the Generation Unit:

- Grid Connected Generation
- Off-Grid Generation (not connected to a utility transmission or distribution system)
- Customer Sited Generation (interconnected on the end-use customer side of the retail electricity meter in such a manner that it displaces all or part of the metered consumption of the end-use customer)

5.2 Generation Unit address: Narragansett Bay Commission
Bucklin Point Wastewater Treatment Facility
102 Campbell Avenue
East Providence, RI 02916

5.3 Please provide the Generation Unit’s geographic location information:

- A. Universal Transverse Mercator Coordinates: N/A
- B. Longitude/Latitude: 41 deg_51 min 4.13 sec N / 71 deg 21 min_58.63 sec
W_____

5.4 The Generation Unit located: (please check the appropriate box)

- In the NEPOOL control area
- In a control area adjacent to the NEPOOL control area
- In a control area other than NEPOOL which is not adjacent to the NEPOOL control area ← *If you checked this box, then the generator does not qualify for the RI RES – therefore, please do not complete/submit this form.*

5.5 If you checked “In a control area adjacent to the NEPOOL control area” in Section 5.4 above, please complete Appendix E.

Appendix E completed and attached?

Yes No N/A

SECTION VI: Certification

6.1 Please attach documentation, using one of the applicable forms below, demonstrating the authority of the Authorized Representative indicated in Section 1.8 to certify and submit this Application.

Corporations

If the Owner or Operator is a corporation, the Authorized Representative shall provide **either**:

- (a) Evidence of a board of directors vote granting authority to the Authorized Representative to execute the Renewable Energy Resources Eligibility Form, **or**
- (b) A certification from the Corporate Clerk or Secretary of the Corporation that the Authorized Representative is authorized to execute the Renewable Energy Resources Eligibility Form or is otherwise authorized to legally bind the corporation in like matters.

Evidence of Board Vote provided? Yes No N/A

Corporate Certification provided? Yes No N/A

Individuals

If the Owner or Operator is an individual, that individual shall complete and attach APPENDIX A, or a similar form of certification from the Owner or Operator, duly notarized, that certifies that the Authorized Representative has authority to execute the Renewable Energy Resources Eligibility Form.

Appendix A completed and attached? Yes No N/A

Non-Corporate Entities

(Proprietorships, Partnerships, Cooperatives, etc.) If the Owner or Operator is not an individual or a corporation, it shall complete and attach APPENDIX B or execute a resolution indicating that the Authorized Representative named in Section 1.8 has authority to execute the Renewable Energy Resources Eligibility Form or to otherwise legally bind the non-corporate entity in like matters.

Appendix B completed and attached? Yes No N/A


6.2 Authorized Representative Certification and Signature:

I hereby certify, under pains and penalties of perjury, that I have personally examined and am familiar with the information submitted herein and based upon my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate and complete. I am aware that there are significant penalties, both civil and criminal, for submitting false information, including possible fines and punishment. My signature below certifies all information submitted on this Renewable Energy Resources Eligibility Form. The Renewable Energy Resources Eligibility Form includes the Standard Application Form and all required Appendices and attachments. I acknowledge that the Generation Unit is obligated to and will notify the Commission promptly in the event of a change in a generator's eligibility status (including, without limitation, the status of the air permits) and that when and if, in the Commission's opinion, after due consideration, there is a material change in the characteristics of a Generation Unit or its fuel stream that could alter its eligibility, such Generation Unit must be re-certified in accordance with Section 9.0 of the RES Regulations. I further acknowledge that the Generation Unit is obligated to and will file such quarterly or other reports as required by the Regulations and the Commission in its certification order. I understand that the Generation Unit will be immediately de-certified if it fails to file such reports.

Signature of Authorized Representative:

SIGNATURE:

DATE:

 _____ 3/12/18

Executive Director

(Title)

APPENDIX A
(Required When Owner or Operator is An Individual)

STATE OF RHODE ISLAND
PUBLIC UTILITIES COMMISSION

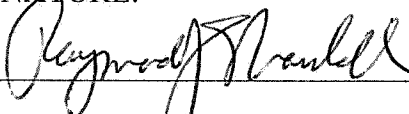
RENEWABLE ENERGY RESOURCES ELIGIBILITY FORM

Pursuant to the Renewable Energy Act
Section 39-26-1 et. seq. of the General Laws of Rhode Island

I, Raymond Marshall, as Owner or Operator of the Generation Unit named in Section 1.1 of the attached Renewable Energy Resources Eligibility Form, under the pains and penalties of perjury, hereby certify that Raymond Marshall, named in Section 1.8 of the attached Application, is authorized to execute this Renewable Energy Resource Eligibility Form.

SIGNATURE:

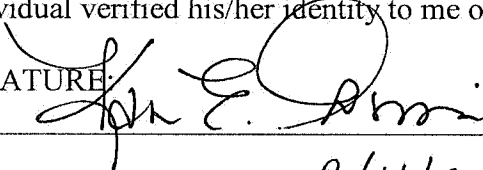
DATE:

 3/12/18
Executive Director
(Title)

State: Rhode IslandCounty: Providence

(TO BE COMPLETED BY NOTARY) I, Karen E. Musumeci as a notary public, certify that I witnessed the signature of the above named Raymond J. Marshall and said individual verified his/her identity to me on this date: 3/12/2018.

SIGNATURE:


My commission expires on: 3/4/2020

NOTARY SEAL:


APPENDIX F
(Revised 6/11/10)
Eligible Biomass Fuel Source Plan
(Required of all Applicants Proposing to Use An Eligible Biomass Fuel)

STATE OF RHODE ISLAND PUBLIC UTILITIES COMMISSION
Part of Application for Certificate of Eligibility
RENEWABLE ENERGY RESOURCES ELIGIBILITY FORM
Pursuant to the Renewable Energy Act
Section 39-26-1 et. seq. of the General Laws of Rhode Island

Note to Applicants: Please refer to the RES Certification Filing Methodology Guide posted on the Commission's web site (www.ripuc.org/utilityinfo/res.html) for information, templates and suggestions regarding the types and levels of detail appropriate for responses to specific application items requested below. Also, please see Section 6.9 of the RES Regulations for additional details on specific requirements.

The phrase "Eligible Biomass Fuel" (per RES Regulations Section 3.7) means fuel sources including brush, stumps, lumber ends and trimmings, wood pallets, bark, wood chips, shavings, slash, yard trimmings, site clearing waste, wood packaging, and other clean wood that is not mixed with other unsorted solid wastes⁵; agricultural waste, food and vegetative material; energy crops; landfill methane⁶ or biogas⁷, provided that such gas is collected and conveyed directly to the Generation Unit without use of facilities used as common carriers of natural gas; or neat biodiesel and other neat liquid fuels that are derived from such fuel sources.

In determining if an Eligible Biomass Generation Unit shall be certified, the Commission will consider if the fuel source plan can reasonably be expected to ensure that only Eligible Biomass Fuels will be used, and in the case of co-firing ensure that only that proportion of generation attributable to an Eligible Biomass Fuel be eligible. Certification will not be granted to those Generation Units with fuel source plans the Commission deems inadequate for these purposes.

⁵ Generation Units using wood sources other than those listed above may make application, as part of the required fuel source plan described in Section 6.9 of the RES Regulations, for the Commission to approve a particular wood source as "clean wood." The burden will be on the applicant to demonstrate that the wood source is at least as clean as those listed in the legislation. Wood sources containing resins, glues, laminates, paints, preservatives, or other treatments that would combust or off-gas, or mixed with any other material that would burn, melt, or create other residue aside from wood ash, will not be approved as clean wood.

⁶ Landfill gas, which is an Eligible Biomass Fuel, means only that gas recovered from inside a landfill and resulting from the natural decomposition of waste, and that would otherwise be vented or flared as part of the landfill's normal operation if not used as a fuel source.

⁷ Gas resulting from the anaerobic digestion of sewage or manure is considered to be a type of biogas, and therefore an Eligible Biomass Fuel that has been fully separated from the waste stream.

This Appendix must be attached to the front of Applicant's Fuel Source Plan required for Generating Units proposing to use an Eligible Biomass Fuel (per Section 6.9 of RES Regulations).

F.1 The attached Fuel Source Plan includes a detailed description of the type of Eligible Biomass Fuel to be used at the Generation Unit.

Detailed description attached? Yes No N/A

Comments: A description of the anaerobic digester gas is included in the attached Fuel Source Plan

F.2 If the proposed fuel is "other clean wood," the Fuel Source Plan should include any further substantiation to demonstrate why the fuel source should be considered as clean as those clean wood sources listed in the legislation.

Further substantiation attached? Yes No N/A

Comments: _____

F.3 In the case of co-firing with ineligible fuels, the Fuel Source Plan must include a description of (a) how such co-firing will occur; (b) how the relative amounts of Eligible Biomass Fuel and ineligible fuel will be measured; and (c) how the eligible portion of generation output will be calculated. Such calculations shall be based on the energy content of all of the proposed fuels used.

Description attached? Yes No N/A

Comments: The generating Unit may co-fire with natural gas and a description is attached showing how the measurements will be made and used to determine the eligible portion of the generation output

F.4 The Fuel Source Plan must provide a description of what measures will be taken to ensure that only the Eligible Biomass Fuel are used, examples of which may include: standard operating protocols or procedures that will be implemented at the Generation Unit, contracts with fuel suppliers, testing or sampling regimes.

Description provided? Yes No N/A

Comments: A description of the protocol is included in the attached Fuel Source Plan

F.5 Please include in the Fuel Source Plan an acknowledgement that the fuels stored at or brought to the Generation Unit will only be either Eligible Biomass Fuels or fossil fuels used for co-firing and that Biomass Fuels not deemed eligible will not be allowed at the premises of the certified Generation Unit. And please check the following box to certify that this statement is true.

← check this box to certify that the above statement is true

N/A or other (please explain) _____

F.6 If the proposed fuel includes recycled wood waste, please submit documentation that such fuel meets the definition of Eligible Biomass Fuel and also meets material separation, storage, or handling standards acceptable to the Commission and furthermore consistent with the RES Regulations.

Documentation attached? Yes No N/A

Comments: _____

F.7 Please certify that you will file all reports and other information necessary to enable the Commission to verify the on-going eligibility of the renewable energy generators pursuant to Section 6.3 of the RES Regulations. Specifically, RES Regulations Section 6.3(i) states that Renewable Energy Resources of the type that combust fuel to generate electricity must file quarterly reports due 60 days after the end of each quarter on the fuel stream used during the quarter. Instructions and filing documents for the quarterly reports can be found on the Commissions website or can be furnished upon request.

← check this box to certify that the above statement is true

N/A or other (please explain) _____

F.8 Please attach a copy of the Generation Unit's Valid Air Permit or equivalent authorization.

Valid Air Permit or equivalent attached? Yes No N/A

Comments: _____

F.9 Effective date of Valid Air Permit or equivalent authorization:

12 / 12 / 2016

F.10 State or jurisdiction issuing Valid Air Permit or equivalent authorization:
Rhode Island

Narragansett Bay Commission Fuel Source Plan

For

Bucklin Point WWTF Biogas Engine CHP System

This document and its attachments provides a detailed description of the type of eligible biomass fuel to be used at the generation unit commonly referred to as the NBC Bucklin Point Biogas Engine CHP System. It also includes a description of how the unit will at times be co-fired with natural gas, the relative amounts of eligible and ineligible fuel will be measured and how the eligible portion will be calculated. This Fuel Source Plan describes measures that will be taken to ensure that the amount of fuel used, measured and reported as eligible is truly eligible.

Type of eligible biomass fuel to be used at the generation unit

The eligible fuel to be used by this combined heat and power (CHP) system will be renewable digester gas commonly called biogas that is produced by the NBC's anaerobic digester. The digester was installed in the 1950s as part of the municipal wastewater treatment facility (WWTF) that was constructed at Bucklin Point in East Providence. The WWTF provides sewage collection and treatment to over 100,000 people in the Pawtucket, Central Falls, Lincoln and Cumberland and Rumford, RI. The sewage sludge that is continuously produced by the WWTF is fed into the mesophilic complete-mix digester. The digestion process reduces the amount of sewage solids that the WWTF needs to ship offsite.

Over several days in the digester, a portion of the sludge is biologically converted into biogas which is a mixture comprised mostly of methane (about 61% by volume) and carbon dioxide (about 39% by volume). The biogas will typically contain relatively low amounts of hydrogen sulfide, water and siloxane that can be removed to help improve CHP system performance. The composition of the raw biogas before its cleaned is shown in the attached summary table of results.

The biogas will be used to make renewable heat and electricity. The carbon dioxide emissions from combusting biogas are considered biogenic. At times it may be necessary to waste some of the biogas to the flare or radiator.

How the generation unit will be co-fired with biogas and natural gas

NBC's biogas engine CHP system will generate heat and electricity for the WWTF to use. The project is designed to utilize practically all of the biogas produced and to co-fire using natural gas (an ineligible fuel) only when needed. For example, when biogas production is less than the engine needs, some utility supplied natural gas will be automatically blended with the biogas (based on measured pressures) so that the engine can operate at the full capacity it was designed for.

The amount of eligible and ineligible fuels fed into the engine will be measured by revenue grade meters. The BTU content of the biogas will be measured at least monthly with a Lantec portable

methane content meter. The Btu content of natural gas will be determined from information provided by National Grid. The biogas flow meter will be an ultrasonic type meter. The natural gas flow meter will be a thermal mass type meter. The net power output from the engine will be measured by an ANSI approved meter. The useful heat produced by the system will be measured by an EN 1434 approved BTU meter. Specifications for these meters are attached.

The portion of the energy fed to the engine that came from eligible fuel will be calculated for each month. The calculation will be based on the flow and energy content of eligible and ineligible fuels used by the engine. The portion of the engine's output energy that is eligible will be considered equal to the portion of the engine's input that is eligible. An example spreadsheet showing calculations and data on a 15-minute, monthly, quarterly and annual basis is attached.

Measures to ensure the amount of eligible fuel measured is eligible

The sludge fed to the digester is largely made up of human waste and waste activated sludge (beneficial bacteria used to treat the wastewater). These materials are considered to originate from non-fossil (biogenic) sources and the energy they produced is considered eligible as a renewable energy resource. The digester feed is considered to be one of the WWTF's treatment streams.

Fossil based fuel materials are not allowed to enter the WWTF or digester. The NBC Pretreatment Program prevents fossil fuels from entering the sewer collection system and WWTF. Fossil fuel based materials also prohibited from entering treatment streams at the facility because these substances are strictly limited in the final effluent by the RI Department of Environmental Management. For these reasons, essentially all biogas leaving the digester and entering the engine can be considered to originate from non-fossil based sources.

Fuel Source Plan Attachments

VOC	ppb	Siloxanes	ppm
Per Method EPA TO-15 and ALS 102		Per Method ALS 112	
Acetic Acid	24.00	D4 (Octamethylcyclotetrasiloxane)	0.6
Propene	630.00	D5 (Decamethylcyclopentasiloxane)	1.44
n-Pentane	1,863.92	D6 (Dodecamethylcyclohexasiloxane)	0.09
Trimethylsilanol	134.19	Trimethylsilanol	0.12
2,4,4-Trimethyl-1-pentene	191.75	Hexamethyldisiloxane (L2)	0.01
1-Decene	148.61	Hexamethylcyclotrisiloxane (D3)	0.01
n-Decane	126.02	Octamethyltrisiloxane (L3)	0.02
2,2,4,6,6-Pentamethylheptane	157.90	Decamethyltetrasiloxane (L4)	0.01
2,2,11,11-Tetramethyldodecane	58.40	Dodecamethylpentasiloxane (L5)	0.01
2,7,10-Trimethyldodecane	105.52	Total	2.31
2,2,5-Trimethylhexane	85.63	Field Testing using Drager Tubes	
3-Methyldodecane	76.59	Hydrogen Sulfide	180
n-Tridecane	75.38	Ammomnia	<1
Decamethylcyclopentasiloxane	193.45	Amines	<0.5
n-Dodecane	80.27	Formaldehyde	<0.1
2,6-Dimethylundecane	110.63	Hydrogen Sulfide	110
cis-1,2-Dichloroethene	49.00	Per Method ASTM D 5504-12	
n-Hexane	320.00	Composition	
Benzene	16.00	Per Method ASTM D3588-98	
Trichloroethene	18.00	Methane	61.44%
n-Heptane	580.00	Carbon Dioxide	37.90%
Toluene	820.00	Nitrogen	0.54%
n-Octane	820.00	Oxygen	0.10%
Tetrachloroethene	11.00	BTU (LHV as Dry Gas)	560.6 BTU/SCF
Ethylbenzene	50.00	<p>Biogas samples were taken from Bucklin Point Wastewater Treatment Facility on 4/5/17 using a Silonite canister and sorbent tubes. Samples were sent to ALS for analysis by gas chromatography and mass spectrometry, methods are listed above. Analyses were processed to assess biogas content in anticipation of the installation of the CHP, (combined heat and power or cogeneration) . The CHP will utilize the biogas to fuel a reciprocating engine for the production of electricity and useful heat, at high efficiency. Biogas consists primarily of methane and carbon dioxide, but also contains contaminants including sulphur and siloxanes. Contaminants will need to be monitored as a preventative maintenance for the CHP. Parameters such as methane and LHV will need to be reported to the RIPUC on the Quarterly Fuel Eligibility Filing Form for eligibility of Renewable Energy Credits.</p>	
m,p-Xylenes	29.00		
o-Xylene	7.30		
n-Nonane	71.00		
Cumene	7.40		
alpha-Pinene	180.00		
1,2,4-Trimethylbenzene	6.60		
d-Limonene	140.00		
Sulfur Dioxide	1,084.56		
Total	8,272.11		
Analytical results reflect biogas production from two of the three primary digesters operating for the past several months while one is down for maintenance.			

DRESSER-RAND.	GROUP	GAS	PRODUCT INFORMATION	INDEX
	IC		IC-G-B-36-161	B1
	POWER RATING			DATE 26/08/14
				DEP. 2

GENSET:	SFGLD 360	SPEED:	1800
JACKET WATER TEMPERATURE(*F):	194	FUEL TYPE:	SEWAGE GAS
INTERCOOLER WATER TEMP(*F):	131		

APPLICATION:	CONTINUOUS	COMPRESSION RATIO:	11,6:1
COOLING SYSTEM:	TWO CIRCUITS	REGULATION:	Electronic
EXHAUST MANIFOLD TYPE:	TWO STAGE IC	IGNITION TIMING:	20°
EMISSIONS:	WATER COOLED	MAX. BACK PRESSURE:	18 "H2O (450 mmH2O)
	NOX g/bHPH 0,5	AMBIENT CONDITIONS ISO 3046/1:	
	CO g/bHPH <1,8	Atmospheric pressure ("Hg (kPa))=	30 (100)
	NMHC g/bHPH <0,7	Ambient temperature (*F (*C))=	77 (25)
		Relative humidity (%)=	30

POWER RATING (4)			NOMINAL	PARTIAL LOADS		
LOAD		%	100%	80%	60%	40%
MECHANICAL POWER	{3, 4, 5}	BHP (KWb)	893 (666)	713 (532)	536 (400)	357 (265)
BMEP		psi (bar)	178 (12.3)	144 (9.9)	107 (7.4)	71 (4.9)
ELECTRICAL POWER (cosφ 1)		kWe	644	514	384	253
ELECTRICAL POWER (cosφ 0,8)		kWe	637	509	381	251
FUEL CONSUMPTION	{1}	BTU/bHP-hr (KW)	6794 (1778)	7054 (1474)	7480 (1175)	8306 (869)
MECHANICAL EFFICIENCY		%	37.5	35.1	34.0	30.6
ELECTRICAL EFFICIENCY (cosφ 1)		%	36.2	34.9	32.7	29.1

HEAT IN MAIN WATER CIRCUIT	{1}	BTU/min (KW)	27920 (491)	23660 (416)	19560 (344)	15980 (281)
HEAT IN SECONDARY WATER CIRCUIT	{1}	BTU/min (KW)	6711 (118)	6028 (105)	5403 (95)	4265 (75)
HEAT IN CHARGE COOLER	{1}	BTU/min (KW)	2559 (45)	2161 (38)	1820 (32)	853 (15)
HEAT IN OIL COOLER	{1}	BTU/min (KW)	4151 (73)	3867 (68)	3583 (63)	3412 (60)
HEAT IN EXHAUST GASES (25 °C)	{1}	BTU/min (KW)	26780 (471)	22410 (394)	17970 (316)	13250 (233)
HEAT IN EXHAUST GASES (120°C)	{1}	BTU/min (KW)	19930 (350)	16850 (296)	13630 (240)	10140 (178)
EXHAUST GAS TEMPERATURE	{1}	*F (*C)	747 (397)	765 (407)	784 (418)	802 (428)
HEAT TO RADIATION	{1}	BTU/min (KW)	1820 (32)	1479 (26)	1137 (20)	796 (14)

CARBURETION SETTINGS (2)						
O2 TO EXHAUST(DRY)(ONLY A REFERENCE)		%	8.5	8.3	8.1	7.8

MASS FLOWS						
INTAKE AIR FLOW	{1}	lb/h (Kg/h)	8000 (3630)	6520 (2960)	5070 (2300)	3640 (1650)
EXHAUST GAS FLOW (WET)	{1}	lb/h (Kg/h)	8720 (3960)	7110 (3230)	5540 (2520)	3990 (1810)

NOTES:	
1. 100% LOAD TOLERANCES: FUEL CONSUMPTION +5%, COOLING CIRCUIT AND EXHAUST GASES ± 8%, RADIATION ±25% EXHAUST TEMPERATURE ±36°F (20°C), MASS FLOWS ± 10%.	
2. THE ENGINE PERFORMANCE DATA, TIMING ADVANCE AND CARBURETION SETTINGS ARE VALID FOR A GAS THAT FULFILLS THE REQUIREMENTS DEFINED IN IC-G-D-30-001e AND IC-G-D-30-003e. HEAT BALANCE FOR A REFERENCE GAS: CH4 62.5%, CO2 36%, N2 1,5%	
3. NET POWER, MECHANICAL PUMPS NOT INCLUDED.	
4. POWERS ARE VALID FOR AMBIENT TEMP.=77 °F (25 °C) AND AN ALTITUDE OF =1640 ft (500 m). SEE OTHER CONDITIONS IN PI IC-G-B-00-001	
5. OVERLOAD NOT ALLOWED	
6. THE SPECIFICATIONS AND MATERIALS ARE SUBJECT TO CHANGE WITHOUT NOTIFICATION	
7. A ENGINE WITH INLET OR OUTPUT RESTRICTION OVER PUBLISHED LIMITS, OR WITH INADEQUATE MAINTENANCE OR INSTALLATION CAN MODIFY POWER RATING DATA.	
8. EMISSIONS	
9. ALTERNATOR VOLTAGE 440 V	
10. ONLY IN PARALLEL TO THE NET OPERATION	

Annual Reporting of Electricity and Heat Generation from Anaerobic Digester Gas Operations

Narragansett Bay Commission

Site: Bucklin Point Wastewater Treatment Facility, 102 Campbell Avenue, Rumford, RI 02916

2018	ADG* To Engine (1,000 scf)	ADG LHV** (Etu/scf)2	Natural Gas To Engine (1,000 scf)3	Natural Gas LHV (Etu/scf)4	Portion of Input Fuel Renewable	Net Electricity Generated (MWh)5	Net Renewable Electricity Generated (MWh)	Heat Recovered (MMBtu)6	Renewable Heat Recovered (MMBtu)	Comments
January-18										
February-18										
March-18										
April-18										
May-18	8,800	561	1,200	1,028	80.0%	423	339	1,861	1,489	Heat from cleaned biogas fed to boilers not metered
June-18										
July-18										
August-18										
September-18										
October-18										
November-18										
December-18										
VALUES LISTED BELOW ARE FOR EXAMPLE ONLY										

* ADG = Anaerobic Digester Gas

** LHV = Lower Heating Value

Notes:

- 1) From average 15-minute SCADA data from ADG meter "A"
- 2) From quarterly measurements from portable Landtec GA5000 meter "B"
- 3) From average of 15-minute SCADA data from Natural Gas meter "C"
- 4) From information provided National Grid
- 5) From average of 15-minute SCADA data for net electric meter "D"
- 6) From average 15-minute SCADA data from BTU meter "E"

Conversion Factors

1 Wh =	3.41496 Btu
1 MWh =	3.41496 MMBtu

Quarterly filing example for all potential and independent energy credits:

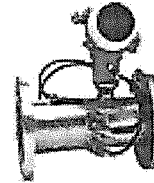
Quarter	Date Quarter	Date Filings	RECs (MWh)	TRECs (MWh)
Quarter 1	31-Mar	30-May	0	0
Quarter 2	30-Jun	29-Aug	339	436
Quarter 3	30-Sep	29-Nov	0	0
Quarter 4	31-Dec	1-Mar	0	0

Meter A - Biogas Meter
Specifications & Diagram

Applicator Sizing - Condensed (Flow)

Project

Project NBC Bucklin Point
 C.Project No.
 Customer: BioSpark LLC
 TAG FT100.1
 Timestamp ---
 Review number ---
 Sales order number
 Contact person Tom Moore
 eMail:
 Phone 9786210421
 Fax



General Parameters

Fluid Bio Gas-60%CH4,40%CO2 (Gas)
 State Gas
 Character Clean
 Abrasivity Not abrasive
 Fluid Group (PED) Dangerous Fluid (Fluid group 1)
 Fluid Type Newtonian
 Ref. Temperature 59 °F
 Ref. Pressure 14.696 psi_a
 Atmospheric Pressure 1.0132 bar_a
 Standard ASME/(ANSI)

Operating Conditions

	minimum	nominal	maximum	
Requested Flow	40	170	200	SCFM
Pressure		2.5		psi_g
Temperature		90		°F
Density		1.2752		kg/m3
Viscosity		0.01349		cP
Z-factor		0.9971		
Sound velocity		346.6		m/s
Pressure (min/max)	2.5		2.5	psi_g
Temp. (min/max)	90		90	°F

Flowmeter

Flowmeter Prosonic Flow B 200
 Flow Principle Ultrasonic Flow (Prosonic Flow)
 Extended order code 9B2B80-*****A14*+WA
 Meter Size 3"
 Operating range min. 3.973 SCFM
 Operating range max. 397.277 SCFM
 Material (sensor) * SS 1.4404 / 316L
 Process connection* CI 150 ASME B16.5, 316L lap joint flange
 PED category **: Application is Cat. I

Operating Conditions

	minimum	nominal	maximum	
Requested Flow	40	170	200	SCFM
Velocity	3.021	12.84	15.1	m/s
Pressure loss	0	0	0	in.H2O@68°F
Measured error Vol.***	1.5	1.5	1.5	%
Measured error Spec. Volume***	1.5	1.5	1.5	%
Reynolds No.	24 243	103 032	121 215	

*The user is responsible for the selection of process-wetted materials in view of their corrosion resistance. Endress+Hauser makes no guarantees and assumes no liability for the corrosion resistance of the materials selected here for the application described above.

** The PED category is an Endress+Hauser recommendation and depends on the fluid category, process data as well from the max. permissible pressure of the selected pressure rating. The fluids of the Applicator data base are classified to 67/548/EWG.

***For error calculation, the specified reference conditions for the calibration of the flowmeter according to ISO/IEC 17025 apply. Further information in technical documentation.

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Applicator Sizing - Flow

Project : NBC Bucklin Point

Customer: BioSpark LLC

Contact person: Tom Moore

Phone: 9786210421

eMail:

C.Project No.:

Fax:

TAG : FT100.1

Timestamp: —

Review number: —

Sales order number:

Fluid properties sheet

Fluid

Fluid name	Bio Gas-60%CH ₄ ,40%CO ₂ (Gas)	State	Gas
Chemical formula	60%CH ₄ , 40%CO ₂	Calculation standard	NEL

Fluid description

Medium character	Clean	Gas mixture	Fraction	
Fluid group (PED)	Dangerous Fluid (Fluid group 1)	Component		
Fluid Type	Newtonian	1 Carbon dioxide (Gas)	40 Mole%	64.76 Mass%
Fluid stability	Stable	2 Methane (Gas)	60 Mole%	35.24 Mass%
		3	0 Mole%	0 Mass%
		4	0 Mole%	0 Mass%
		5	0 Mole%	0 Mass%
		6	0 Mole%	0 Mass%
		7	0 Mole%	0 Mass%
		8	0 Mole%	0 Mass%

Basic fluid parameters

Tc (Critical temperature)	-42.26 °F	Tm (Melting point)	n.a. °F
Pc (Critical pressure)	813.209 psi	Tb (Boiling point)	n.a. °F
Rho_c (Critical density)	280.4 kg/m ³		

Calculated results

Density nom.	1.2752 kg/m ³	Pressure nom.	2.5 psi_g
Molar mass	27.23 kg/kmol	Temperature nom.	90 °F
Z-factor nom.	0.9971		
Viscosity nom.	0.01349 cP		
Sound velocity nom.	346.6 m/s		
Thermal capacity nom.	1.351 kJ/(kg*K)		
Heat conductivity nom.	0.028 W/(m K)		
Rel. humidity nom.	0 %		

Reference values: Normal conditions (SI):

Atmospheric pressure	1.0132 bar_a
Density normal	1.2193 kg/m ³
Temperature	0 °C
Pressure	1.0132 bar_a

Standard conditions (US):

Atmospheric pressure	1.0132 bar_a
Density standard	1.1551 kg/m ³
Temperature	59 °F
Pressure	14.696 psi_a

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Applicator Sizing - Flow

Project : NBC Bucklin Point

Customer: BioSpark LLC
 Contact person: Tom Moore

Phone: 9786210421
 eMail:

C.Project No.:
 Fax:

TAG : FT100,1

Timestamp: --- | Review number: ---
 Sales order number:

Tri-Size Sheet

General Parameters

Fluid	Bio Gas-60%CH4,40%CO2 (Gas)	Ref. Temperature	59 °F
State	Gas	Ref. Pressure	14.696 psi_a
Character	Clean	Atmospheric Pressure	1.0132 bar_a
Abrasivity	Not abrasive	Standard	ASME/(ANSI)
Fluid Group (PED)	Dangerous Fluid (Fluid group 1)		
Fluid Type	Newtonian		

Sizing and Calculated Results

	Next Smaller Size	Current Size	Next Bigger Size	
Flow meter	Prosonic Flow B 200	Prosonic Flow B 200	Prosonic Flow B 200	
Flow Principle	Ultrasonic Flow (Prosonic Flow)	Ultrasonic Flow (Prosonic Flow)	Ultrasonic Flow (Prosonic Flow)	
Meter Size	2"	3"	4"	
Process connection*	CI 150 ASME B16.5, 316L	CI 150 ASME B16.5, 316L	CI 150 ASME B16.5, 316L	
Operating range min.	1.747	3.973	6.705	SCFM
Operating range max.	174.701	397.277	670.546	SCFM
Velocity at req. Flow min.	6.869	3.021	1.79	m/s
Velocity at req. Flow nom.	29.19	12.84	7.606	m/s
Velocity at req. Flow max.	34.34	15.1	8.948	m/s
Pressure loss at req. Flow min.	0	0	0	in.H2O@68°F
Pressure loss at req. Flow nom.	0	0	0	in.H2O@68°F
Pressure loss at req. Flow max.	0	0	0	in.H2O@68°F
Meas. error Vol. at req. Flow min.***	1.5	1.5	3	%
Meas. error Vol. at req. Flow nom.***	1.5	1.5	1.5	%
Meas. error Vol. at req. Flow max.***	n.a.	1.5	1.5	%
Meas. error Spec. Vol. at req. Flow min.***	1.5	1.5	1.5	%
Meas. error Spec. Vol. at req. Flow nom.***	1.5	1.5	1.5	%
Meas. error Spec. Vol. at req. Flow max.***	n.a.	1.5	1.5	%
Reynolds No.	155 372	103 032	79 306	
Warnings	1. Requested max. flow too big for flowmeter range. Please adapt the max. flow or select a bigger size (if available) or select another flowmeter.			

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***For error calculation, the specified reference conditions for the calibration of the flowmeter according to ISO/IEC 17025 apply. Further information in technical documentation.

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Applicator Sizing - Flow

Project : NBC Bucklin Point

Customer: BioSpark LLC

Contact person: Tom Moore

Phone: 9786210421

eMail:

C.Project No.:

Fax:

TAG : FT100.1

Timestamp: ---

Sales order number:

Review number: ---

Chart Sheet

Flowmeter: Prosonic Flow B 200

Flow Principle Ultrasonic Flow (Prosonic Flow)

Meter Size 3"

Operating range min. 3.973 SCFM

Operating range max. 397.277 SCFM

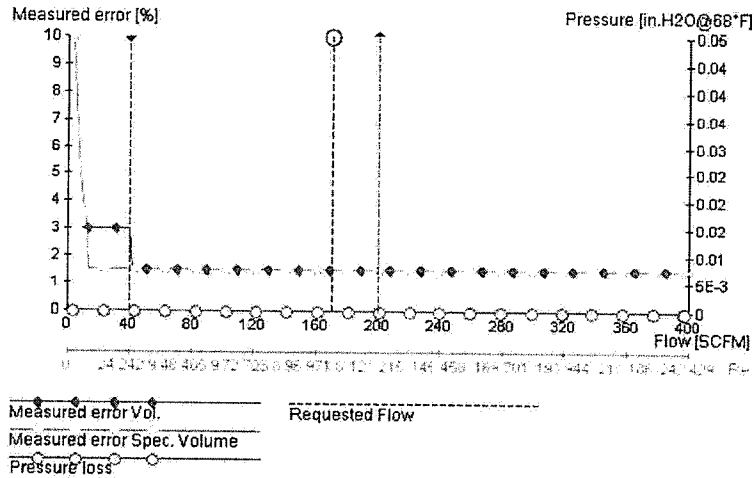
Fluid Bio Gas-60%CH₄,40%CO₂ (Gas)

Pressure 2.5 psi_g

Temperature 90 °F

Density 1.2752 kg/m³

Viscosity 0.01349 cP

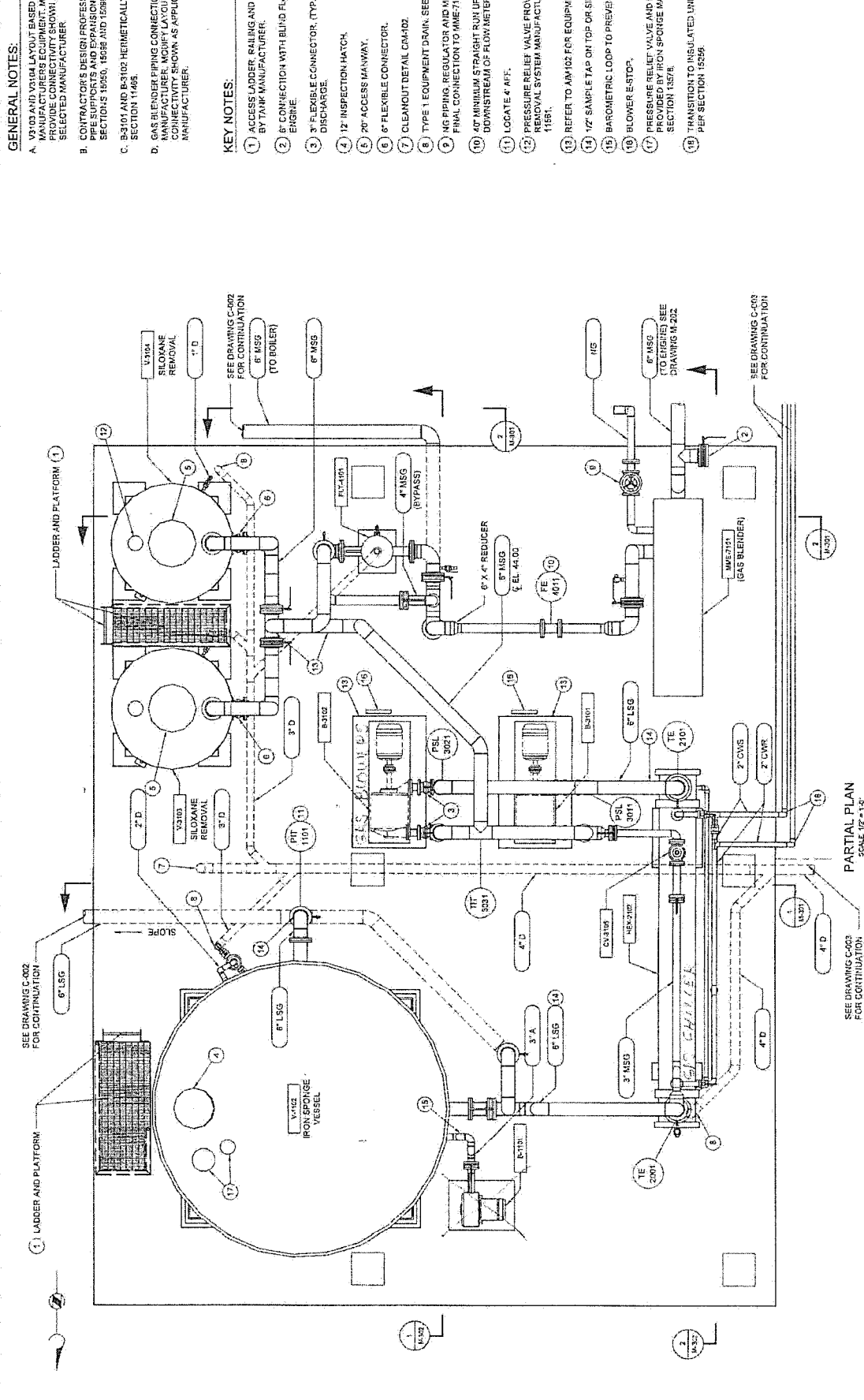


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A B C D E F G H J K L M N O P

10 9 8 7 6 5 4 3 2 1



- GENERAL NOTES:**
- V-103 AND V-104 LAYOUT BASED ON ONE MANUFACTURER'S EQUIPMENT. MODIFY LAYOUT BUT PROVIDE CONNECTIVITY SHOWN AS APPLICABLE TO SELECTED MANUFACTURER.
 - CONTRACTOR'S DESIGN PROFESSIONAL SHALL DESIGN PIPE SUPPORTS AND EXPANSION COMPENSATION PER SECTIONS 15050, 15058 AND 15059.
 - B-3101 AND B-3102 HERMETICALLY ENCLOSED PER SECTION 11465.
 - GAS BLENDER PIPING CONNECTIONS MAY VARY BY MANUFACTURER. VERIFY MANUFACTURER'S CONNECTIONS AND PROVIDE CONNECTIVITY SHOWN AS APPLICABLE TO MANUFACTURER.

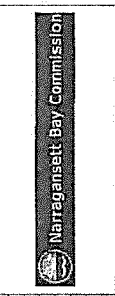
KEY NOTES:

- ACCESS LADDER, RAILING AND PLATFORM PROVIDED BY TANK MANUFACTURER.
- 6" CONNECTION WITH BLIND FLANGE FOR FUTURE ENGINE.
- 3" FLEXIBLE CONNECTOR (TYP.) SUCTION AND DISCHARGE.
- 12" INSPECTION HATCH.
- 20" ACCESS MANWAY.
- 6" FLEXIBLE CONNECTOR.
- CLEANOUT DETAIL C-102.
- TYPE 1 EQUIPMENT DRAIN. SEE M-102.
- ING PIPING REGULATOR AND METER BY UTILITY. FINAL CONNECTION TO MME7101 BY CONTRACTOR. DOWNSTREAM OF FLOW METER.
- LOCATE 4 AFF.
- PRESSURE RELIEF VALVE PROVIDED BY SILOXANE REMOVAL SYSTEM MANUFACTURER. SEE SECTION 11551.
- REFER TO M-102 FOR EQUIPMENT MOUNTING.
- 1/2" SAMPLE TAP ON TOP OR SIDE OF PIPE.
- BAROMETRIC LOOP TO PREVENT WATER BACKFLOW.
- BLOWER R-STOP.
- PRESSURE RELIEF VALVE AND HOSE CONNECTION PROVIDED BY IRON SPONGE MANUFACTURER. SEE SECTION 15078.
- TRANSITION TO INSULATED UNDERGROUND PIPING PER SECTION 15256.

PARTIAL PLAN
SCALE: 1/2" = 1'-0"

Brown and Caldwell <small>AN OVER MICHIGANISTS</small>	SUBMITTED: _____ DATE: _____ APPR'D: _____ DATE: _____	REVISIONS: <table border="1"> <thead> <tr> <th>NO.</th> <th>DATE</th> <th>DESCRIPTION</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table>	NO.	DATE	DESCRIPTION				PROJECT NUMBER: _____ DRAWING NUMBER: _____ M-201 SHEET NUMBER: _____ OF _____
	NO.		DATE	DESCRIPTION					
SEE EXTERIOR REFERENCE FILE: # NOT A PART OF CONTRACT DOCUMENTS	SEE DRAWING C-002 FOR CONTINUATION								

BIOGAS COGENERATION SYSTEM BUCKLIN POINT WWTF
MECHANICAL
GAS CONDITIONING PLAN



Meter B - Methane Content Meter
Specifications



GA5000

PORTABLE GAS
ANALYZER
INSTRUMENTATION

WWW.LANDTECNA.COM

- ▼ EASY TO USE AND CALIBRATE
- ▼ CAPABLE OF MONITORING UP TO SIX GASES
- ▼ MEASURES AND STORES FLOW READINGS, RELATIVE PRESSURE, TEMPERATURE AND MORE
- ▼ UPGRADABLE WITH INTERNAL, LOW-FLOW OPTION

PORTABLE GAS ANALYZER FOR LANDFILLS AND CONTAMINATED LAND

The GA5000 is our landfill and contaminated land portable gas analyzer, with available gas measurements of CH₄, CO₂, O₂, H₂S and CO. It's easy to use and calibrate and will help standardize your monitoring routines while supporting environmental compliance.

✉ INFO@QEDENV.COM

☎ 800-LANDTEC



QED ENVIRONMENTAL
2355 Bishop Circle West
Dexter, MI 48130, USA





GA5000

PORTABLE GAS ANALYZER INSTRUMENTATION



▼ FEATURES

- Measures % CH₄, CO₂ and O₂
- Measures barometric pressure, relative pressure and temperature
- Modular and upgradeable
- Up to six gases monitored
- Simultaneous display of all gases
- Peak and previous readings shown
- Adaptable to low flow measurement

▼ APPLICATIONS

- Landfill Gas Monitoring
- Waste to Energy
- Site Investigation
- Contaminated Land

▼ KEY BENEFITS

- Easy to use and calibrate
- Industry leading reliability
- Standardizes monitoring routines
- Supports environmental compliance
- Easy transfer of data

▼ TECHNICAL SPECIFICATION

GAS RANGES

Gases Measured	CH ₄	By dual wavelength infrared cell with reference channel	Standard
	CO ₂	By dual wavelength infrared cell with reference channel	Standard
	O ₂	By internal electrochemical sensor	Standard
	CO	By internal electrochemical sensor	Optional
	H ₂ S	By internal electrochemical sensor	Optional
	NH ₃	By internal electrochemical sensor	Optional
	H ₂	By internal electrochemical sensor	Optional
	CO (H ₂ Comp)**	By internal electrochemical sensor	Optional
Ranges	CH ₄	0-100% (vol)	
	CO ₂	0-100% (vol)	
	O ₂	0-25% (vol)	
	CO	0-2,000ppm***	
	CO (H ₂ Comp)**	0-2,000ppm***	
	H ₂ S	0-10,000ppm***	
	NH ₃	0-1000ppm	
	H ₂	0-1000ppm	
Gas Accuracy*	CO ₂	0-60%: +/-0.5% (vol)	60-100%: +/- 1.5% (vol)
	CH ₄	0-70%: +/-0.5% (vol)	70-100%: +/-1.5% (vol)
	O ₂	0-25%: +/-1.0% (vol)	
	CO	+/- 2.0% FS	
	CO(H ₂)**	+/- 1.0% FS	
	H ₂ S	+/- 5.0% FS	
	NH ₃	+/- 10.0% FS	
	H ₂	+/- 2.5% FS	

*All typical accuracies quoted are after calibration

**Hydrogen cross gas effect on carbon monoxide approximately 1% Do not use where hydrogen is in excess of 10,000ppm

***Additional ranges available. Contact LANDTEC for more information

POWER SUPPLY

Battery Life	Typical use 8 hours from fully charged
Charge Time	Approximately 4 hours from complete discharge

PUMP

Flow	Typically 550cc/min
Flow with 80 in. H ₂ O vacuum	Approximately 80cc/min
Low Flow Range	0-0.0117cfm
Accuracy	+/- .0001cfm



WWW.LANDTECNA.COM

#2386 REV 1 4-17

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QED ENVIRONMENTAL
2355 Bishop Circle West
Dexter, MI 48130, USA



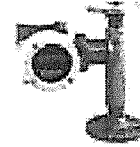
Meter C - Natural Gas Meter

Specifications & Diagrams

Applicator Sizing - Condensed (Flow)

Project

Project	NBC Bucklin Point
C.Project No.	
Customer:	BioSpark LLC
TAG	FT101.1
Timestamp	—
Review number	—
Sales order number	
Contact person	Tom Moore
eMail:	
Phone	9786210421
Fax	



General Parameters

Fluid	Natural Gas (Gas)
State	Gas
Character	Clean
Abrasivity	Not abrasive
Fluid Group (PED)	Dangerous Fluid (Fluid group 1)
Fluid Type	Newtonian
Ref. Temperature	59 °F
Ref. Pressure	14.696 psi_a
Atmospheric Pressure	1.0132 bar_a
Standard	ASME/(ANSI)

Flowmeter

Flowmeter	t-mass 65F
Flow Principle	Thermal (t-mass)
Extended order code	65F50-AK**G1
Meter Size	2"
Operating range min.	2.779 SCFM
Calibrated Flow	277.932 SCFM

Operating Conditions

	minimum	nominal	maximum	
Requested Flow	10	100	160	SCFM
Pressure		5		psi_g
Temperature		60		°F
Density		0.9795		kg/m3
Viscosity		0.01088		cP
Z-factor		0.9971		
Sound velocity		423.3		m/s
Pressure (min/max)	5		5	psi_g
Temp. (min/max)	60		60	°F

Operating Conditions

	minimum	nominal	maximum	
Requested Flow	10	100	160	SCFM
Velocity	1.854	18.54	29.67	m/s
Pressure loss	0	0.01	0.01	psi
Measured error	4.17	1.5	1.5	%
Mass***				
Reynolds No.	8 218	82 178	131 485	

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Operating range max.	555.864 SCFM
Material (sensor) *	SS 1.4404 / 316L
Process connection*	CI 150 ASME, 316L/1.4404 ASME B16.5 flange
PED category ** :	Application is Cat. I

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** The PED category is an Endress+Hauser recommendation and depends on the fluid category, process data as well from the max. permissible pressure of the selected pressure rating. The fluids of the Applicator data base are classified to 67/548/EWG.

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Applicator Sizing - Flow

Project : NBC Bucklin Point

Customer: BioSpark LLC

Contact person: Tom Moore

Phone: 9786210421

eMail:

C.Project No.:

Fax:

TAG : FT101.1

Timestamp: ---

Review number: ---

Sales order number:

Fluid properties sheet

Fluid

Fluid name	Natural Gas (Gas)	State	Gas
Chemical formula	93%CH4, 3%C2H6, 2%C3H8, 2%N2	Calculation standard	NEL

Fluid description

Medium character	Clean	Gas mixture	Fraction	
Fluid group (PED)	Dangerous Fluid (Fluid group 1)	Component		
Fluid Type	Newtonian	1 Nitrogen (Gas)	2 Mole%	3.23 Mass%
Fluid stability	Stable	2 Methane (Gas)	93 Mole%	86.3 Mass%
		3 Propane (Gas)	2 Mole%	5.21 Mass%
		4 Ethane (Gas)	3 Mole%	5.26 Mass%
		5	0 Mole%	0 Mass%
		6	0 Mole%	0 Mass%
		7	0 Mole%	0 Mass%
		8	0 Mole%	0 Mass%

Basic fluid parameters

Tc (Critical temperature)	-104.7 °F	Tm (Melting point)	n.a. °F
Pc (Critical pressure)	669.112 psi	Tb (Boiling point)	n.a. °F
Rho_c (Critical density)	168.01 kg/m3		

Calculated results

Density nom.	0.9795 kg/m3	Pressure nom.	5 psi_g
Molar mass	17.264 kg/kmol	Temperature nom.	60 °F
Z-factor nom.	0.9971		
Viscosity nom.	0.01088 cP		
Sound velocity nom.	423.3 m/s		
Thermal capacity nom.	2.128 kJ/(kg*K)		
Heat conductivity nom.	0.032 W/(m K)		
Rel. humidity nom.	0 %		

Reference values: Normal conditions (SI):

Atmospheric pressure	1.0132 bar_a
Density normal	0.7723 kg/m3
Temperature	0 °C
Pressure	1.0132 bar_a

Standard conditions (US):

Atmospheric pressure	1.0132 bar_a
Density standard	0.7317 kg/m3
Temperature	59 °F
Pressure	14.696 psi_a

Under no circumstances is Endress+Hauser liable for errors, neither in the Software and in its documentation, nor for any errors and consequential damage which may arise out of their use. The results in Applicator apply to parameters entered by the user. A change in these parameters could lead to different results. Mandatory data are in the according technical information (TI).

Applicator Sizing - Flow

Project : NBC Bucklin Point

Customer: BioSpark LLC
 Contact person: Tom Moore

Phone: 9786210421
 eMail:

C.Project No.:
 Fax:

TAG : FT101.1

Timestamp: ---
 Sales order number:

Review number: ---

Tri-Size Sheet

General Parameters

Fluid	Natural Gas (Gas)	Ref. Temperature	59 °F
State	Gas	Ref. Pressure	14.696 psi_a
Character	Clean	Atmospheric Pressure	1.0132 bar_a
Abrasivity	Not abrasive	Standard	ASME/(ANSI)
Fluid Group (PED)	Dangerous Fluid (Fluid group 1)		
Fluid Type	Newtonian		

Sizing and Calculated Results

	Next Smaller Size	Current Size	Next Bigger Size	
Flow meter	t-mass 65F	t-mass 65F	t-mass 65F	
Flow Principle	Thermal (t-mass)	Thermal (t-mass)	Thermal (t-mass)	
Meter Size	1 1/2"	2"	3"	
Process connection*	CI 150 ASME, 316L/1.4404	CI 150 ASME, 316L/1.4404	CI 150 ASME, 316L/1.4404	
Operating range min.	1.695	2.779	6.534	SCFM
Calibrated Flow	169.508	277.932	653.375	SCFM
Operating range max.	339.016	555.864	1 306.75	SCFM
Velocity at req. Flow min.	3.092	1.854	0.751	m/s
Velocity at req. Flow nom.	30.92	18.54	7.513	m/s
Velocity at req. Flow max.	49.48	29.67	12.02	m/s
Pressure loss at req. Flow min.	0	0	0	psi
Pressure loss at req. Flow nom.	0.01	0.01	0	psi
Pressure loss at req. Flow max.	0.04	0.01	0	psi
Meas. error Mass at req. Flow min.***	2.54	4.17	9.8	%
Meas. error Mass at req. Flow nom.***	1.5	1.5	1.5	%
Meas. error Mass at req. Flow max.***	1.5	1.5	1.5	%
Reynolds No.	106 120	82 178	52 305	
Warnings				

*The user is responsible for the selection of process-wetted materials in view of their corrosion resistance. Endress+Hauser makes no guarantees and assumes no liability for the corrosion resistance of the materials selected here for the application described above.

***For error calculation, the specified reference conditions for the calibration of the flowmeter according to ISO/IEC 17025 apply. Further information in technical documentation.

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Applicator Sizing - Flow

Project : NBC Bucklin Point

Customer: BioSpark LLC
 Contact person: Tom Moore

Phone: 9786210421
 eMail:

C.Project No.:
 Fax:

TAG : FT101.1

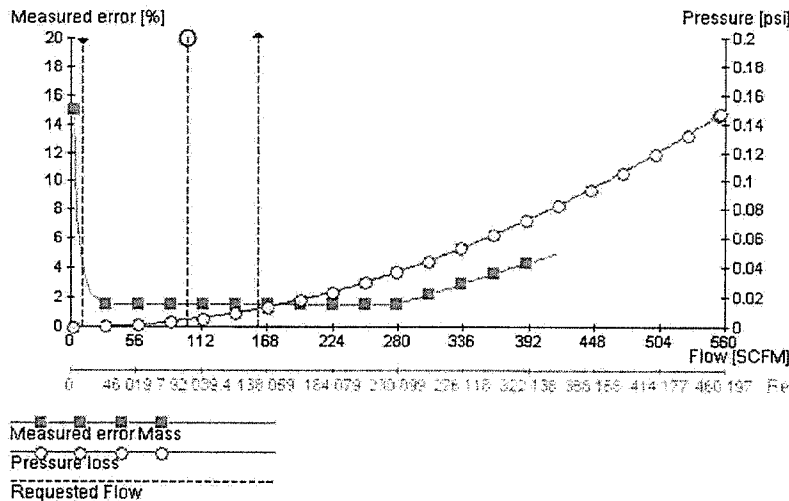
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 Sales order number:

Review number: —

Chart Sheet

Flowmeter: t-mass 65F

Flow Principle	Thermal (t-mass)	Fluid	Natural Gas (Gas)
Meter Size	2"	Pressure	5 psi_g
Operating range min.	2.779 SCFM	Temperature	60 °F
Calibrated Flow	277.932 SCFM	Density	0.9795 kg/m ³
Operating range max.	555.864 SCFM	Viscosity	0.01088 cP



***For error calculation, the specified reference conditions for the calibration of the flowmeter according to ISO/IEC 17025 apply. Further information in technical documentation.

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11467 Natural Gas Blending System P&ID

Drawing	Function	Location	Revision	Date	Created by	Description	Folder designation
1	F1	L1	0	10/8/2015	G Marks	Title Page	
2	F1	L1	0	10/8/2015	G Marks	Drawing list	
3	F1	L1	0	10/8/2015	G Marks	LEGEND	
4	F1	L5	0	10/8/2015	G Marks	NATURAL GAS BLENDING SYSTEM P&ID	

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LOCATION
 L1
 NBC - BUCKLIN POINT WWTP

CONTRACT #:

REVISION 0
 DATE 10/8/2015
 NAME G Marks
 CHANGES 150204
 DRAWING No. 150204 P011

REVISION 0
 SHEET 2 / 4

INSTRUMENT IDENTIFICATION GENERAL REFERENCE (ISA - S5.1)

ALARM	USER'S CHOICE CONTROL (CLOSE)	SHUTDOWN FIRST OUT (HIGH)	INDICATE (HIGH)	CONTROL STATUS (MIDDLE (INTERMEDIATE))	ORIFICE (OPEN) POINT	RECORD OR PRINT SWITCH	TEMPERATURE MULTI-FUNCTION VALVE OR DAMPER WELL	UNCLASSIFIED RELAY OR COMPUTE DRIVE OR ACTUATE	POSITION OR SPEED	PRIMARY ELEMENT	INDICATOR	RECORDER	CONTROLLER INDICATING RECORDING	TRANS-MITTER	CONTROL SWITCH	CONTROL VALVE OR REGULATOR	ALARM	SELF-ACTUATED VALVE	RELAY OR CONVERTER
A	ANALYSIS	AE	AI	AR	AIC	ARC	AT	AS	AA	AV	BY								
B	BURNER FLAME	BE	BI	BR	BC	CRC	BT	BS	BA	BV	BY								
C	CONDUCTIVITY	CE	CI	CR	CC	DRC	CT	CS	CA	CV	BY								
D	DENSITY OR MASS	DE	DI	DR	DC	ERC	DT	DS	DA	DV	DY								
E	VOLTAGE	EE	EI	ER	EC	FRC	ET	ES	EA	EV	EY								
F	FLOW (RATIO OR FRACTION)	FE	FI	FR	FC	GRC	FT	FS	FA	FV	FY								
G	GAUGING	GE	GI	GR	GC	HRC	GT	GS	GA	GV	FY								
H	HAND	HE	HI	HR	HC	IRC	HT	HS	HA	HV	HY								
I	CURRENT	IE	II	IR	IC	JRC	IT	IS	IA	IV	IY								
J	PULSE (SCRM)	JE	JI	JR	JC	KRC	IT	KS	KA	IV	IY								
K	LEVEL	KE	KI	KR	KC	LRC	LT	LS	LA	LV	IY								
L	MOISTURE - HUMIDITY	LE	LI	LR	LC	MRC	LT	MS	MA	MV	IY								
M	USER'S CHOICE	ME	MI	MR	MC	NRC	MT	NS	NA	NV	IY								
N	PRESSURE OR VACUUM QUANTITY OR EVENT	NE	NI	NR	NC	ORC	OT	OS	OA	OV	IY								
O	POINT	OE	OI	OR	OC	PRC	PT	PS	PA	PV	IY								
P	QUANTITY OR EVENT	PE	PI	PR	PC	RRC	RT	RS	RA	PV	IY								
Q	PRESSURE OR VACUUM QUANTITY OR EVENT	QE	QI	QR	QC	SRC	ST	SS	SA	RV	IY								
R	RADIOACTIVITY	RE	RI	RR	RC	TRC	TT	TS	TA	RV	IY								
S	SPEED OR FREQUENCY	SE	SI	SR	SC	URC	UT	US	UA	UV	IY								
T	TEMPERATURE	TE	TI	TR	TC	VRC	VT	VS	VA	WV	IY								
U	MULTI-VARIABLE	UE	UI	UR	UC	WRC	WT	WS	VA	WV	IY								
V	TEMPERATURE	VE	VI	VR	VC	XRC	XT	XS	VA	WV	IY								
W	WEIGHT OR FORCE	WE	WI	WR	WC	ZRC	ZT	ZS	ZA	XY	IY								
X	UNCLASSIFIED	XE	XI	XR	XC					XY	IY								
Y	USER'S CHOICE	YE	YI	YR	YC					XY	IY								
Z	POSITION OR SPEED	ZE	ZI	ZR	ZC					XY	IY								

Note- TM designation for the flow meters means "Thermal Mass"

(XX)-DIAGNOSTIC SHUTDOWN (USED TO INDICATE THE DIAGNOSTIC CHECK REQD ON THE ANALOG INPUT)

PIPE REFERENCE

AA-BB-CC-DD-EEEE

AA: NOMINAL PIPE SIZE
 BB: FLUID
 CC: PIPE MATERIAL
 DD: PIPE SCHEDULE
 EE: PIPE SEQUENCE NUMBER

DIGESTER GAS	NATURAL GAS	316	314	AS3
COMBUSTION EXHAUST	SYNTHETIC GAS	A106	314	AS3
ATMOSPHERIC AIR	INSTRUMENT AIR	CPVC	120F TO 180F	PVC
TREATED WATER	SEA WATER			
PROPYLENE GLYCOL	SATURATED STEAM			
ETHYLENE GLYCOL	FEED WATER			
STEAM CONDENSATE	DEAERATED WATER			
RO WATER	REDUCING AGENT			
	LUBRICATION OIL			
	OIL MIST			
	PIPE MATERIAL	314	314	AS3
	PIPE SCHEDULE	106	120F TO 180F	PVC
	PIPE SEQUENCE NUMBER			

EXAMPLE > 04-DG-304-10-0000
 DIGESTER GAS IN A 4" SCHEDULE 10 PIPE MADE FROM 304 SS

COMMON INSTRUMENT SYMBOLS

	GENERIC VALVE		REDUCER / INCREASER		OPEN DRAIN		DIFFERENTIAL PRESSURE GAUGE
	LUG / WATER BUTTERFLY VALVE		FLEX CONNECTOR (FLANGED)		P-TRAP		SINGLE PRESSURE GAUGE
	FLANGED BUTTERFLY VALVE		FLEX CONNECTOR (THREADED)		TEMPERATURE SENSOR WITH INTEGRAL THERMOWELL		TEMPERATURE TRANSMITTER WITH INTEGRAL THERMOWELL AND DISPLAY
	NEEDLE VALVE (THREADED)		FLEX CONNECTOR (CLAMPED)		TEMPERATURE TRANSMITTER WITH INTEGRAL THERMOWELL AND DISPLAY		PRESSURE TRANSMITTER WITH NO DISPLAY
	BALL VALVE (FLANGED)		CHECK VALVE (THREADED SPRING LOADED BALL)		PRESSURE TRANSMITTER WITH DISPLAY		DIFFERENTIAL PRESSURE TRANSMITTER
	BALL VALVE (THREADED)		CHECK VALVE (FLANGED SWING GATE)		FLOW TRANSMITTER WITH INDICATION & VORTEX FLOW ELEMENT		FLOW TRANSMITTER WITH INDICATION & THERMAL MASS FLOW ELEMENT
	FLOAT VALVE (THREADED)		THERMAL INSULATION WITH U VALUE		THERMAL INSULATION WITH U VALUE & HEAT TRACE		MOTOR OPERATOR
	WYE STRAINER (THREADED)		THERMAL INSULATION WITH U VALUE		SOLENOID OPERATOR		DOUBLE SOLENOID OPERATOR
	RELIEF VALVE		MOTOR OPERATOR / MOTOR		SOLENOID OPERATOR		GEAR OPERATOR / GEARBOX
	3-WAY BALL VALVE (THREADED)		SOLENOID OPERATOR		DOUBLE SOLENOID OPERATOR		GEAR OPERATOR / GEARBOX
	CIRCUIT SETTER (FLANGED)		DOUBLE SOLENOID OPERATOR		GEAR OPERATOR / GEARBOX		GEAR OPERATOR / GEARBOX

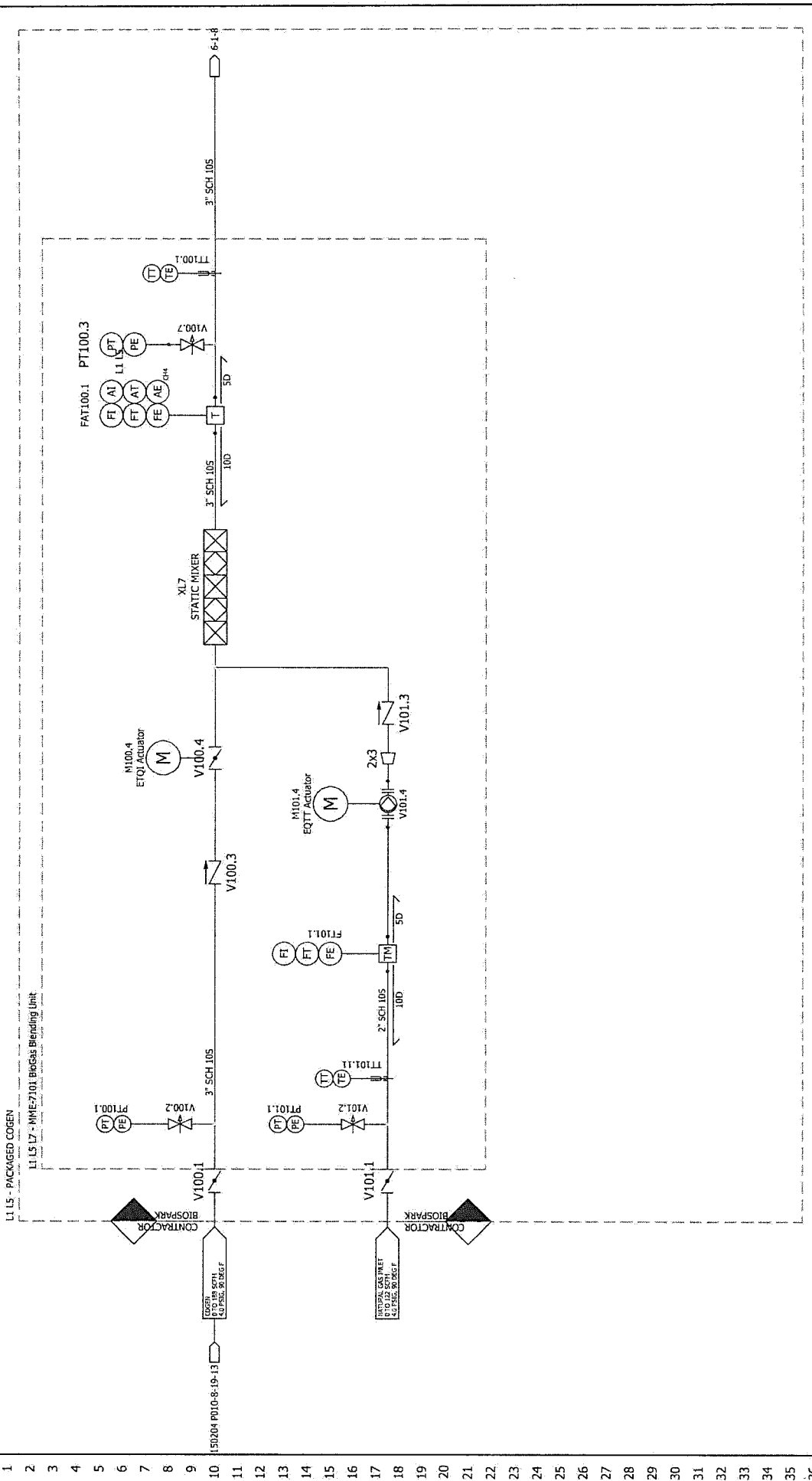
LEGEND

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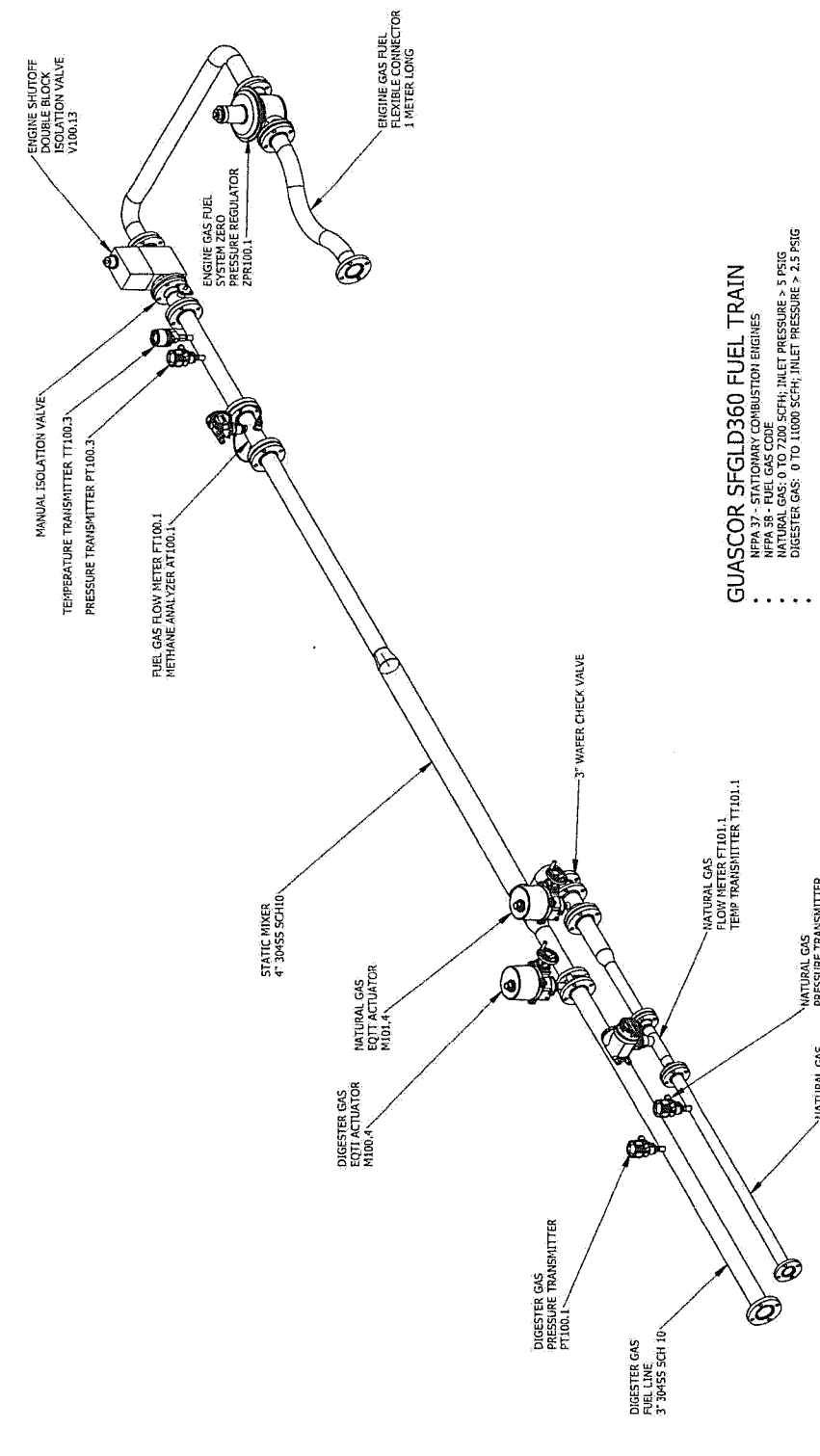
REVISION: 0
 DATE: 10/8/2015
 NAME: G Marks
 CONTRACT NO.: 150204
 LOCATION: NBC - BUCKLIN POINT WWTP
 DRAWING NO.: 150204 P011
 SHEET: 3 / 4

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20



DESIGN OFFICE	BIOSPARK LLC 1 LIBERTY SQ - 11TH FLOOR BOSTON, MA 02109 WWW.BIOSPARKUSA.COM		DIGESTER GAS BLENDING SYSTEM SPECIFICATION SECTION 11467	REVISION	0
CONTRACTOR	BIOSPARK		CONTRACT NO.:	150204	150204 P011
LOCATION	LI15.L1 DIGESTER / NATURAL GAS MIXING SYSTEM		REVISION DATE	10/8/2015	0
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SOLIDWORKS Electrical	2016.0.3.12				

GUASCOR SFGLD360 DUAL FUEL GAS BLENDING/MIXING TRAIN



GUASCOR SFGLD360 FUEL TRAIN

- NFPA 37 - STATIONARY COMBUSTION ENGINES
- NFPA 99 - FUEL GAS CODE
- DIGESTER GAS: 0 TO 7200 SCFH; INLET PRESSURE < 5 PSIG
- NATURAL GAS: 0 TO 10000 SCFH; INLET PRESSURE > 2.5 PSIG

MISC NOTES:

- FUEL GAS ISOLATION VALVES (NOT SHOWN) SHALL BE INSTALLED OUTSIDE THE ENCLOSURE AT A LOCATION THAT PROVIDES CONVENIENT ACCESS FOR GAS ISOLATION.
- DIGESTER GAS LINE SHALL BE FITTED WITH A FLAME ARRESTOR LOCATED OUTSIDE THE ENCLOSURE.
- FLAME ARRESTOR SHALL BE INSTALLED BY THE CONTRACTOR SO AS TO ELIMINATE THE POSSIBILITY OF MOISTURE COLLECTING IN THE FLAME ARRESTOR.

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CLIENT NAME
NARRAGANSETT BAY COMMISSION
 102 CAMPBELL AVENUE
 EAST PROVIDENCE, RI 02914

PROJECT NAME
BIOGAS COGENERATION SYSTEM - BUCKLIN POINT WWTP

DRAWING DESCRIPTION
SECTION 11467 - GAS BLENDING SYSTEM

DATE	6/24/2016
SCALE	1:24
WEIGHT	
ENGINEER / DESIGNER	

SHEET 1 OF 2
 SIZE B
 DRAWING NUMBER 150204 P102

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 COMMISSION
 102 CAMPBELL AVENUE
 EAST PROVIDENCE, RI 02914

PROJECT NAME
 BIOGAS
 COGENERATION
 SYSTEM - BUCKLIN
 POINT WWTP

DRAWING DESCRIPTION
 SECTION 11467 - GAS
 BLENDING SYSTEM

DATE
 6/24/2016

SCALE
 1:32

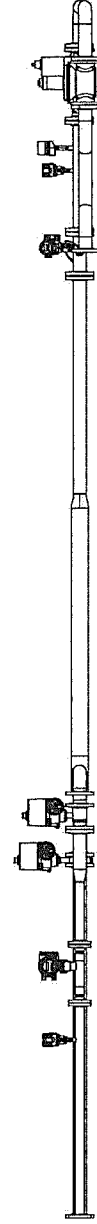
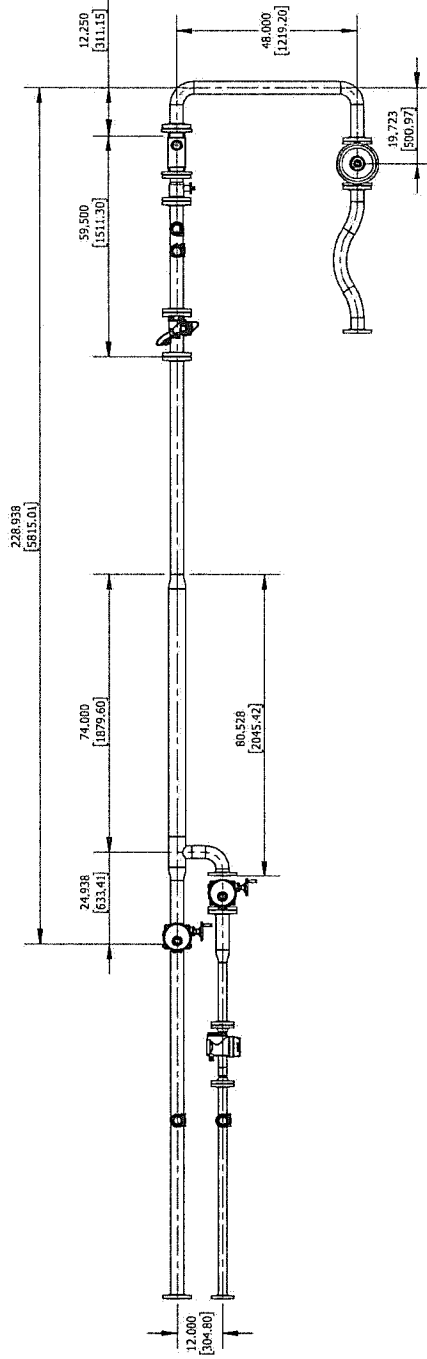
WEIGHT

ENGINEER / DESIGNER

SHEETS
 SHEET 2 OF 2

SIZE
 B

DRAWING NUMBER
 150204 P102

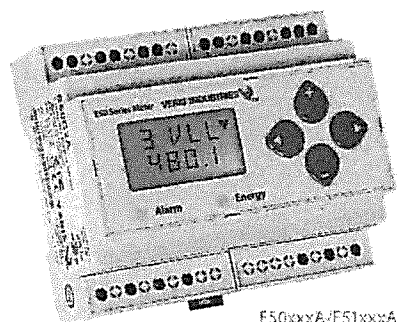


Meter D - Net Power Meter

Specifications & Diagrams

E5XXXA SERIES

Cost-Saving, Versatile Monitoring
Solution with Associated E683x Rope Style CTs
(Sold Separately)



E500xA/E510xA



E683x Series Rope CT
(sold separately)

The E5xxxA Series DIN Rail Meter combines exceptional metering performance with a built-in integrator and power supply to deliver a cost-effective, easily installed solution for power monitoring applications. Multiple communication protocol options offer added flexibility for easy system integration.

E5xxxA devices work exclusively with Veris E683x Series rope CTs for fast connection. The rope style CTs allow convenient installation in tight spaces.

The data logging capability (E5xC3A and E5xx5A) protects data in the event of a power or communications failure elsewhere in the system. Different devices in the series offer serial communication, pulse output, and phase alarms to suit a wide variety of applications.

SPECIFICATIONS

ACCURACY

Real Power & Energy
E5xxxA 0.5% (ANSI C12.20, IEC 62053-22 Class 0.5S)

INPUTS

Control Power, AC 50/60 Hz; 5 VA max.; 90 V min.; UL Maximums: 600 VL-L (347 VL-N); CE Maximum: 300 VL-N

Control Power, DC 3 W max.; UL and CE: 125 to 300 Vdc (external DC current limiting required)

Voltage Input UL: 90 VL-N to 600 VL-L; CE: 90 VL-N to 300 VL-N

Current Input Scaling 50 to 5000 A

Input Range E683x Series rope style CTs only (CTs must be rated for connection to Class 1 voltage inputs)

Pulse Inputs (E5xHxA & E50FxA only) Contact inputs to pulse accumulators (one set with E5xH2A & E50F2A; two sets with E5xH5A & E51F5A)*

OUTPUTS

All Models (except E5xHxA & E50FxA) Real Energy Pulse: N.O. static**;
Alarm contacts: N.C. static**

E50BxA Reactive energy pulse**

E5xCxA RS-485 2-wire Modbus RTU (1200 baud to 38.4 kbaud)

Faster installation 0.5% accuracy

Integrator and power supply for the CTs are built into the meter... fewer devices to purchase and faster installation

ANSI C12.20 0.5% accuracy, IEC 62053-22 Class 0.5S on all E5xxxA...great for cost allocation

Rope CTs

Versatile rope CTs allow convenient installation in tight spaces

Easy installation

DIN rail or screw mounting options

400 to 5000A

Designed to work exclusively with E683x Series rope CTs which offer 1% accuracy from 50 to 5000 A... monitor a wide range of loads with breakers from 400 to 5000 A

Multiple applications

Real energy output and phase loss alarm output on E50BxA and E5xCxA models...one device serves multiple applications

APPLICATIONS

- Energy monitoring in building automation systems
- Commercial sub-metering
- Renewable energy
- Industrial monitoring
- Energy management
- Cost allocation

E5xHxA	RS-485 2-wire BACnet MS/TP (9600 baud to 115.2 kbaud)
E50FxA	2-wire LON FT
MECHANICAL	
Mounting	DIN rail or 3-point screw mount
ENVIRONMENTAL	
Operating Temp Range	-30 to 70 °C (-22 to 158 °F)
Storage Temp Range	-40 to 85 °C (-40 to 185 °F)
Humidity Range	<95% RH non-condensing; indoor use only
WARRANTY	
Limited Warranty	5 years
AGENCY APPROVALS	
Agency Approvals	UL508, EN61010, California CSI Solar, ANSI C12.20



*10 kΩ Vac/dc to 4 to 10 Vdc.

**30 Vac/dc, 100 mA max.

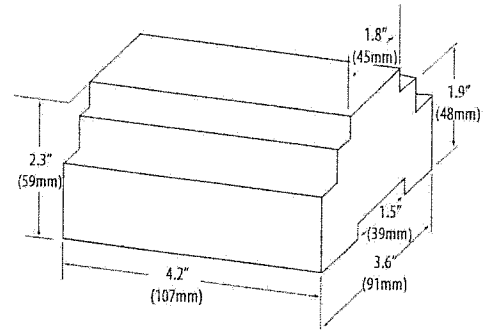
***The CE mark indicates RoHS2 compliance. Please refer to the CE Declaration of Conformity for additional details.



ORDERING INFORMATION

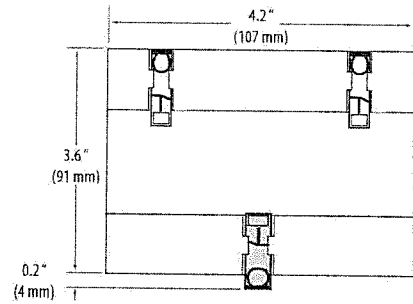
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MEASUREMENT CAPABILITY - FULL DATA SET											
Bi-directional Energy Measurements								•	•	•	•
Power (3-phase total and per phase): Real (kW), Reactive (kVAR), & Apparent (kVA)	•	•	•	•	•	•	•	•	•	•	•
Power Factor: 3-phase average & per phase	•	•	•	•	•	•	•	•	•	•	•
Present Power Demand: Real (kW), Reactive (kVAR), and Apparent (kVA)	•	•	•	•	•	•	•	•	•	•	•
Import & Export totals of Present Power Demand: Real (kW), Reactive (kVAR), & Apparent (kVA)								•	•	•	•
Peak Power Demand: Real (kW), Reactive (kVAR), and Apparent (kVA)	•	•	•	•	•	•	•	•	•	•	•
Current (3-phase average and per phase)	•	•	•	•	•	•	•	•	•	•	•
Voltage: Line-Line and Line-Neutral (3-phase average and per phase)	•	•	•	•	•	•	•	•	•	•	•
Frequency	•	•	•	•	•	•	•	•	•	•	•
ANSI C12.20 0.5% accuracy, IEC 62053-22 Class 0.5S	•	•	•	•	•	•	•	•	•	•	•
Accumulated Net Energy: Real (kWh), Reactive (kVARh), and Apparent (kVAh)	•	•	•	•	•	•	•	•	•	•	•
Accumulated Real Energy by phase (kWh)	•	•	•	•	•	•	•	•	•	•	•
Import and Export Accumulators of Real and Apparent Energy								•	•	•	•
Reactive Energy Accumulators by Quadrant (3-phase total and per phase)								•	•	•	•
Demand Interval Configuration: Fixed or Rolling Block	•	•	•	•	•	•	•	•	•	•	•
Demand Interval Configuration: External Sync to Comms	•	•	•	•	•	•	•	•	•	•	•
DATA LOGGING											
Data Logging: 10 16-Bit Configurable (can include Date/Time) Data Buffers			•						•		
Data Logging: 3 Timestamped 32-Bit Configurable Data Buffers					•		•				•
Store up to 60 days of readings at 15-minute intervals			•		•		•		•		•
OUTPUTS											
Alarm Output (N.C.)	•	•	•	•	•	•	•	•	•	•	•
1 Pulse Output (N.O.)	•	•	•								
2 Pulse Outputs (N.O.)	•										
RS-485 Serial (Modbus RTU Protocol)		•	•					•	•		
RS-485 Serial (BACnet MS/TP Protocol)						•		•	•		
Lon FT Serial (LonTalk Protocol)				•	•						
INPUTS											
2 Pulse Contact Accumulator Inputs				•		•					•
1 Pulse Contact Accumulator Input				•						•	

DIMENSIONAL DRAWING



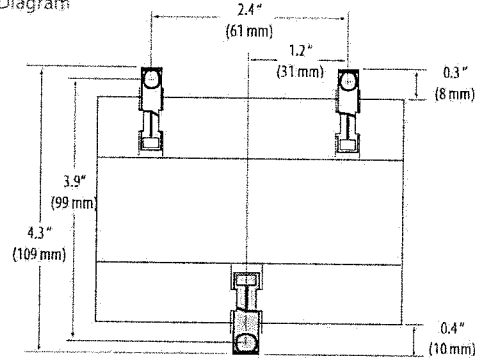
DIN MOUNT CONFIGURATION

Mounting Diagram



SCREW MOUNT CONFIGURATION

Mounting Diagram

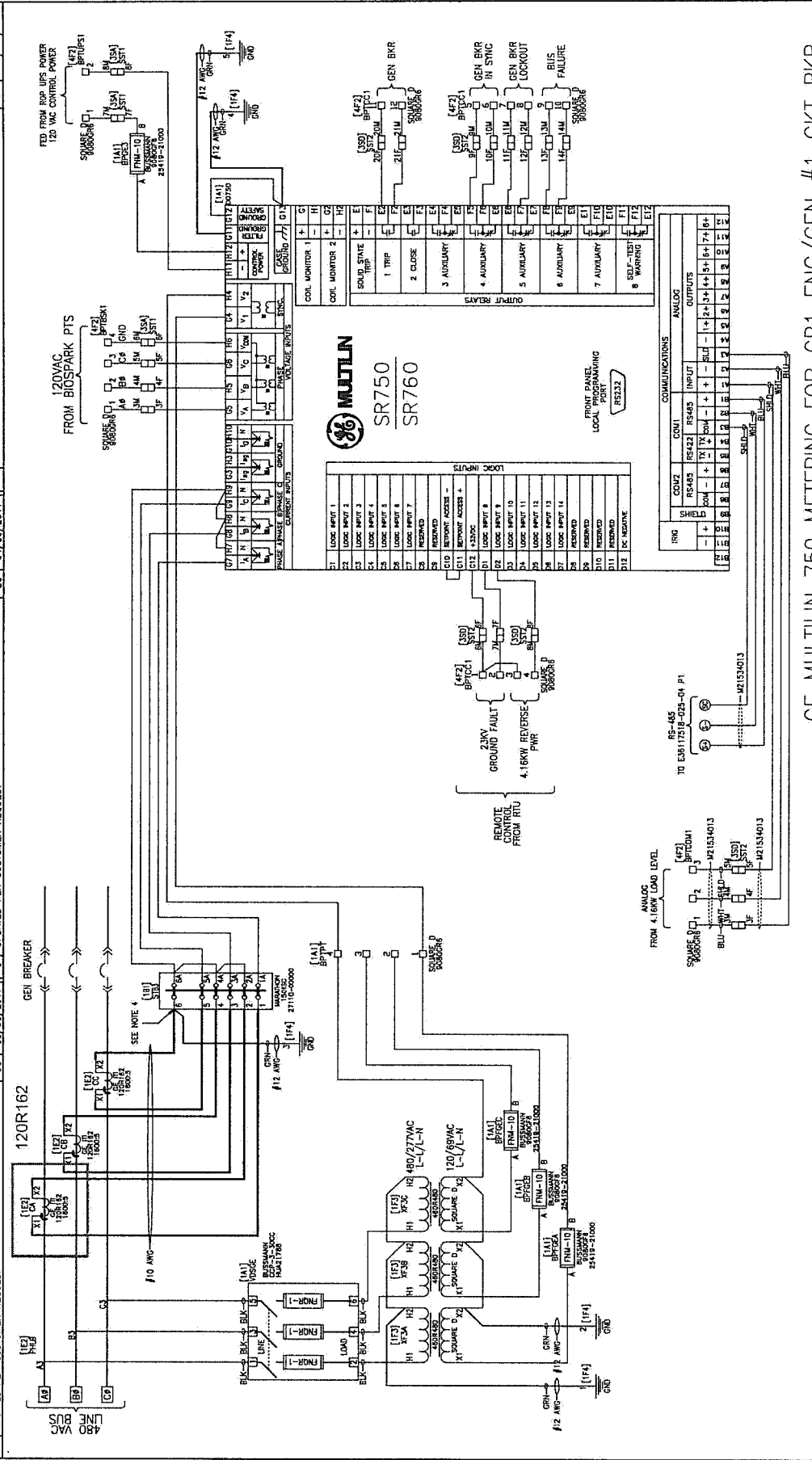


REQUIRED CTS

MODEL	DESCRIPTION
E683C502	Rogowski CT, 250 mm (9"), 600 V, 5 kA, U018 equivalent
E683D502	Rogowski CT, 300 mm (12"), 600 V, 5 kA, U018 equivalent
E683G502	Rogowski CT, 460 mm (18"), 600 V, 5 kA, U018 equivalent
E683J502	Rogowski CT, 600 mm (24"), 600 V, 5 kA, U018 equivalent
E683L502	Rogowski CT, 900 mm (35"), 600 V, 5 kA, U018 equivalent



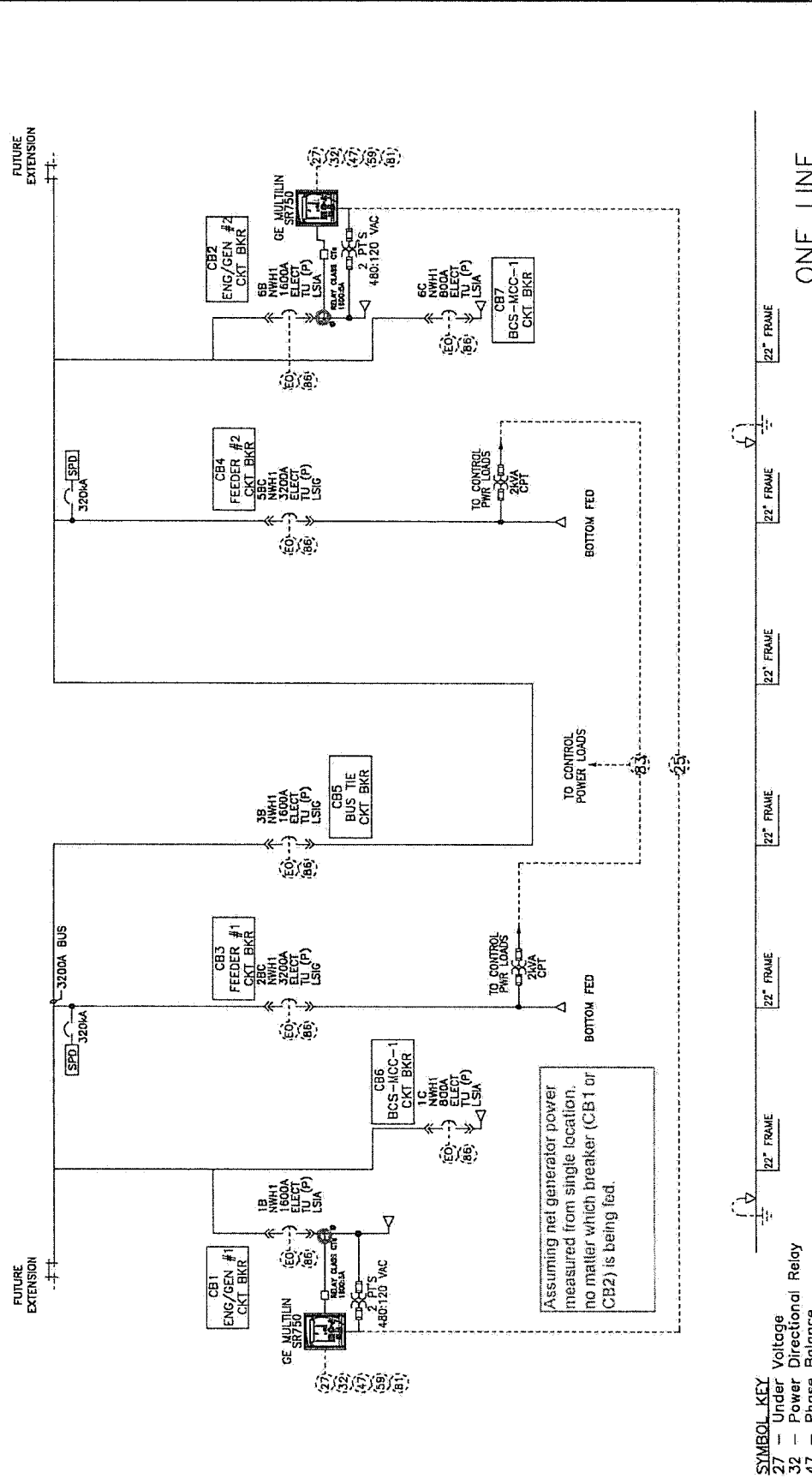
REV	DESCRIPTION	BY	DATE	SC	REV	DESCRIPTION	BY	DATE	SC
A	UPDATED PER CUSTOMER REQUEST	SC	03/03/2017	C	UPDATED PER CUSTOMER REQUEST	SC	04/06/2017		



GE MULTILIN 750 METERING FOR CB1 ENG/GEN #1 CKT BKR	
JOB NAME:	BIOGAS COGEN BUCKLIN PT WWTF ABC
JOB LOCATION:	CHATTANOOGA TN
DRAWN BY:	SHANE CARTER
ENGR:	SJC/LRB
DATE:	FEBRUARY 20, 2017
DRAWING STATUS:	RECORD
DWG#	636117518-025-03
PG#	OF 4

- NOTES:
1. ALL WIRING TO BE TYPE "SIS" (UL LISTED)
 2. ALL CONTROL FUSES MOUNTED IN FUSED PULLOUTS.
 3. USE #14 AWG WIRE UNLESS OTHERWISE NOTED.
 4. GROUNDED TERMINAL OF THE SHORTING BLOCK TO BE A PAN HEAD SCREW.
 5. RELAY CLASS CT'S ARE MOUNTED ON INCOMING BUS

REV	DESCRIPTION	BY	DATE	APP	DATE	APP	DATE	APP	DATE
A	REPLACED GE PDMI WITH MULTILIN 750	SC	08/14/2016						



SYMBOL KEY	
27	Under Voltage
32	Power Directional Relay
47	Phase Balance
59	Over Voltage
81	Frequency Over/Under Relay
83	Control Power Auto Throw Over Relay
86	Lock-out Relay
E0	Electrically Operated

JOB NAME:	BOGAS COSEN BUCKLIN PT WHIF NBC
JOB LOCATION:	CHATTAHOOGA TN
DRAWN BY:	SHANE CARTER
ENGR:	SC
DATE:	JUNE 23, 2016
DRAWING STATUS:	APPROVAL

EQUIPMENT DESIGNATION:	GEN SWGR
EQUIPMENT TYPE:	P24 SWITCHGEAR
DRAWING TYPE:	ONE LINE

DWG NO.	REV
DWG 03611751B-0295-01	REV A

February 16, 2018

Ms. Luly E. Massaro, Commission Clerk
Rhode Island Public Utilities Commission
89 Jefferson Blvd
Warwick, RI 02888

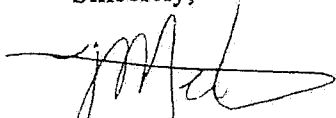
RE: Application for Certification of Eligibility of Renewable Energy Resource

Dear Ms. Massaro,

As the Mechanical Inspector for NBC, I hereby attest that the BTU Meter and the Net Power Meter were both installed as per the approved drawings and requirements by the device manufactures. By contract and specification, this project is to be done in accordance with RI State Codes.

I declare that the above statement is true and accurate to the best of my knowledge.

Sincerely,

A handwritten signature in black ink, appearing to read 'Jose Medina', with a long horizontal flourish extending to the right.

Jose Medina
Mechanical Inspector

Meter E - BTU Meter

Specifications, Diagram & Calibration Certificate

• SYSTEM-10 BTU METER •



DESCRIPTION

The System-10 BTU Meter provides highly accurate thermal energy measurement in chilled water, hot water and condenser water systems based on signal inputs from two matched temperature sensors (included) and any of ONICON's insertion or inline flow meters (ordered separately). The basic model provides a local indication of energy, flow and temperature data through an alphanumeric display. An isolated solid state dry contact is provided for energy total. Optional analog outputs and network communications are also available.

APPLICATIONS

Chilled water, hot water and condenser water systems for:

- Commercial office tenant billing
- Central plant monitoring
- University campus monitoring
- Institutional energy cost allocation
- Performance/efficiency evaluations
- Performance contracting energy monitoring

FEATURES

Simple Installation and Commissioning - Factory programmed and ready for use upon delivery. All process data and programming functions are accessible via front panel display and keypad.

Single Source Responsibility - One manufacturer is responsible for every aspect of the energy measurement process ensuring component compatibility and overall system accuracy.

N.I.S.T. Traceable Calibration with Certification - Each Btu measurement system is individually calibrated using application specific flow and temperature data and is provided with calibration certificates.

Precision Solid State Temperature Sensors - Custom calibrated and matched to an accuracy better than $\pm 0.15^\circ \text{F}$ over calibrated range.

Highly Accurate Flow Meters - ONICON offers a wide variety of insertion and inline type flow measurement technologies including turbine, electromagnetic and vortex sensing. Each type offers unique advantages depending on the application. All ONICON flow meters are individually wet calibrated and designed to operate over a wide flow velocity range with accuracies ranging from $\pm 0.2\%$ to $\pm 2.0\%$ of rate depending on the model.

Complete Installation Package - All mechanical installation hardware, color coded interconnecting cabling and installation instructions are provided to ensure error-free installation and accurate system performance.

Serial Communications - Optional communications card provides complete energy, flow and temperature data to the control system through a single network connection, reducing installation costs.

ORDERING INFORMATION

The System-10 BTU Meter is sold complete with temperature sensors. Thermowell installation kits and flow meters are purchased separately.

ITEM #	DESCRIPTION
SYSTEM-10	System-10 BTU Meter ←
SYSTEM-10-OPT8	High temperature sensors (over 200° F)
SYSTEM-10-OPT9	Add one analog output
SYSTEM-10-OPT10	Add four analog outputs
Choose from the following commonly used thermowell installation kits:	
SYSTEM-10-OPT4	Upgrade to outdoor thermowells (pair)
BTU-ST-INSTL32	Brass kit for welded steel pipe (¾" - 5") ←
BTU-ST-INSTL52	Brass kit for threaded steel pipe (¾" - 2½")
BTU-ST-INSTL34	SS kit for welded steel pipe (¾" and up)
BTU-ST-INSTL36	Brass kit for copper tube (¾" - 2")
BTU-ST-INSTL37	Brass kit for copper tube (2½" - 3")
Choose from the following flow meters:	
F-1100 / F-1200	Insertion Turbine Flow Meter (1¼" - 72")
F-1300	Inline Turbine Flow Meter (¾" - 1")
F-3100 / F-3200	Inline Electromagnetic Flow Meter (¼" - 48") ←
F-3500	Insertion Electromagnetic Flow Meter (3" - 72")
F-4200	Clamp-on Ultrasonic Flow Meter (½" - 48")
F-2000 Series	Inline Vortex Flow Meter (½" - 12")
Refer to catalog for flow meter installation kits. Consult with ONICON for additional thermowell installation kit and flow meter options.	

SYSTEM-10 BTU METER SPECIFICATIONS

CALIBRATION

Flow meters and temperature sensors are individually calibrated followed by a complete system calibration.
Field commissioning is also available.

ACCURACY

TEMPERATURE

Overall differential temperature measurement uncertainty of $\leq \pm 0.15^\circ\text{F}$ over the stated range
(Includes uncertainty associated with the sensors, transmitters, cabling and calculator input circuitry)
Temperature sensors meet EN1434 / CSA C900.1 accuracy requirements for 1K sensors for cooling applications, $32^\circ\text{F} - 77^\circ\text{F}$
Temperature sensors meet EN1434 / CSA C900.1 accuracy requirements for 2K sensors for heating applications, $140^\circ\text{F} - 212^\circ\text{F}$

CALCULATOR

Computing nonlinearity within $\pm 0.05\%$
Calculator meets EN1434 / CSA C900.1 class 1 accuracy requirements for 2K sensors for all applications

PROGRAMMING

Factory programmed for specific application
Field programmable via front panel interface

MEMORY

Non-volatile EEPROM memory retains all program parameters and totalized values in the event of power loss.

DISPLAY

Alphanumeric LCD displays total energy, total flow, energy rate, flow rate, supply temperature, return temperature, serial number and alarm status
Alpha: 16 character, 0.2" high
Numeric: 8 digit, 0.4" high
Rate Display Range: 0 - 9,999,999
Total Display Range: 0 - 9,999,999
The totals will roll over to zero when the maximum count is exceeded.

OUTPUT SIGNALS

Standard:
Isolated solid state dry contact for energy total:
Contact rating: 100 mA, 50 V
Contact duration: 0.5, 1, 2, or 6 sec
Optional:
Analog Output(s) (4-20 mA, 0-10 V or 0-5 V):
One or four analog output(s) available for flow rate, energy rate, supply/return temps, or delta-T.
Serial Communications:

BACnet IP or MS/TP	LONWORKS - TP/FT-10F
Siemens Apogee - P1	Johnson Controls Metasys - N2
MODBUS RTU RS485 or TCP/IP	

TEMPERATURE SENSORS

Solid state sensors are custom calibrated using N.I.S.T. traceable temperature standards.
Current based signal (mA) is unaffected by wire length.

TEMPERATURE RANGE

Standard liquid temperature range: 32°F to 200°F
Optional extended temperature ranges available
Ambient temperature range: -20°F to 140°F

LIQUID FLOW SIGNAL INPUT

0-15 V pulse output from any ONICON flow meter

MECHANICAL

Electronics Enclosure:

Standard: Steel NEMA 13, wall mount, 8"x 10"x 4"
Optional: NEMA 4 (Not UL listed)
Approximate weight: 12 lbs

Temperature Sensor Thermowell Kits:

Thermowells and other kit components vary by fluid type, fluid temperature, pipe material and pipe size. Commonly used kits are listed on the previous page. Contact ONICON for additional thermowell kit options, including hot tap installation kits for retrofit installations.

ELECTRICAL

Input Power: Based on Btu meters configured for network connection without the optional analog outputs

Standard: 24 VAC, 50/60 Hz, 500 mA

Optional: 120 VAC, 50/60 Hz, 200 mA
230 VAC, 50 Hz, 150 mA

Internal Supply:

Provides 24 VDC at 200 mA to electronics and flow meter

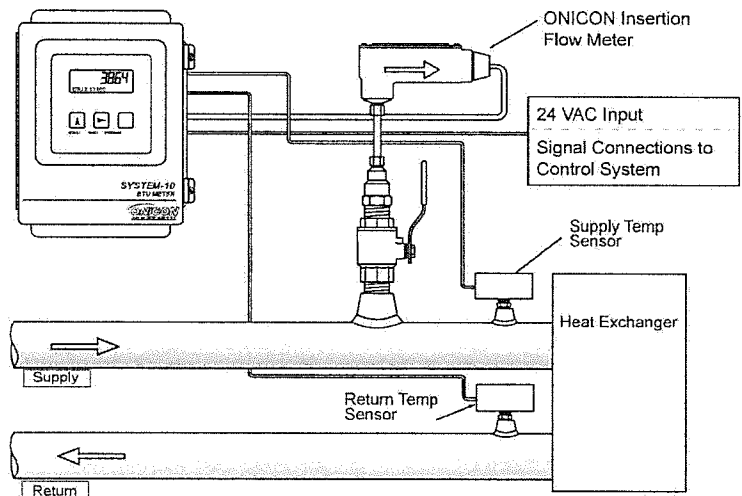
Wiring:

Temperature signals: Use 18-22 ga twisted shielded pair

Flow signals: Use 18-22 ga - see flow meter specification sheet for number of conductors.

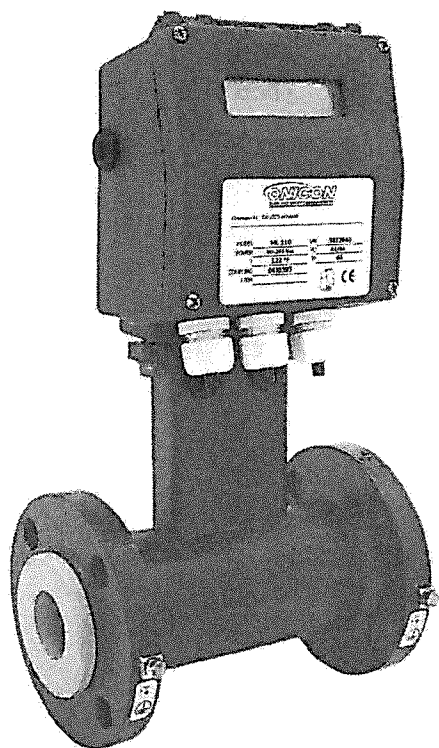
Note: Specifications are subject to change without notice.

TYPICAL SYSTEM-10 INSTALLATION

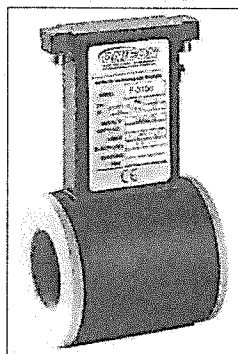


Insertion turbine flow meter shown.
Any ONICON flow meter may be used with the System-10 BTU Meter.
Consult with ONICON for additional flow meter types.

• F-3100 SERIES • INLINE ELECTROMAGNETIC FLOW METER



Wafer style meter
is also available



Faraday's Law states that a voltage will be induced in a conductor (the conductive fluid) when it passes through a magnetic field (generated by the meter), and that voltage will be directly proportional to the velocity of the conductor (the fluid). This voltage is measured by electrodes on opposite sides of the flow tube and is used to calculate the flow velocity.

DESCRIPTION

ONICON F-3100 series inline electromagnetic flow meters are suitable for measurement of electrically conductive liquids, in a wide variety of applications. Inherently bi-directional, each F-3100 series meter is equipped with ONICON's standard transmitter that provides a single analog 4-20 mA output for flow rate and two programmable pulse outputs.

APPLICATIONS

- Chilled water, hot water, condenser water & water/glycol/brine solutions used in HVAC
- Bi-directional flow for primary/secondary bypass
- Process flow with conductivity greater than 5 $\mu\text{S}/\text{cm}$
- Domestic/municipal water

GENERAL SPECIFICATIONS

ACCURACY

Accurate to within:

- $\pm 0.4\%$ of reading from 3.3 to 33 ft/s
- $\pm 0.75\%$ of reading from 1 to 3.3 ft/s
- ± 0.0075 ft/s at flows less than 1 ft/s

(continued on back)

CALIBRATION

Every ONICON F-3100 series flow meter is wet calibrated in a flow laboratory against standards that are directly traceable to international standards. A certificate of calibration accompanies every meter.

FEATURES

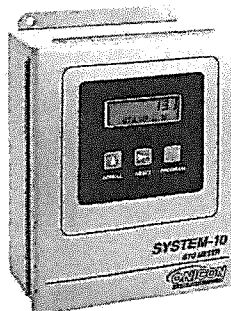
Exceptional Performance & Accuracy - ONICON F-3100 series meters deliver $\pm 0.4\%$ of reading accuracy with as little as 3 diameters of straight pipe upstream of the meter, an exceptional level of performance by any standard.

Easy to Install and Use - Every ONICON meter is individually calibrated, configured and programmed using customer specific application data. Complex field programming is not required.

Excellent Long Term Reliability - ONICON electromagnetic flow meters have no moving parts. In addition, state-of-the-art electronics and proprietary noise filtering algorithms ensure years of accurate, trouble-free performance. This makes them the ideal choice for critical measurement applications or applications where water quality is less than ideal.

Advanced Design Features - Each meter is equipped with a multifunction user interface and display. Advanced programming options include an empty pipe detector, auto-zero and auto-calibration capabilities. A number of alarm options are also available.

Installation Flexibility - The F-3100 is an ideal choice for difficult installations as it only requires 3 diameters of straight pipe upstream and 2 diameters downstream for proper operation, in most applications.



For energy measurement applications, specify the F-3100 Flow Meter together with the System-10 BTU Meter to form an energy measurement system with exceptional accuracy and reliability.

GENERAL SPECIFICATIONS (cont.)

SENSING METHOD

Electromagnetic sensing (no moving parts)

AMBIENT TEMPERATURE RANGE

Electronics: 14° to 122° F

Sensor Body: Refer to Material vs. Temp graph

OUTER BODY MATERIAL OPTIONS

- Carbon Steel, painted
- 316 Stainless Steel

FLOW TUBE (internal)

304 Stainless Steel

CONNECTION TYPES AVAILABLE

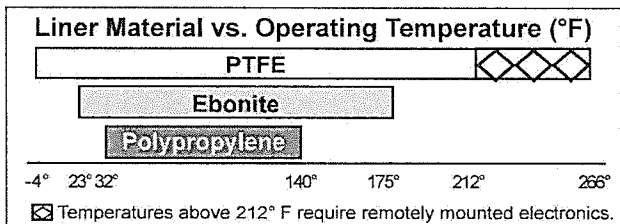
- ANSI Class 150 Flange
- ANSI Class 300 Flange
- Wafer

ELECTRICAL CONNECTIONS

Use 18-22 AWG shielded cable

FLUID CONDUCTIVITY

- 5 µS/cm minimum



POWER SUPPLY OPTIONS

- 90 to 265 VAC, 44 to 66 Hz, 35 mA maximum
- 18 to 45 VDC or VAC, 44 to 66 Hz, 300 mA maximum

DISPLAY

16 character, 2-line alphanumeric LCD displays: flow rate and velocity, flow direction, totals, and alarm messages.

OUTPUT SIGNALS PROVIDED

- Isolated 4 - 20 mA analog output for flow rate
- (2) Programmable digital/pulse outputs (configurable for frequency, pulse or directional flow)
- Optional: MODBUS RTU (RS485)

ELECTRONICS ENCLOSURE

- Reinforced Nylon, NEMA 4X (IP65)
- Optional: For outdoor use, epoxy painted aluminum NEMA 6 (IP67)
- Optional: Remote mount transmitter (either version) available, maximum distance from the sensor - up to 164 ft @ conductivities ≥ 200 µS/cm.

MAXIMUM OPERATING PRESSURE

230 - 580 psi depending on liner material and flange rating (Consult ONICON when higher pressure ratings are required)

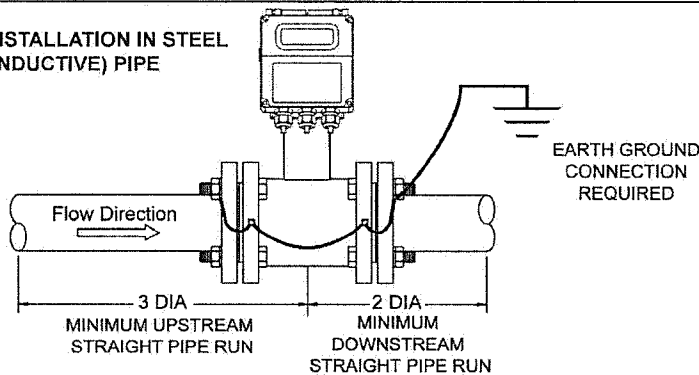
APPROVALS NSF - 61

Liner Material vs. Meter Size

PTFE																				
Polypropylene									Ebonite											
1"	1.5"	2"	2.5"	3"	4"	5"	6"	8"	10"	12"	14"	16"	18"	20"	24"	30"	36"	40"	42"	48"

Meter Sizes in Inches (other sizes available upon request)

TYPICAL INSTALLATION IN STEEL (CONDUCTIVE) PIPE



OPERATING RANGE

Pipe Size (Inches)	Flow Rate (GPM) (0.1 ft/sec* - 33 ft/sec)
1	0.2 - 79
1½	0.6 - 203
2	0.9 - 317
2½	1.6 - 536
3	2.4 - 812
4	3.8 - 1,268
5	5.9 - 1,981
6	8.5 - 2,853
8	15 - 5,072
10	24 - 7,925
12	34 - 11,412
14	47 - 15,533
16	61 - 20,288
18	77 - 25,678
20	95 - 31,701
24	137 - 45,649
30	214 - 71,326
36	308 - 102,710
40	380 - 126,803
42	417 - 139,800
48	547 - 182,596

*Note: The default low flow cut-off is set for 0.1 ft/sec

F-3100 Model Numbering System

F-31BB - CDE

BB = Meter Size in Inches

- | | |
|-----------|------------|
| 01 = 1" | 05 = 5" |
| 15 = 1.5" | 06 = 6" |
| 02 = 2" | 08 = 8" |
| 25 = 2.5" | 10 = 10" |
| 03 = 3" | |
| 04 = 4" | Above 10": |

BB = meter size

C = Body Material & Liner Material

- 1 = Carbon steel / PTFE
- 2 = Carbon steel / Polypropylene
- 3 = Carbon steel / Ebonite

D = Wafer or Flange Connection

- 0 = Wafer
- 1 = ANSI 150 Flange
- 3 = ANSI 300 Flange

E = Integral or Remote Mount Electronics Enclosure

- 1 = Integral Mount
- 2 = Remote Mount

Default configurations include the following:

- (2) 316 SS electrodes
- Viton o-rings on Polypropylene lined meters

11451 Belcher Road South, Largo, FL 33773 • USA • Tel +1 (727) 447-6140 • Fax +1 (727) 442-5699

www.onicon.com • sales@onicon.com



BTU METER CERTIFICATE OF CALIBRATION

METER INFORMATION

Meter Tag: BTU-1
BTU Meter Model: SYSTEM-10-MODBUS_TCP
Serial No: 372124
Attached Flow Meter Model: F-3104-111
Serial No: 372124

CALIBRATION DATA

Firmware Version: DDM3.3
Communications Protocol: MODBUS_TCP
Device Network Address: 192.168.1.24
Flow Meter MCU Code: 30.000
Display Units & Multipliers:
Energy Total: BTU x 10K
Flow Total: GAL x 100
Temperature: °F
Damping: 5

SPECIFIED INSTALLATION & OPERATING PARAMETERS

Pipe Information: 4 Inch Mat'l Unknown Carbon Steel
Design Maximum Flow Rate: 309.0 GPM
Design Supply Temperature: MODE 1: 200°F
Design Return Temperature: MODE 1: 180°F
Fluid: 30% Propylene Glycol
Fluid Specific Heat: 0.964 BTU/lb°F
Fluid Density: 61.65 lb/ft³

Energy Rate: BTU/HR x IK
Flow Rate: GPM x I

Pulse Duration: 500 ms
Supply Temperature Slope: 8.892
Return Temperature Slope: 8.891
Flow Diagnostic Test Output (60 Hz): 120 GPM

CONFIGURATION DATA

Enclosure Type: NEMA 13
Input Supply Voltage: 120 AC
Thermowell Type:

OUTPUT SIGNAL SCALING

Energy Total(s): 1 Pulse = BTU x 10K
Flow Rate: NA
Energy Rate: NA
Supply T: NA
Return T: NA
Delta T: NA

Calibrated By:

Kurt Gunning

Kurt Gunning

Date: 11/10/2017

ONICON Incorporated certifies that the flow and temperature sensors provided with this Btu meter have been individually calibrated based on the application specific data provided above; using standards directly traceable to the U.S. National Institute of Standards and Technology (N.I.S.T.).

11451 Belcher Road South, Largo, Florida 33773 Tel (727) 447-6140 Fax (727) 442-5699



FLOW METER CERTIFICATE OF CALIBRATION

CALIBRATION & CONFIGURATION DATA for F-3000 SERIES MAGNETIC FLOW METERS

METER DATA

Meter Tag: FM-1
Model: F-3104-111
Serial Number: 372124
Component S/N's: 04V001535 38U003419

Meter Size: 4"
Max. Operating Pressure: 225 psi
Max. Operating Temperature: 212 °F
Connections: ANSI 150# Class Flanges
Peripheral device serial number 372124

CALIBRATION of PRIMARY FLOW ELEMENT

Ka factor: 1.4148
Medium: Water
Primary Calibration Date: 4/6/2017

ONICON certifies that this flow meter was calibrated in accordance with ISO 9104:1991 and ISO 17025:2005 using standards that are directly traceable to international standards.

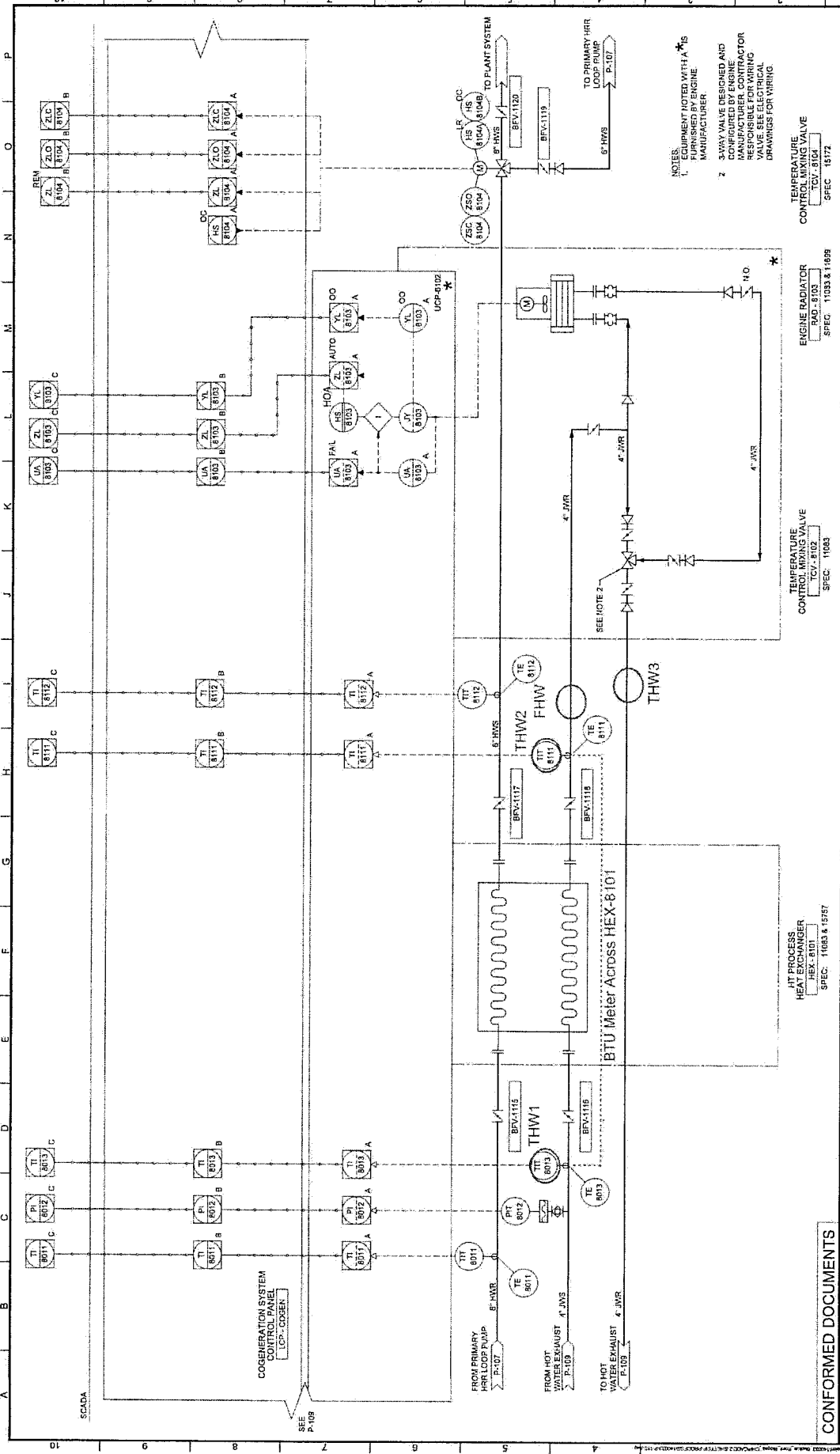
FACTORY PROGRAMMED OUTPUT SIGNALS

(Performed at ONICON Factory; can be reprogrammed in the field)

Analog Flow Range: 4-20 mA = 0 to	400.00 GAL/Min
Frequency Output Meter Factor	30.00 ppG
Scaled Pulse Output: 1 pulse =	100 Gallons

Programmed By: L.E.B. Date: 11/9/2017

11451 Belcher Road South, Largo, Florida 33773 Tel (727)447-6140 Fax (727)442-5699



- NOTES:
 1. EQUIPMENT NOTED WITH * IS FURNISHED BY ENGINE MANUFACTURER.
 2. 3-WAY VALVE DESIGNED AND CONFIGURED BY ENGINE MANUFACTURER. CONTRACTOR TO VERIFY OPERATIONAL VALUE. SEE ELECTRICAL DRAWINGS FOR WIRING.

TEMPERATURE CONTROL MIXING VALVE
 TCV-8104
 SPEC 15172

ENGINE RADIATOR
 RAD-8103
 SPEC 11033 & 11099

TEMPERATURE CONTROL MIXING VALVE
 TCV-8108
 SPEC 11083

FT PROCESS ENGINE HEAT EXCHANGER
 HEX-8101
 SPEC 11033 & 15267

CONFORMED DOCUMENTS

Brown and Caldwell
 CONSULTANTS

DATE: 5/18/15
 CHECKED: [Signature]
 APPROVED: [Signature]

EXTERNAL REFERENCE FILE
 11033-15267-0000

REV. NO. | DATE | BY
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REVISIONS

NO.	DATE	BY	DESCRIPTION
1			CONFORMED DOCUMENT AS DRAWN

STATE: FLV | DESCRIPTION: BIOMETHANE ENGINE HEAT EXCHANGER

PROJECT: BIOMETHANE ENGINE HEAT EXCHANGER

CONFORMED DOCUMENTS

Brown and Caldwell
 CONSULTANTS

DATE: 5/18/15
 CHECKED: [Signature]
 APPROVED: [Signature]

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REVISIONS

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STATE: FLV | DESCRIPTION: BIOMETHANE ENGINE HEAT EXCHANGER

PROJECT: BIOMETHANE ENGINE HEAT EXCHANGER

BIOMETHANE ENGINE HEAT EXCHANGER
 PROCESS & INSTRUMENTATION DIAGRAM
 HIGH TEMPERATURE
 HEAT RECOVERY SYSTEM 2

P-110
 SHEET NUMBER

27 OF 28



February 16, 2018

Ms. Luly E. Massaro, Commission Clerk
Rhode Island Public Utilities Commission
89 Jefferson Blvd
Warwick, RI 02888

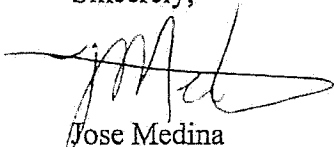
RE: Application for Certification of Eligibility of Renewable Energy Resource

Dear Ms. Massaro,

As the Mechanical Inspector for NBC, I hereby attest that the BTU Meter and the Net Power Meter were both installed as per the approved drawings and requirements by the device manufactures. By contract and specification, this project is to be done in accordance with RI State Codes.

I declare that the above statement is true and accurate to the best of my knowledge.

Sincerely,

A handwritten signature in black ink, appearing to read 'Jose Medina', with a long horizontal flourish extending to the right.

Jose Medina
Mechanical Inspector

RI Department of Environmental Management

Minor Air Source Approval No. 2337



RHODE ISLAND

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

235 Promenade Street, Providence, RI 02908-5767

TDD 401-222-4462

12 December 2016

Mr. Raymond J. Marshall
Executive Director
Narragansett Bay Commission
Bucklin Point Waste Water Treatment Facility
102 Campbell Avenue
East Providence, RI 02916

Dear Mr. Marshall:

The Department of Environmental Management, Office of Air Resources has reviewed and approved your application for the construction, installation and operation of a sewage sludge digester-gas fired combined heat and power engine/generator set to be located at the Bucklin Point Waste Water Treatment Facility, 102 Campbell Avenue, East Providence, RI.

Enclosed is a minor source permit issued pursuant to our review of your application (Approval No. 2337).

If there are any questions concerning this permit, please contact me at (401)-222-2808, extension 7028 or at aleida.whitney@dem.ri.gov.

Sincerely,

A handwritten signature in black ink, appearing to read "Aleida M. Whitney".

Aleida M. Whitney
Senior Air Quality Specialist
Office of Air Resources

cc: East Providence Building Official
Kathryn Kelly, Narragansett Bay Commission
Eric Pearson, ESS Group, Inc.



30% post-consumer fiber

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF AIR RESOURCES

MINOR SOURCE PERMIT

NARRAGANSETT BAY COMMISSION

APPROVAL NO. 2337

Pursuant to the provisions of Air Pollution Control Regulation No. 9, this minor source permit is issued to:

Narragansett Bay Commission

For the following:

Installation of a 644 kW Dresser-Rand Guascor lean-burn engine, Model No. SFGLD 360. The engine shall fire digester gas containing 100 ppm hydrogen sulfide or less, or natural gas.

Located at: *Bucklin Point Waste Water Treatment Facility*

102 Campbell Avenue, East Providence, RI

This permit shall be effective from the date of its issuance and shall remain in effect until revoked by or surrendered to the Department. This permit does not relieve *Narragansett Bay Commission* from compliance with applicable state and federal air pollution control rules and regulations. The design, construction and operation of this equipment shall be subject to the attached permit conditions and emission limitations.

Douglas L. McVay, Chief
Office of Air Resources

Date of Issuance

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF AIR RESOURCES

Permit Conditions and Emission Limitations

Narragansett Bay Commission

Approval No. 2337

I. The following requirements are applicable to:

- The Dresser-Rand Guascor, Model No. SFGLD 360, 0.644 MW, combined heat and power (CHP) internal combustion engine, capable of firing sewage sludge digester gas and natural gas. The heat input capacity of the engine while firing sewage sludge digester gas is 6.08 MMBtu/hr and 6.04 MMBtu/hr while firing natural gas.

A. Emission Limitations

1. Nitrogen Oxides (as Nitrogen Dioxide (NO₂))

The emission rate of nitrogen oxides discharged to the atmosphere from the engine exhaust shall not exceed 1.53 pounds per megawatt-hour (lbs/MWh) or 0.98 pounds per hour, whichever is more stringent.

2. Carbon Monoxide (CO)

The emission rate of carbon monoxide discharged to the atmosphere from the engine exhaust shall not exceed 5.50 pounds per megawatt-hour (lbs/MWh) or 3.54 pounds per hour, whichever is more stringent.

3. Volatile Organic Compounds (VOC)

The emission rate of volatile organic compounds discharged to the atmosphere from the engine exhaust shall not exceed 2.14 pounds per megawatt-hour (lb/MWh) or 1.38 pounds per hour, whichever is more stringent.

4. Sulfur Dioxide (SO₂)

- a. The sulfur content of all digester gas burned in the engine shall not exceed 100 ppm by volume, dry.
- b. The emission rate of sulfur dioxide discharged to the atmosphere from the engine exhaust shall not exceed 0.19 pounds per hour.

5. Particulate Matter (as PM)

The emission rate of particulate matter discharged to the atmosphere from the engine exhaust shall not exceed 0.31 pounds per megawatt-hour (lb/MWh) or 0.20 pounds per hour, whichever is more stringent.

6. Opacity

Visible emissions from the engine exhaust shall not exceed 10% opacity.

7. Listed Toxic Air Contaminants

The emissions of 1,3-butadiene, acetaldehyde, acrolein, benzene, ethylene dibromide and formaldehyde discharged to the atmosphere from the engine exhaust while firing digester gas shall not exceed the levels specified in the following table:

Pollutant	lbs/hr	lbs/day	lbs/year
1,3-Butadiene	--	--	46.43
Acetaldehyde	--	--	744.61
Acrolein	3.00E-03	--	26.28
Benzene	0.017	0.408	148.92
Ethylene dibromide	--	0.084	30.66
Formaldehyde	0.011	0.264	96.36

B. Operating Requirements

1. Sewage sludge digester gas and natural gas shall be the only fuels fired in the engine.
2. All sewage sludge digester gas shall be directed through the hydrogen sulfide (H₂S) remediation system and the siloxane remediation system prior to being fired in the engine.
3. The maximum firing rate of the engine shall not exceed 11,237 ft³/hr of sewage sludge digester gas or 6,491 ft³/hr of natural gas.
4. The engine must be equipped with an automatic fail-safe block valve, which must be designed to stop the flow of sewage sludge digester gas in the event of an engine failure.
5. In the event that the engine is not operational, all sewage sludge digester gas from the digester tanks shall be routed to the flares or digester tank boilers.
6. The owner/operator shall operate and maintain the hydrogen sulfide (H₂S) remediation system and the siloxane remediation system according to the manufacturer's design specifications and operating procedures.

C. Monitoring Requirements

1. The engine shall be equipped with a non-resettable elapsed time meter to indicate, in cumulative hours, the elapsed engine operating time for the unit.
2. The generator shall be equipped with a kilowatt-hour meter to indicate, in cumulative kilowatt-hours, the power generated by the engine-generator set.
3. Sewage sludge digester gas and natural gas flow to the engine shall be continuously measured and recorded.
4. The engine shall be equipped with an air-to-fuel ratio controller and ignition timer to maintain efficient fuel combustion.
5. The owner/operator shall, on a daily basis, measure and record the O₂ content in the exhaust of the engine.

D. Compliance Demonstration/Stack Testing

1. Within 90 days of startup, initial performance testing shall be conducted for the engine for nitrogen oxides, carbon monoxide, and volatile organic compounds.

For nitrogen oxides, carbon monoxide, and volatile organic compounds, performance testing shall be conducted in accordance with 40 CFR 60.4244. The test report shall indicate the engine power in (kW and BHP) during the test and the biogas heating value. To demonstrate compliance with this permit, the performance test results shall be reported in lb/hr and lb/MWh. To demonstrate compliance with NSPS 40 CFR Part 60, Subpart JJJJ emission limits, the performance test results shall be reported in g/bhp-hr.

Thereafter, emissions testing for the engine shall be conducted every 8760 hours of operation or every 3 years, whichever is first, to determine compliance with the nitrogen oxides, carbon monoxide, and volatile organic compounds. Each emission test for nitrogen oxides, carbon monoxide, and volatile organic compounds shall be conducted in accordance with the procedures specified in 40 CFR 60.4244.

2. Additionally, during the initial performance test, the owner/operator shall measure the emissions of sulfur dioxide, particulate matter, 1,3-butadiene, acetaldehyde, acrolein, benzene, ethylene dibromide and formaldehyde from the engine stack to demonstrate compliance with the emission limitations in Conditions I.A.4-5 and I.A.7 of this permit. Additionally, the owner/operator shall determine and quantify individual species of volatile organic compounds (VOC) emissions other than the six listed toxic air contaminants.
3. A stack testing protocol shall be submitted to the Office of Air Resources and the USEPA at least 60 days prior to the performance of any emissions test. The owner/operator shall provide the Office of Air Resources and the USEPA at least 60 days prior notice of any emissions test.

4. All test procedures used for stack testing shall be approved by the Office of Air Resources and the USEPA prior to the performance of any stack tests.
5. The owner/operator shall install any and all test ports or platforms necessary to conduct the required stack testing, provide safe access to any platforms and provide the necessary utilities for sampling and testing equipment.
6. All testing shall be conducted under operating conditions deemed acceptable and representative for the purpose of assessing compliance with the applicable emissions limitations.
7. All emissions testing must be observed by the Office of Air Resources or the USEPA to be considered acceptable, unless the Office of Air Resources or the USEPA provides written authorization to the owner/operator to conduct the testing without an observer present.
8. A final report of the results of the initial and subsequent performance tests shall be submitted to the Office of Air Resources and the USEPA no later than 60 days following completion of testing.

E. Recordkeeping and Reporting

1. The owner/operator shall, on a monthly basis, no later than 15 days after the first of each month, determine and record the following for the engine for the previous month:
 - a. The hours of operation and the total hours of operation for the prior consecutive 12-month period.
 - b. The fuel use.
 - c. The gross electrical power generated in kilowatt-hours.

The owner/operator shall keep records of this determination and provide such records to the Office of Air Resources or its authorized representative upon request.

2. The owner/operator shall, on a daily basis, measure and record the O₂ content in the exhaust of the engine and the date, time and measurement shall be recorded. The owner/operator shall keep records of this determination and provide such records to the Office of Air Resources or its authorized representative upon request.
3. The owner/operator shall, on a monthly basis, no later than 15 days after the first of the month, determine the total quantity of 1,3-butadiene, acetaldehyde, acrolein, benzene, ethylene dibromide and formaldehyde discharged to the atmosphere from the engine during the previous month while firing sewage sludge digester gas. Hourly emission averages shall be calculated for acrolein, benzene and formaldehyde. These hourly averages shall be used for comparison to the hourly emission limitations. Daily emission totals shall be calculated for benzene, ethylene dibromide, and formaldehyde to be used for comparison the daily emission limitations. Monthly and annual emission averages shall be calculated for 1,3-butadiene, acetaldehyde, acrolein, benzene, ethylene dibromide and formaldehyde

to be used for comparison to the annual emission limitations. The owner/operator shall keep records of this determination and provide such records to the Office of Air Resources upon request.

4. The owner/operator shall notify the Office of Air Resources in writing, within 15 days of determining that the total quantity of 1,3-butadiene, acetaldehyde, acrolein, benzene, ethylene dibromide or formaldehyde, discharged to the atmosphere from the engine exceeds the hourly, daily, or annual emission limitations.
5. The owner/operator shall develop a maintenance plan for the engine and air pollution control system and shall maintain records of all maintenance conducted.
6. The owner/operator shall notify the Office of Air Resources in writing of the date of actual initial start-up of the engine no later than fifteen days after such date.

F. Other Permit Conditions

1. The emission limitations of Conditions I.A. shall not apply during engine startup/shutdown conditions. Engine startup shall be defined as the first ten minutes of firing following the initiation of firing. Engine shutdown shall be defined as the cessation of operation for any purpose.
2. The owner/operator is subject to the requirements of 40 CFR 60, Subpart A (General Provisions) and Subpart JJJJ (Standards of Performance for Stationary Spark Ignition Internal Combustion Engines). Compliance with all applicable provisions therein is required.

II. The following requirements are applicable to the three existing 3.891 MMBtu/hr Gordon Piatt digester tank boilers, Model No. R12.8-GG-30, capable of burning sewage sludge digester gas and natural gas:

A. Emission Limitations – Digester Gas Firing

1. Listed Toxic Air Contaminants

The emissions of acetaldehyde, acrolein, benzene, and formaldehyde discharged to the atmosphere from each boiler shall not exceed the levels specified in the following table:

Pollutant	lbs/hr	lbs/day	lbs/year
Acetaldehyde	--	--	0.088
Acrolein	6.30E-06	--	0.055
Benzene	1.87E-05	4.49E-04	0.164
Formaldehyde	3.97E-05	9.53E-04	0.348

B. Operating Requirements

1. Sewage sludge digester gas and natural gas shall be the only fuels combusted in each boiler.

2. The maximum firing rate of each boiler shall not exceed 7,192 ft³/hr of sewage sludge digester gas or 3,891 ft³/hr of natural gas.
3. All sewage sludge digester gas shall be directed through the hydrogen sulfide (H₂S) remediation system prior to being combusted in each boiler.
4. The owner/operator shall maintain and operate each boiler according to the manufacturer's design specifications and operating procedures.

B. Monitoring Requirements

1. Sewage sludge digester gas flow to each boiler shall be continuously measured and recorded.

C. Recordkeeping and Reporting

1. The owner/operator shall maintain the following records and provide such records to the Office of Air Resources upon request:
 - a. The sewage sludge digester gas flow rate to each boiler;
 - b. The dates and times when each boiler is combusting sewage sludge digester gas.
2. The owner/operator shall, on a monthly basis, no later than 15 days after the first of the month, determine the total quantity of sewage sludge digester gas combusted in each boiler. The owner/operator shall keep records of this determination and provide such records to the Office of Air Resources upon request.
3. The owner/operator shall, on a monthly basis, no later than 15 days after the first of the month, determine the total quantity of acetaldehyde, acrolein, benzene, and formaldehyde discharged to the atmosphere from each boiler during the previous month while firing digester gas. Hourly emission averages shall be calculated for acrolein, benzene, and formaldehyde. These hourly averages shall be used for comparison to the hourly emission limitations. Daily emission totals shall be calculated for benzene and formaldehyde to be used for comparison the daily emission limitations. Monthly and annual emission averages shall be calculated for acetaldehyde, acrolein, benzene, and formaldehyde to be used for comparison to the annual emission limitations. The owner/operator shall keep records of this determination and provide such records to the Office of Air Resources upon request.
4. The owner/operator shall notify the Office of Air Resources in writing, within 15 days of determining that the total quantity of acetaldehyde, acrolein, benzene, or formaldehyde discharged to the atmosphere from each boiler exceeds the respective hourly, daily or annual emission limitations.
5. The owner/operator shall maintain records of all maintenance conducted on each boiler.

III. The following emission limitations are applicable to the two existing 5.150 MMBtu/hr Varec candlestick flares, Model No. 244W:

A. Emission Limitations – Digester Gas Firing

1. Listed Toxic Air Contaminants

The emissions of acetaldehyde, acrolein, benzene, and formaldehyde discharged to the atmosphere from each flare shall not exceed the levels specified in the following table:

Pollutant	lbs/hr	lbs/day	lbs/year
Acetaldehyde	--	--	1.17
Acrolein	3.09E-05	--	0.27
Benzene	4.91E-04	0.0118	4.30
Formaldehyde	3.61E-03	0.0866	31.62

2. Each flare shall be designed for and operated with no visible emissions as determined by the methods specified in condition III.D.1, except for periods not to exceed a total of 5 minutes during any 2 consecutive hours.

B. Operating Requirements

1. Sewage sludge digester gas shall be the only fuel combusted in each flare, except the use of propane as an auxiliary fuel shall be allowed to light the pilot.
2. Excess sewage sludge digester gas generated from the digester tanks and not combusted by the CHP engine or the boilers, shall be treated by the flares before discharge to the atmosphere.
3. Each flare shall be operated with a flame present at all times.
4. Each flare shall be used only with the net heating value of the gas being combusted being 200 BTU/SCF or greater. The net heating value of the gas being combusted shall be determined by the methods specified in 40 CFR 60.18(f)(3).
5. The owner/operator shall visually inspect each flare system to confirm that a flame is present at least once per shift. The date and time of each observation shall be recorded.
6. Each flare shall be operated at all times when sewage sludge digester gas is being vented to it.
7. The owner/operator shall maintain and operate each flare according to the manufacturer's design specifications and operating procedures.

C. Monitoring Requirements

1. The owner/operator shall monitor each flare to ensure that it is operated and maintained in conformance with its design.
2. The owner/operator shall install, calibrate, maintain and operate according to the manufacture's specifications, the following equipment:
 - a. A heat sensing device, such as an ultraviolet beam sensor or thermocouple, at the pilot light or the flame itself to indicate the continuous presence of a flame; and
 - b. A gas flow rate measuring device that shall record the flow to each flare at least every 15 minutes.

D. Testing Requirements

1. Method 22 of Appendix A to 40 CFR 60 shall be used to determine the compliance of each flare with the visible emission provisions of condition A.1. The observation period is 2 hours and shall be used according to Method 22.

E. Recordkeeping and Reporting

1. The owner/operator shall maintain the following records and provide such records to the Office of Air Resources upon request:
 - a. The sewage sludge digester gas flow rate to each flare;
 - b. The dates and times when each flare is combusting sewage sludge digester gas;
 - c. All visible emission readings;
 - d. Heat content determinations;
 - e. Exit velocity determinations; and,
 - f. Continuous records of pilot flame or flare flame monitoring and records of all periods of operations during which the pilot flame or the flare flame is absent.
2. The owner/operator shall, on a monthly basis, no later than 15 days after the first of the month, determine the total quantity of acetaldehyde, acrolein, benzene, and formaldehyde discharged to the atmosphere from each flare during the previous month. Hourly emission averages shall be calculated for acrolein, benzene, and formaldehyde. These hourly averages shall be used for comparison to the hourly emission limitations. Daily emission totals shall be calculated for benzene and formaldehyde to be used for comparison the daily emission limitations. Monthly and annual emission averages shall be calculated for acetaldehyde, acrolein, benzene, and formaldehyde to be used for comparison to the annual

emission limitations. The owner/operator shall keep records of this determination and provide such records to the Office of Air Resources upon request.

3. The owner/operator shall notify the Office of Air Resources in writing, within 15 days of determining that the total quantity of acetaldehyde, acrolein, benzene, or formaldehyde discharged to the atmosphere from each flare exceeds the respective hourly, daily or annual emission limitations.
4. The owner/operator shall maintain records of all maintenance conducted on each flare.
5. The owner/operator shall keep up-to-date, readily accessible continuous records for each flare of the flame or flare pilot flame monitoring and up-to-date, readily accessible records of all periods of operation which the flame or flare pilot flame is absent.

IV. The following requirements are applicable to operations on a facility-wide basis:

A. Emission Limitations

1. Listed Toxic Air Contaminants

The total quantity of emissions discharged to the atmosphere from the entire facility, of any listed toxic air contaminant, with the exception of 1,3-butadiene, acetaldehyde, acrolein, benzene, ethylene dibromide, and formaldehyde shall not exceed the minimum quantity for that contaminant as specified in Appendix A of Air Pollution Control Regulation No. 9, during a calendar year. Emissions from activities exempted from the provisions of APC Regulation No. 22 in subsection 22.2.2 are not included in this limitation.

2. Odors

Any air contaminant or combination of air contaminants discharged to the atmosphere from the facility shall not create an objectionable odor beyond the property line of this facility. Odor evaluations shall be conducted according to the provisions of Air Pollution Control Regulation No. 17.

B. Monitoring Requirements

1. The owner/operator shall, upon startup and at least daily, measure the hydrogen sulfide concentration (in ppm by volume) at both the inlet and the outlet of the H₂S remediation system and the date, time and measurement shall be recorded.
2. All monitoring equipment used for measuring all parameters required by this permit shall be calibrated periodically, consistent with the manufacturer's recommendations.

C. Recordkeeping and Reporting

1. The owner/operator shall maintain records of the hydrogen sulfide concentration (in ppm by volume) at the inlet and the outlet of the H₂S remediation system and provide such records to the Office of Air Resources upon request.
2. The owner/operator shall notify the Office of Air Resources in writing, within 15 days of determining that the concentration of H₂S in the digester gas at the outlet of the H₂S remediation system exceeds 100 ppm, by volume, dry.
3. The owner/operator shall, for each calendar year, determine the total quantity of each listed toxic air contaminant in Appendix A of Air Pollution Control Regulation No. 9 discharged to the atmosphere from all operations at the entire facility excluding 1,3-butadiene, acetaldehyde, acrolein, benzene, ethylene dibromide, and formaldehyde. The owner/operator shall keep records of this determination and provide such records to the Office of Air Resources upon request.
4. The owner/operator shall notify the Office of Air Resources in writing, within 15 days of determining that the total quantity of emissions discharged to the atmosphere from the entire facility, of any listed toxic air contaminant excluding 1,3-butadiene, acetaldehyde, acrolein, benzene, ethylene dibromide, and formaldehyde, exceeds the minimum quantity for that contaminant as specified in Appendix A of Air Pollution Control Regulation No. 9. In accordance with Air Pollution Control Regulation No 22, this notification shall be included in the annual air pollution inventory.
5. Any breakdown or malfunction of the engine, flares or digester tank boilers resulting in the discharge of sewage sludge digester gas shall be reported to the Office of Air Resources within one hour after the occurrence. A written report of any breakdown or malfunction shall be submitted within five (5) days of the breakdown or malfunction. The following information shall be provided in each report:
 - a. The date the breakdown or malfunction occurred
 - b. The suspected reason for the malfunction
 - c. The corrective action taken
 - d. The time needed to make repairsA copy of each report shall be kept at the facility.
6. The owner/operator shall notify the Office of Air Resources of any anticipated noncompliance with the terms of this permit or any other applicable air pollution control rules and regulations.
7. The owner/operator shall notify the Office of Air Resources in writing of any planned physical or operational change to any equipment that would:

- a. Change the representation of the facility in the application.
- b. Alter the applicability of any state or federal air pollution rules or regulations.
- c. Result in the violation of any terms or conditions of this permit.
- d. Qualify as a modification under APC Regulation No. 9.

Such notification shall include:

- Information describing the nature of the change.
- Information describing the effect of the change on the emission of any air contaminant.
- The scheduled completion date of the planned change.

Any such change shall be consistent with the appropriate regulation and have the prior approval of the Director.

8. The owner/operator shall notify the Office of Air Resources, in writing, of any noncompliance with the terms of this permit within 30 calendar days of becoming aware of such occurrence and supply the Director with the following information:
 - a. The name and location of the facility;
 - b. The subject source(s) that caused the noncompliance with the permit term;
 - c. The time and date of first observation of the incident of noncompliance;
 - d. The cause and expected duration of the incident of noncompliance;
 - e. The estimated rate of emissions (expressed in lbs/hr or lbs/day) during the incident and the operating data and calculations used in estimating the emission rate;
 - f. The proposed corrective actions and schedule to correct the conditions causing the incidence of noncompliance.
9. The owner/operator shall maintain properly signed, contemporaneous operating logs or other relevant evidence to document actions during startup/shutdown periods.
10. All records required in this permit shall be maintained for a minimum of five years after the date of each record and shall be made available to representatives of the Office of Air Resources or its authorized representative and EPA upon request.

D. Other Permit Conditions

1. To the extent consistent with the requirements of this permit and applicable federal and state laws, the equipment shall be designed, constructed and operated in accordance with the representation of the equipment in the permit application.
2. Employees of the Office of Air Resources and its authorized representatives shall be allowed to enter the facility at all times for the purpose of inspecting any air pollution source, investigating any condition it believes may be causing air pollution or examining any records required to be maintained by the Office of Air Resources.
3. At all times, including periods of startup, shutdown and malfunction, the owner/operator shall, to the extent practicable, maintain and operate the facility in a manner consistent with good air pollution control practice for minimizing emissions. The general duty to minimize emissions does not require you to make any further efforts to reduce emissions if levels required by this permit have been achieved. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to the Office of Air Resources which may include, but is not limited to, monitoring results, opacity observations, review of operating and maintenance procedures and inspection of the source.
4. The emission and dispersion characteristics of all sources of 1,3-butadiene, acetaldehyde, acrolein, benzene, ethylene dibromide, and formaldehyde at the facility shall be consistent with the parameters used in the air quality modeling to demonstrate that the emissions of 1,3-butadiene, acetaldehyde, acrolein, benzene, ethylene dibromide, and formaldehyde from the facility do not cause or contribute to air pollution in violation of RI Air Pollution Control Regulation No. 22. The Office of Air Resources, in its sole discretion, may reopen this minor source permit if it determines that the emission and dispersion characteristics have changed significantly and that emission limitations must be revised and/or added to this permit to ensure compliance with RI Air Pollution Control Regulation No. 22.

E. Malfunctions

1. The owner/operator may seek to establish that a malfunction of any air pollution control system that would result in noncompliance with any of the terms of this permit or any other applicable air pollution control rules and regulations was due to unavoidable increases in emissions attributable to the malfunction. To do so, the owner/operator must demonstrate to the Office of Air Resources that:
 - a. The malfunction was not attributable to improperly designed equipment, lack of preventative maintenance, careless or improper operation or operator error;
 - b. The malfunction is not part of a recurring pattern indicative of inadequate design, operation or maintenance;
 - c. Repairs were performed in an expeditious fashion. Off-shift labor and overtime should be utilized, to the extent practicable, to ensure that such repairs were completed as expeditiously as practicable.

- d. All possible steps were taken to minimize emissions during the period of time that repairs were performed.
- e. Emissions during the period of time that the repairs were performed will not:
 - (1) Cause an increase in the ground level ambient concentration at or beyond the property line in excess of that allowed by Air Pollution Control Regulation No. 22 and any Calculated Acceptable Ambient Levels; and
 - (2) Cause or contribute to air pollution in violation of any applicable state or national ambient air quality standard.
- f. The reasons that it would be impossible or impractical to cease the source operation during said period.
- g. The owner/operator's actions in response to the excess emissions were documented by properly signed, contemporaneous operating logs or other relevant evidence.

This demonstration must be provided to the Office of Air Resources within two working days of the time when the malfunction occurred and contain a description of the malfunction, any steps taken to minimize emissions and corrective actions taken.

The owner/operator shall have the burden of proof in seeking to establish that noncompliance was due to unavoidable increases in emissions attributable to the malfunction.