IMPACT COMPLIANCE & TESTING

AIR EMISSION TEST REPORT

Title	AIR EMISSION TEST REPORT FOR THE VERIFICATION OF AIR POLLUTANT EMISSIONS FROM IC ENGINE – GENERATOR SETS OPERATED AT THE FREMONT REGIONAL DIGESTER FACILITY
Report Date	May 24, 2019
Test Date	May 6-7, 2019

Facility Information	
Name	Fremont Community Digester, LLC Fremont Regional Digester
Street Address	Lot 19, 20, and 21 Locust Street
City, County	Fremont, Newaygo County, Michigan

Facility Permit Information	
Permit to Install No.: 378-08A	Facility SRN: N8210

Testing Contractor	
Company	Impact Compliance & Testing, Inc.
Mailing Address	39395 Schoolcraft Road Livonia, MI 48150
Phone	(734) 464-3880
Project No.	1900081

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1.0 INTRODUCTION

Fremont Community Digester, LLC (Fremont Regional Digester, FRD), owned by Generate Capital and operated by Dynamic Systems Management, consists of two (2) General Electric (GE) Jenbacher Model J420 GS B82 biogas-fired reciprocating internal combustion (IC) engines and electricity generator sets in Fremont, Newaygo County, Michigan. The IC engines are fueled with digester gas produced at the adjacent digester treatment plant. The digester gas fueled IC engine generator sets are identified as emission units EUICENGINE1 and EUICENGINE2 in Permit to Install (PTI) 378-08A issued by the Michigan Department of Environment, Great Lakes, and Energy, Air Quality Division (EGLE-AQD) (formerly Michigan Department of Environmental Quality-Air Quality Division (MDEQ-AQD)).

Permit to Install No. 378-08A:

1. Allows for the installation and operation of two (2) spark ignition reciprocating internal combustion engines for combusting biogas to produce electricity (approximately 3 MW gross electrical output). The engines will drive an associated generator set to produce electricity.

2. *Specifies that … the permittee shall conduct an initial performance test for each engine in FGICENGINES within one year after startup of the engine and every 8760 hours of operation … to demonstrate compliance with the emission limits in 40 CFR 60.4233(e) (40 CFR Part 60 Subpart JJJJ)… If a performance test is required, the performance test shall be conducted according to 40 CFR 60.4244.*

The compliance emission testing was performed by Impact Compliance & Testing, Inc. (ICT, formerly Derenzo Environmental Services), a Michigan-based environmental consulting and testing company. ICT representatives Tyler Wilson and Jory VanEss performed the field sampling and measurements May 6-7, 2019.

The exhaust gas sampling and analysis was performed using procedures specified in the Stack Test Protocol that was reviewed and approved by the EGLE-AQD. Mr. Dave Patterson and Ms. Kaitlyn DeVries of the EGLE-AQD observed portions of the compliance testing.

Questions regarding this emission test report should be directed to:

Tyler J. Wilson	Mr. Karl Crave
Senior Project Manager	VP Operations
Impact Compliance & Testing, Inc.	Dynamic Systems Management
39395 Schoolcraft Road	Lot 19, 20, and 21 Locust Street
Livonia, MI 48150	Fremont, Michigan
Ph: (734) 464-3880	Ph: (608) 347-8747
Tyler.Wilson@ImpactCandT.com	karl.crave@dynamicgrp.us

Report Certification

This test report was prepared by Impact Compliance & Testing, Inc. based on field sampling data collected by ICT. Facility process data was collected and provided by FRD employees or representatives. This test report has been reviewed by FRD representatives and approved for submittal to the EGLE-AQD.

I certify that the testing was conducted in accordance with the specified test methods and submitted test plan unless otherwise specified in this report. I believe the information provided in this report and its attachments are true, accurate, and complete.

Report Prepared By:

Brad Thome
Environmental Consultant
Impact Compliance & Testing, Inc.

Reviewed by:

Tyler J. Wilson
Senior Project Manager
Impact Compliance & Testing, Inc.

I certify that the facility and emission units were operated at maximum routine operating conditions for the test event. Based on information and belief formed after reasonable inquiry, the statements and information in this report are true, accurate and complete.

Responsible Official Certification:

Karl Crave
VP Operations
Dynamic Systems Management

2.0 SOURCE AND SAMPLING LOCATION DESCRIPTION

2.1 General Process Description

FRD generates up to three (3) megawatts (MW) of power from processing 100,000 tons of residual food waste. The anaerobic digester is fed residual products from baby food manufacturing at the nearby Gerber plant. The digester is designed to handle an array of organic feedstocks from agricultural producers and food processors. The bacterial population within the digester slurry converts organic substrate into methane-rich biogas. This biogas is combusted in two (2) 1.5 MW engine-generator sets, providing baseload power for transfer to a local utility.

2.2 Rated Capacities and Air Emission Controls

The GE Jenbacher J420 GS engine generator sets have a rated output of 1,966 brake-horsepower (bhp) and the connected generator has a rated electricity output of 1,426 kilowatts (kW).

The engines/generator sets do not have any add-on emission control equipment. The electronic air-to-fuel ratio controller automatically adjusts the air-to-fuel ratio and ignition timing to maintain efficient fuel combustion, which minimizes air pollutant emissions. Exhaust gas is exhausted directly to atmosphere through a noise muffler and vertical exhaust stack.

The methane content from anaerobic digesters is not always consistent. The methane concentration in the digester gas can vary based on the feedstock and other digester operating conditions.

2.3 Sampling Locations

The RICE exhaust gas is directed through mufflers and is released to the atmosphere through dedicated vertical exhaust stacks. The two (2) GE Jenbacher J420 GS RICE exhaust stacks are identical.

The exhaust stack sampling ports for the GE Jenbacher J420 GS engines (EUICENGINE1 and EUICENGINE2) are located in individual exhaust stacks with an inner diameter of 19.625 inches. Each stack is equipped with two (2) sample ports, opposed 90°, that provide a sampling location 120 inches (6.1 duct diameters) upstream and 48 inches (2.5 duct diameters) downstream from any flow disturbance and satisfies the USEPA Method 1 criteria for a representative sample location.

Individual traverse points were determined in accordance with USEPA Method 1.

Appendix A provides diagrams of the emission test sampling locations.

3.0 SUMMARY OF TEST RESULTS AND OPERATING CONDITIONS

3.1 Purpose and Objective of the Tests

The conditions of Permit to Install (PTI) No. 378-08A and 40 CFR Part 60 Subpart JJJJ require FRD to test each engine (FGICENGINES) for carbon monoxide (CO), nitrogen oxides (NOx) and volatile organic compounds (VOCs) every 8,760 hours of operation.

3.2 Operating Conditions During the Compliance Tests

The testing was performed while the FRD RICE-generator sets were operated at maximum operating conditions (1,426 kW electricity output +/- 10%). FRD representatives provided the kW output in 15-minute intervals for each test period. The FGICENGINES generator electricity output ranged between 1,351 and 1,436 kW for each test period.

Fuel use (scfm) and fuel methane content (%) were also recorded by FRD representatives in 15-minute intervals for each test period. The FGICENGINES fuel consumption rate ranged between 332 and 358 scfm, and fuel methane content ranged between 63.1 and 64.6%. Fuel heat value was calculated using a lower heating value of 910 Btu/scf for methane.

In addition, the engine serial number and operating hours at the beginning of test No. 1 for each RICE were recorded by the facility operators.

Appendix B provides operating records provided by FRD representatives for the test periods.

Engine output (bhp) cannot be measured directly and was calculated based on the recorded electricity output, the calculated GE Jenbacher J420 GS generator efficiency (97.3%), and the unit conversion factor for kW to horsepower (0.7457 kW/hp).

Engine output (bhp) = Electricity output (kW) / (0.973) / (0.7457 kW/hp)

Table 3.1 presents a summary of the average engine operating conditions during the test periods.

3.3 Summary of Air Pollutant Sampling Results

The gases exhausted from each RICE (EUICENGINE1 and EUICENGINE2) were sampled for three (3) one-hour test periods during the compliance testing performed May 6-7, 2019.

Tables 3.2 and 3.3 present the average measured pollutant emission rates for EUICENGINE1 and EUICENGINE2, respectively (average of the three test periods for each engine).

Test results for each one-hour sampling period are presented in Section 6.0 of this report.

Table 3.1 Average engine operating conditions during the test periods

Engine Parameter	EUICENGINE1	EUICENGINE2
Generator output (kW)	1,360	1,431
Engine output (bhp)	1,874	1,972
Engine fuel use (scfm)	340	339
Methane content (%)	63.4	64.4
Exhaust temperature (°F)	808	774

Table 3.2 Average measured emission rates for EUICENGINE1 (three-test average)

Emission Unit	CO (g/bhp-hr)	NOx (g/bhp-hr)	VOC (g/bhp-hr)
Engine No. 1 Measured Rates	2.34	0.32	0.17
Permit Limit	2.6	0.6	1.0

Table 3.3 Average measured emission rates for EUICENGINE2 (three-test average)

Emission Unit	CO (g/bhp-hr)	NOx (g/bhp-hr)	VOC (g/bhp-hr)
Engine No. 2 Measured Rates	2.25	0.35	0.18
Permit Limit	2.6	0.6	1.0

4.0 SAMPLING AND ANALYTICAL PROCEDURES

A test protocol for the air emission testing was reviewed and approved by the EGLE-AQD. This section provides a summary of the sampling and analytical procedures that were used during the FRD testing periods.

4.1 Summary of Sampling Methods

USEPA Method 1	Exhaust gas velocity measurement locations were determined based on the physical stack arrangement and requirements in USEPA Method 1
USEPA Method 2	Exhaust gas velocity pressure was determined using a Type-S Pitot tube connected to a red oil incline manometer; temperature was measured using a K-type thermocouple connected to the Pitot tube.
USEPA Method 3A	Exhaust gas O2 and CO2 content was determined using zirconia ion/paramagnetic and infrared instrumental analyzers, respectively.
USEPA Method 4	Exhaust gas moisture was determined based on the water weight gain in chilled impingers.
USEPA Method 7E	Exhaust gas NOx concentration was determined using chemiluminescence instrumental analyzers.
USEPA Method 10	Exhaust gas CO concentration was measured using an NDIR instrumental analyzer
USEPA Method 25A / ALT-096	Exhaust gas VOC (as NMHC) concentration was determined using a flame ionization analyzer equipped with methane separation column

4.2 Exhaust Gas Velocity Determination (USEPA Method 2)

The RICE exhaust stack gas velocity and volumetric flowrate was determined using USEPA Method 2 once for each test. An S-type Pitot tube connected to a red-oil manometer was used to determine velocity pressure at each traverse point across the stack cross section. Gas temperature was measured using a K-type thermocouple mounted to the Pitot tube. The Pitot tube and connective tubing were leak-checked onsite, prior to the test event, to verify the integrity of the measurement system.

The absence of significant cyclonic flow for the exhaust configuration was verified using an S-type Pitot tube and oil manometer. The Pitot tube was positioned at each velocity traverse point with the planes of the face openings of the Pitot tube perpendicular to the stack cross-sectional plane. The Pitot tube was then rotated to determine the null angle (rotational angle as measured from the perpendicular, or reference, position at which the differential pressure is equal to zero).

Appendix C provides exhaust gas flowrate calculations and field data sheets.

4.3 Exhaust Gas Molecular Weight Determination (USEPA Method 3A)

CO_2 and O_2 content in the RICE exhaust gas was measured continuously throughout each test period in accordance with USEPA Method 3A. The CO_2 content of the exhaust was monitored using a Servomex 1440D single beam single wavelength (SBSW) infrared gas analyzer. The O_2 content of the exhaust was monitored using a Servomex 1440D gas analyzer that uses a paramagnetic sensor.

During each sampling period, a continuous sample of the RICE exhaust gas stream was extracted from the stack using a stainless steel probe connected to a Teflon® heated sample line. The sampled gas was conditioned by removing moisture prior to being introduced to the analyzers; therefore, measurement of O_2 and CO_2 content correspond to standard dry gas conditions. Instrument response data were recorded using an ESC Model 8816 data acquisition system that monitored the analog output of the instrumental analyzers continuously and logged data as one-minute averages.

Prior to, and at the conclusion of each test, the instruments were calibrated using upscale calibration and zero gas to determine analyzer calibration error and system bias (described in Section 5.0 of this document). Sampling times were recorded on field data sheets.

Appendix D provides O_2 and CO_2 calculation sheets. Raw instrument response data are provided in Appendix E.

4.4 Exhaust Gas Moisture Content (USEPA Method 4)

Moisture content of the RICE exhaust gas was determined in accordance with USEPA Method 4 using a chilled impinger sampling train. The moisture sampling was performed concurrently with the instrumental analyzer sampling. During each sampling period a gas sample was extracted at a constant rate from the source where moisture was removed from the sampled gas stream using impingers that were submersed in an ice bath. At the conclusion of each sampling period, the moisture gain in the impingers was determined gravimetrically by weighing each impinger to determine net weight gain.

4.5 NO_x and CO Concentration Measurements (USEPA Methods 7E and 10)

NO_X and CO pollutant concentrations in the RICE exhaust gas streams were determined using a Thermo Environmental Instruments, Inc. (TEI) Model 42c High Level chemiluminescence NO_X analyzer and a TEI Model 48i infrared CO analyzer.

Throughout each test period, a continuous sample of the engine exhaust gas was extracted from the stack using the Teflon® heated sample line and gas conditioning system and delivered to the instrumental analyzers. Instrument response for each analyzer was recorded on an ESC Model 8816 data acquisition system that logged data as one-minute averages. Prior to, and at the conclusion of each test, the instruments were calibrated using upscale calibration and zero gas to determine analyzer calibration error and system bias.

Appendix D provides CO and NO_X calculation sheets. Raw instrument response data are provided in Appendix E.

4.6 Measurement of Volatile Organic Compounds (USEPA Method 25A and ALT-096)

The VOC emission rate was determined by measuring the nonmethane hydrocarbon (NMHC) concentration in the engine exhaust gas. NMHC pollutant concentration was determined using a TEI Model 55i Methane / Nonmethane hydrocarbon analyzer. The TEI 55i analyzer contains an internal gas chromatograph column that separates methane from non-methane components. The concentration of NMHC in the sampled gas stream, after separation from methane, is determined relative to a propane standard using a flame ionization detector in accordance with USEPA Method 25A.

The USEPA Office of Air Quality Planning and Standards (OAQPS) has issued several alternate test methods approving the use of the TEI 55-series analyzer as an effective instrument for measuring NMOC from gas-fueled reciprocating internal combustion engines (RICE) in that it uses USEPA Method 25A and 18 (ALT-066, ALT-078 and ALT-096).

Samples of the exhaust gas were delivered directly to the instrumental analyzer using the Teflon® heated sample line to prevent condensation. The sample to the NHMC analyzer was not conditioned to remove moisture. Therefore, VOC measurements correspond to standard conditions with no moisture correction (wet basis).

Prior to, and at the conclusion of each test, the instrument was calibrated using mid-range calibration (propane) and zero gas to determine analyzer calibration error and system bias (described in Section 5.0 of this document).

Appendix D provides VOC calculation sheets. Raw instrument response data for the NMHC analyzer is provided in Appendix E.

5.0 <u>QA/QC ACTIVITIES</u>

5.1 NO_x Converter Efficiency Test

The NO_2 – NO conversion efficiency of the Model 42c analyzer was verified prior to the testing program. A USEPA Protocol 1 certified concentration of NO_2 was injected directly into the analyzer, following the initial three-point calibration, to verify the analyzer's conversion efficiency. The analyzer's NO_2 – NO converter uses a catalyst at high temperatures to convert the NO_2 to NO for measurement. The conversion efficiency of the analyzer is deemed acceptable if the measured NO_x concentration is greater than or equal to 90% of the expected value.

The NO_2 – NO conversion efficiency test satisfied the USEPA Method 7E criteria (measured NO_x concentration was 93.2% of the expected value, i.e., greater than 90% of the expected value as required by Method 7E).

5.2 Gas Divider Certification (USEPA Method 205)

A STEC Model SGD-710C 10-step gas divider was used to obtain appropriate calibration span gases. The ten-step STEC gas divider was NIST certified (within the last 12 months) with a primary flow standard in accordance with Method 205. When cut with an appropriate zero gas, the ten-step STEC gas divider delivers calibration gas values ranging from 0% to 100% (in 10% step increments) of the USEPA Protocol 1 calibration gas that was introduced into the system. The field evaluation procedures presented in Section 3.2 of Method 205 were followed prior to use of gas divider. The field evaluation yielded no errors greater than 2% of the triplicate measured average and no errors greater than 2% from the expected values.

5.3 Instrumental Analyzer Interference Check

The instrumental analyzers used to measure NO_X, CO, O_2 and CO_2 have had an interference response test preformed prior to their use in the field, pursuant to the interference response test procedures specified in USEPA Method 7E. The appropriate interference test gases (i.e., gases that would be encountered in the exhaust gas stream) were introduced into each analyzer, separately and as a mixture with the analyte that each analyzer is designed to measure. All of analyzers exhibited a composite deviation of less than 2.5% of the span for all measured interferent gases. No major analytical components of the analyzers have been replaced since performing the original interference tests.

5.4 Instrument Calibration and System Bias Checks

At the beginning of each day of the testing program, initial three-point instrument calibrations were performed for the NO_x, CO, CO_2 and O_2 analyzers by injecting calibration gas directly into the inlet sample port for each instrument. System bias checks were performed prior to and at the conclusion of each sampling period by introducing the upscale calibration gas and zero gas into the sampling system (at the base of the stainless steel sampling probe prior to the particulate filter and Teflon® heated sample line) and determining the instrument response against the initial instrument calibration readings.

At the beginning of each test day, appropriate high-range, mid-range, and low-range span gases followed by a zero gas were introduced to the NMHC analyzer, in series at a tee connection, which is installed between the sample probe and the particulate filter, through a poppet check valve. After each one-hour test period, mid-range and zero gases were reintroduced in series at the tee connection in the sampling system to check against the method's performance specifications for calibration drift and zero drift error.

The instruments were calibrated with USEPA Protocol 1 certified concentrations of CO_2, O_2, NO_x, and CO in nitrogen and zeroed using hydrocarbon free nitrogen. The NMHC (VOC) instrument was calibrated with USEPA Protocol 1 certified concentrations of propane in air and zeroed using hydrocarbon-free air. A STEC Model SGD-710C ten-step gas divider was used to obtain intermediate calibration gas concentrations as needed.

5.5 Determination of Exhaust Gas Stratification

A stratification test was performed for the RICE exhaust stack. The stainless steel sample probe was positioned at sample points correlating to 16.7, 50.0 (centroid) and 83.3% of the stack diameter. Pollutant concentration data were recorded at each sample point for a minimum of twice the maximum system response time.

The recorded concentration data for each RICE exhaust stack indicate that the measured CO, O_2 and CO_2 concentrations did not vary by more than 5% of the mean across the stack diameter. Therefore, the RICE exhaust gas was considered to be unstratified and the compliance test sampling was performed at a single sampling location within the RICE exhaust stack.

5.6 Meter Box Calibrations

The Nutech Model 2010 sampling console, which was used for exhaust gas moisture content sampling, was calibrated prior to and after the testing program. This calibration uses the critical orifice calibration technique presented in USEPA Method 5. The metering console calibration exhibited no data outside the acceptable ranges presented in USEPA Method 5.

The digital pyrometer in the Nutech metering console was calibrated using a NIST traceable Omega® Model CL 23A temperature calibrator.

5.7 Sampling System Response Time Determination

The response time of the sampling system was determined prior to the compliance test program by introducing upscale gas and zero gas, in series, into the sampling system using a tee connection at the base of the sample probe. The elapsed time for the analyzer to display a reading of 95% of the expected concentration was determined using a stopwatch.

Results of the response time determinations were recorded on field data sheets. For each test period, test data were collected once the sample probe was in position for at least twice the maximum system response time.

Appendix F presents test equipment quality assurance data for the emission test equipment (NO_2 – NO conversion efficiency test data, instrument calibration and system bias check records, calibration gas and gas divider certifications, interference test results, meter box calibration records, Pitot tube calibration records).

6.0 RESULTS

6.1 Test Results and Allowable Emission Limits

Engine operating data and air pollutant emission measurement results for each one-hour test period are presented in Tables 6.1 through 6.2.

The measured air pollutant concentrations and emission rates for Engine Nos. 1 and 2 are less than the allowable limits specified in the PTI 378-08A for Emission Unit Nos. EUICENGINE1 and EUICENGINE2:

- 2.6 grams per brake-horsepower hour (g/bhp-hr) CO;
- 0.6 g/bhp-hr NOx;
- 1.0 g/bhp-hr VOC.

6.2 Variations from Normal Sampling Procedures or Operating Conditions

The testing for all pollutants was performed in accordance with the approved Stack Test Protocol. The engine-generator sets were operated within 10% of maximum output (1,426 kW generator output) and no variations from the normal operating conditions of the RICE occurred during the engine test periods.

Compliance emission testing was originally scheduled to be performed for both Engine Nos. 1 and 2 on May 6, 2019. Due to lack of digester gas, testing was spread out over two (2) days. Engine No. 2 was tested on May 6, 2019 and Engine No. 1 was tested on May 7, 2019. This was discussed with and approved by EGLE-AQD representatives Mr. Dave Patterson and Ms. Kaitlyn DeVries.

Some of the test periods for both Engine Nos. 1 and 2 were paused due to engine shutdowns. Following each engine shutdown, ICT collected test data for at least twice the maximum system response time before resuming the test. Each test was performed for a total of at least 60 1-minute average data points. This was discussed with and approved by EGLE-AQD representatives Mr. Dave Patterson and Ms. Kaitlyn DeVries.

Table 6.1 Measured exhaust gas conditions and NO_x, CO, and VOC air pollutant emission rates for Engine No. 1 (EUICENGINE1)

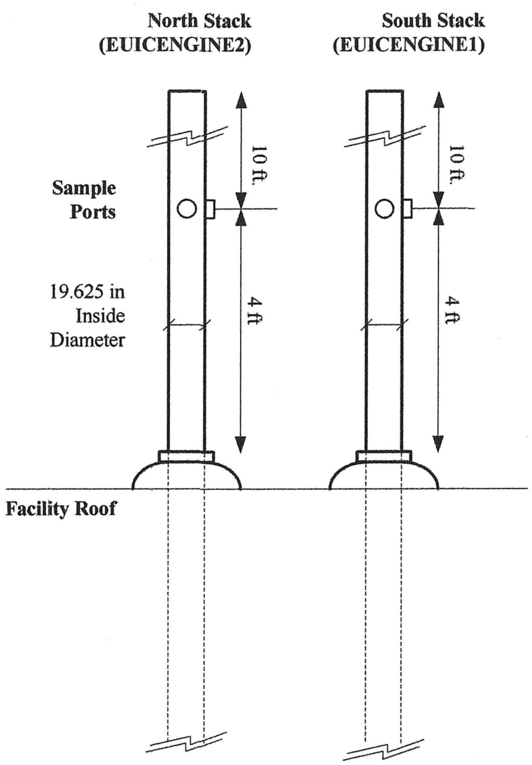
Test No. Test date Test period (24-hr clock)	1 5/7/19 0735-0906	2 5/7/19 0925-1025	3 5/7/19 1042-1142	Three Test Average
Fuel flowrate (scfm)	341	340	341	340
Generator output (kW)	1,359	1,357	1,364	1,360
Engine output (bhp)	1,873	1,870	1,880	1,874
LFG methane content (%)	63.4	63.4	63.4	63.4
Exhaust Gas Composition				
CO_2 content (% vol)	9.80	9.79	7.81	9.80
O_2 content (% vol)	9.37	9.35	9.33	9.35
Moisture (% vol)	10.7	11.1	11.0	10.9
Exhaust gas temperature (^oF)	770	830	825	808
Exhaust gas flowrate (dscfm)	3,887	3,892	3,942	3,907
Exhaust gas flowrate (scfm)	4,355	4,379	4,227	4,387
Nitrogen Oxides				
NO_X conc. (ppmvd)	47.8	47.5	46.6	47.3
NO_X emissions (lb/hr)	1.33	1.33	1.32	1.32
NO_X emissions (g/bhp*hr)	0.32	0.32	0.32	0.32
Permitted emissions (g/bhp*hr)	-	-	-	0.6
Carbon Monoxide				
CO conc. (ppmvd)	570	565	566	567
CO emissions (lb/hr)	9.67	9.60	9.73	9.67
CO emissions (g/bhp*hr)	2.34	2.33	2.35	2.34
Permitted emissions (g/bhp*hr)	-	-	-	2.6
Volatile Organic Compounds				
VOC conc. (ppmv as C_3)	24.0	23.3	23.7	23.6
VOC emissions (g/bhp*hr)	0.17	0.17	0.17	0.17
Permitted emissions (g/bhp*hr)	-	-	-	1.0

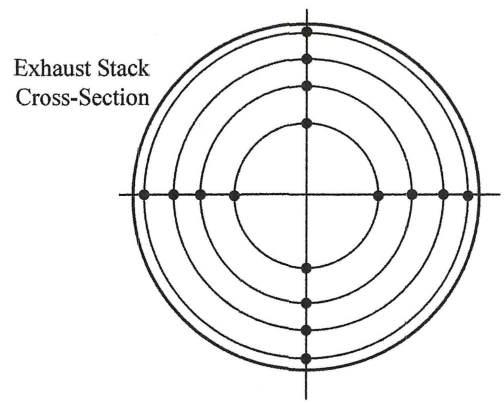
Table 6.2 Measured exhaust gas conditions and NO_x, CO, and VOC air pollutant emission rates for Engine No. 2 (EUICENGINE2)

Test No. Test date Test period (24-hr clock)	1 5/6/19 0913-1013	2 5/6/19 1043-1209	3 5/6/19 1243-1425	Three Test Average
Fuel flowrate (scfm)	336	338	343	339
Generator output (kW)	1,428	1,432	1,432	1,431
Engine output (bhp)	1,968	1,974	1,974	1.972
LFG methane content (%)	64.3	64.4	64.3	64.4
Exhaust Gas Composition				
CO_2 content (% vol)	9.49	9.53	9.58	9.54
O_2 content (% vol)	9.52	9.52	9.45	9.50
Moisture (% vol)	13.8	11.1	12.1	12.3
Exhaust gas temperature (°F)	758	780	785	774
Exhaust gas flowrate (dscfm)	4,036	4,094	4,023	4,051
Exhaust gas flowrate (scfm)	4,680	4,606	4,574	4,620
Nitrogen Oxides				
NO_X conc. (ppmvd)	54.2	52.9	51.6	52.9
NO_X emissions (lb/hr)	1.57	1.55	1.49	1.54
NO_X emissions (g/bhp*hr)	0.36	0.36	0.34	0.35
Permitted emissions (g/bhp*hr)	-	-	-	0.6
Carbon Monoxide				
CO conc. (ppmvd)	554	552	553	553
CO emissions (lb/hr)	9.75	9.85	9.71	9.77
CO emissions (g/bhp*hr)	2.25	2.26	2.23	2.25
Permitted emissions (g/bhp*hr)	-	-	-	2.6
Volatile Organic Compounds				
VOC conc. (ppmv as C_3)	24.0	24.0	24.5	24.1
VOC emissions (g/bhp*hr)	0.18	0.17	0.18	0.18
Permitted emissions (g/bhp*hr)	-	-	-	1.0

APPENDIX A

- Figure A-1 – IC Engine Nos. 1 – 2 Sample Port Diagram
- Figure A-2 – USEPA Method 3A/7E/10/Alt096 Sampling Train Diagram
- Figure A-3 – USEPA Method 4 Sampling Train Diagram

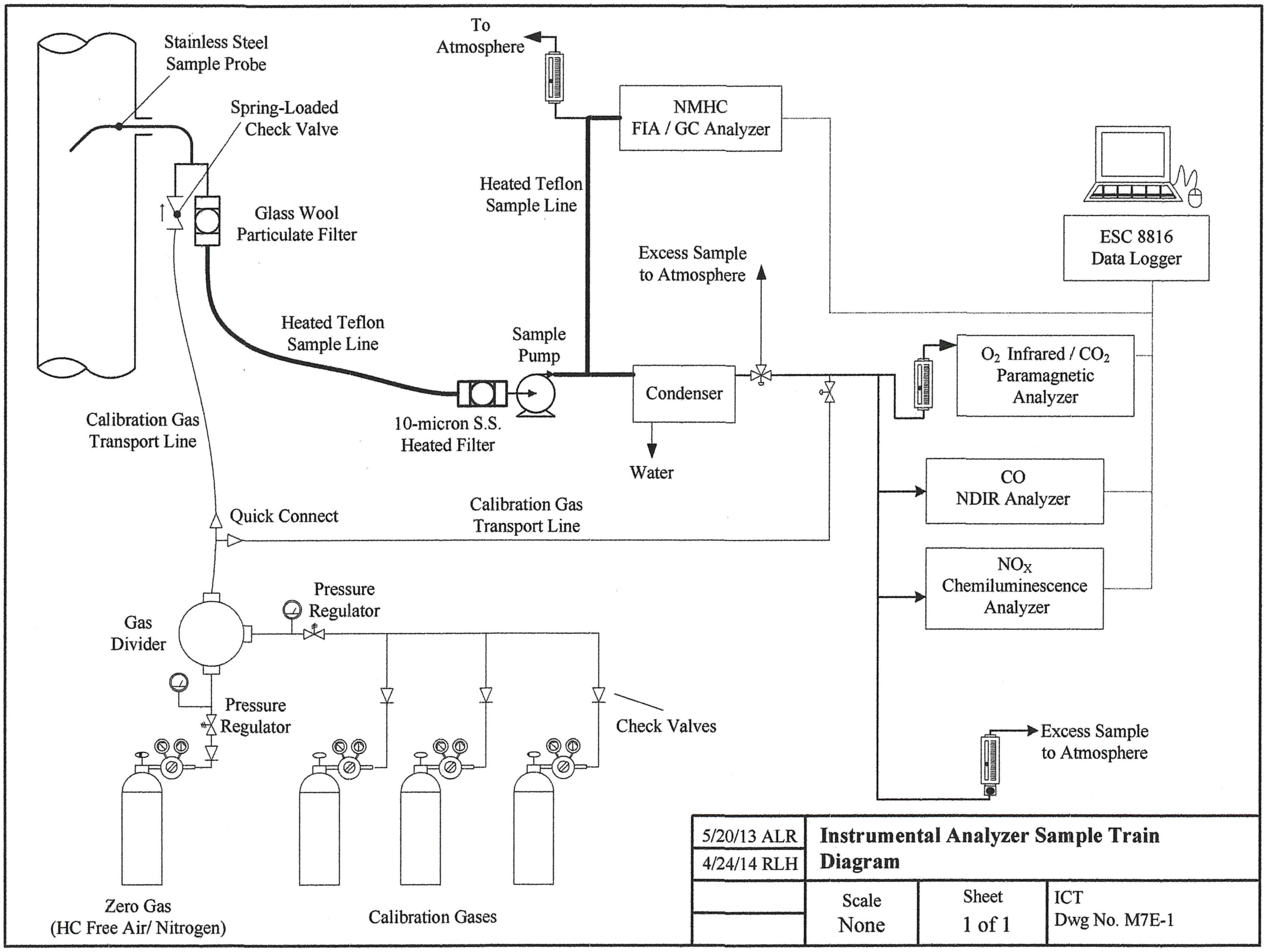




Velocity sample locations as measured from stack wall

Pt. #	in.
1	0.63
2	2.06
3	3.81
4	6.34
5	13.29
6	15.82
7	17.56
8	18.99

5/5/2014	**Fremont Regional Digester**		
7/30/18	**Exhaust Sample Location, GE Jenbacher J420**		
5/24/19	Scale None	Sheet 1 of 1	ICT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Spring-Loaded
Check Valve
Glass Wool
Particulate Filter
To
Atmosphere
NMHC
FIA / GC Analyzer
Heated Teflon
Sample Line
Excess Sample
to Atmosphere
ESC 8816
Data Logger
Heated Teflon
Sample Line
Sample
Pump
Condenser
O_2 Infrared / CO_2
Paramagnetic
Analyzer
Calibration Gas
Transport Line
10-micron S.S.
Heated Filter
Water
CO
NDIR Analyzer
Quick Connect
Calibration Gas
Transport Line
NO_X
Chemiluminescence
Analyzer
Pressure
Regulator
Gas
Divider
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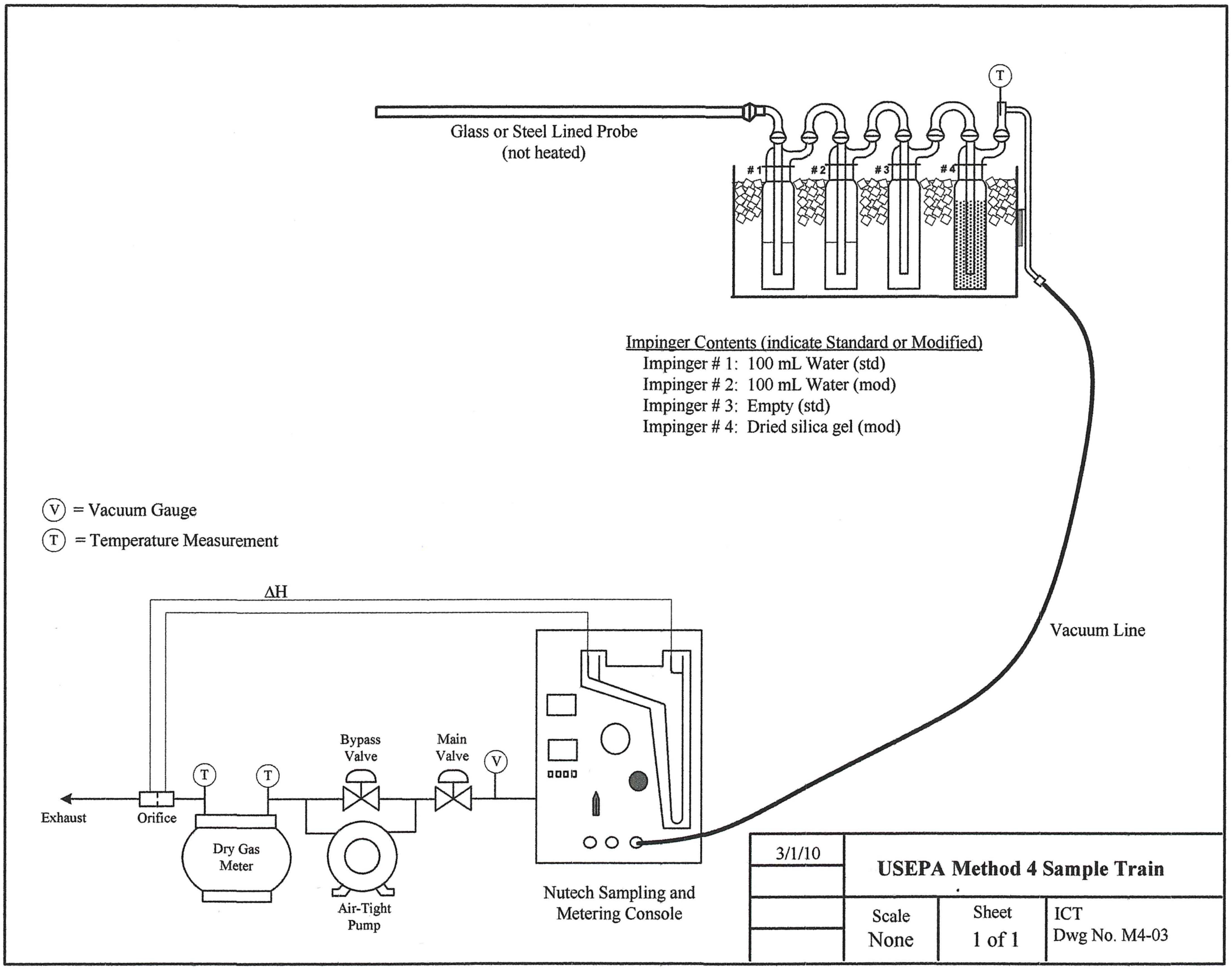
Glass or Steel Lined Probe
(not heated)
T
1
2
3
4
Impinger Contents (indicate Standard or Modified)
Impinger # 1: 100 mL Water (std)
Impinger # 2: 100 mL Water (mod)
Impinger # 3: Empty (std)
Impinger # 4: Dried silica gel (mod)
V = Vacuum Gauge
T = Temperature Measurement
ΔH
Vacuum Line
Bypass Valve
Main Valve
V
T
T
Exhaust
Orifice
Dry Gas Meter
Air-Tight Pump
Nutech Sampling and Metering Console
3/1/10
USEPA Method 4 Sample Train
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