mostardi platt

Compliance Emissions Test Report

Lansing Board of Water & Light
Delta Energy Park Facility
EUCTGSC1
Permit to Install 74-18B
Lansing, Michigan
March 22, 2022

Report Submittal Date
May 9, 2022

Project No. M221106B

Crown Point, IN | Mendota Heights, MN | Denver, CO | Henderson, NV

Corporate Headquarters
888 Industrial Drive
Elmhurst, Illinois 60126
630-993-2100

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY

Mostardi Platt performed a compliance emissions test program on the EUCTGSC1 while firing natural gas at the Lansing Board of Water & Light, Delta Energy Park Facility in Lansing, Michigan. The purpose of the test program is to demonstrate compliance with requirements for emission rate in accordance with Permit to Install 74-18B. This report summarizes the results of the test program and test methods utilized.

The test location, test date, and test parameters are summarized below.

TEST INFORMATION		
Test Location	**Test Date**	**Test Parameters**
EUCTGSC1	March 22, 2022	Carbon Monoxide (CO), Nitrogen Oxide (NO_X), Volatile Organic Compounds (VOC)

All testing, sampling, analytical, and calibration procedures used for this test program was performed as described in the *Code of Federal Regulations*, Title 40, Part 60, Appendix A (40CFR60), Methods 1, 2, 3A, 4, 7E, 10, 18 and 25A, and the latest revisions thereof. Selected results of the test program are summarized below. A complete summary of emission test results follows the narrative portion of this report.

Operating data provided by Lansing Board of Water & Light is included in Appendix E.

Source	Pollutant Tested	Emissions Limit	Emission Rate
EUCTGSC1	Nitrogen Oxides (NO_x)	60.0 lb/hr	50.06 lb/hr
	Carbon Monoxide (CO)	9.0 lb/hr	4.46 lb/hr
	Volatile Organic Compounds (VOC)	5.0 lb/hr	0.03 lb/hr

The identifications of the individuals associated with the test program are summarized below.

TEST PERSONNEL INFORMATION		
Location	**Address**	**Contact**
Test Coordinator	Lansing Board of Water and Light 1232 Haco Drive PO Box 13007 Lansing, Michigan 48912-1610	Mr. Nathan Hude Environmental Compliance Specialist (517) 702-6170 (phone) nathan.hude@lbwl.com
Test Facility	Lansing Board of Water and Light Delta Energy Park Facility 3725 South Canal Road Lansing, MI 48917 Permit to Install 74-18BA	
Testing Company Supervisor	Mostardi Platt 888 Industrial Drive Elmhurst, IL 60126	Mr. Christopher E. Jensen Senior Project Manager 630-993-2100 (phone) cjensen@mp-mail.com

The test crew consisted of Messrs. J. Priesz, S. McGough, T. Long, and C. Jensen of Mostardi Platt.

2.0 TEST METHODOLOGY

Emission testing was conducted following the United States Environmental Protection Agency (USEPA) methods specified in 40CFR60, Appendix A in addition the Mostardi Platt Quality Manual. Schematics of the test section diagrams and sampling trains used are included in Appendix A and B respectively. Calculation nomenclature are included in Appendix C. The computerized reference method test data is included in Appendix D. Process data as provided by Lansing Board of Water & Light are also included in Appendix E.

The following methodologies were used during the test program:

Methods 1 and 2 Volumetric Flowrate Determination

Gas velocity and volumetric flowrate are determined at the stack test location using Reference Methods 1 and 2.

Velocity pressures were determined by traversing the test location with an S-type pitot tube. Temperatures were measured using K-type thermocouples with calibrated digital temperature indicators. The molecular weight and moisture content of the gases are determined to permit the calculation of the volumetric flowrate. Sampling points utilized were determined using Method 1, 40CFR60, following the table below.

Location	Diameter	Upstream Diameters	Downstream Diameters	Test Parameters	Number of Sampling Points
EUCTGSC1	12 Feet	1.5	7.0	CO/VOC/O_2/CO_2	12 (stratification)/Run 1 3 for Runs 2 and 3

Method 3A Oxygen and Carbon Dioxide Determination

Stack gas oxygen (O_2) and carbon dioxide (CO_2) concentrations were determined in accordance with USEPA Method 3A, 40CFR60, Appendix A. A Servomex analyzer was used to determine the CO_2 and O_2 concentrations in the manner specified in the Method. The instrument has a paramagnetic detector and the CO_2 and O_2 operate in the nominal range of 0% to 25% with the specific range determined by the high-level calibration gas. High-range calibrations were performed using USEPA Protocol gas. Zero nitrogen (a low ppm pollutant in balance nitrogen calibration gases) was introduced during other instrument calibrations to check instrument zero. High- and a mid-range % CO_2 and O_2 levels in balance nitrogen were also introduced. Zero and mid-range calibrations were performed using USEPA Protocol gas after each test run. Copies of the gas cylinder certifications are found in Appendix H. This testing met the performance specifications as outlined in the Method.

Method 4 Moisture Determination

USEPA Method 4, 40CFR60, Appendix A, was utilized to determine water (H_2O) content of the exhaust gas. 100 milliliters (ml) of water were added to each of the first two impingers, the third impinger was left empty, and the fourth impinger was charged with approximately 200 grams of silica gel. The impingers were placed in an ice bath to maintain the sampled gas passed through the silica gel impinger outlet below 68°F in order to increase the accuracy of the sampled dry gas volume measurement. The water volumes of the impinger train were measured and the silica gel was weighed before and after each test run to determine the mass of moisture condensed.

Each sample was extracted through a heated stainless-steel probe and filter assembly at a constant sample rate of approximately 0.75 cubic feet per minute, which was maintained throughout the course of the test run. A minimum of 21 dry standard cubic feet (dscf) are sampled for each moisture run. After each run, a leak check of the sampling train was performed at a vacuum greater than the sampling vacuum to determine if any leakage had occurred during sampling. Following the leak check, the impingers were removed from the ice bath, water levels were measured, and the silica gel weight was recorded.

All of the equipment used was calibrated in accordance with the specifications of the Method. Copies of field data sheets are in Appendix F. Calibration data is in Appendix G.

Method 7E Nitrogen Oxides Determination

Stack gas NO_X concentrations and emission rates were determined in accordance with USEPA Method 7E, 40CFR60, Appendix A. A Thermo Scientific Model 42i-HL Chemiluminescence Nitrogen Oxides Analyzer was used to determine nitrogen oxides concentrations, in the manner specified in the Method. The instrument operated in the nominal range of 0 ppm to 100 ppm with the specific range determined by the high-level span calibration gas.

The Model 42i operates on the principle that nitric oxide (NO) and ozone (O_3) react to produce a characteristic luminescence with an intensity linearly proportional to the NO concentration. Infrared light emission results when electronically excited NO_2 molecules decay to lower energy states. Specifically,

$$NO+O_3 \rightarrow NO_2+O_2+hv$$

Nitrogen dioxide (NO_2) must first be transformed into NO before it can be measured using the chemiluminescent reaction. NO_2 is converted to NO by a stainless steel NO_2-to-NO converter heated to about 624.8°C. The flue gas sample is drawn into the Model 42*i* through the sample bulkhead. The sample flows through a capillary, and then to the mode solenoid valve. The

solenoid valve routes the sample either straight to the reaction chamber (NO mode) or through the NO_2-to-NO converter and then to the reaction chamber (NO_x mode). A flow sensor prior to the reaction chamber measures the sample flow. Dry air enters the Model 42*i* through the dry air bulkhead, passes through a flow switch, and then through a silent discharge ozonator. The ozonator generates the ozone needed for the chemiluminescent reaction. At the reaction chamber, the ozone reacts with the NO in the sample to produce excited NO_2 molecules. A photomultiplier tube (PMT) housed in a thermoelectric cooler detects the luminescence generated during this reaction. From the reaction chamber, the exhaust travels through the ozone (O_3) converter to the pump and is released through the vent.

The NO and NO_X concentrations calculated in the NO and NO_X modes are stored in memory. The difference between the concentrations is used to calculate the NO_2 concentration. The Model 42i outputs NO, NO_2, and NO_X concentrations to the front panel display, the analog outputs, and also makes the data available over the serial or ethernet connection.

Stack gas was delivered to the analyzer via a Teflon® sampling line, heated to a minimum temperature of 250°F. Excess moisture in the stack gas was removed using a refrigerated condenser. The entire system was calibrated in accordance with the Method, using USEPA Protocol gases introduced at the probe, before and after each test run. This testing met the performance specifications as outlined in the Method.

A list of calibration gases used and the results of all calibration and other required quality assurance checks are found in Appendix G. Copies of the gas cylinder certifications are found in Appendix H. The NO_2 to NO converter test can be found in Appendix I. This testing met the performance specifications as outlined in the Method.

Method 10 Carbon Monoxide Determination

Stack gas CO concentrations and emission rates were determined in accordance with USEPA Method 10, 40CFR60, Appendix A. A Thermo Scientific Model 48i Gas Filter Correlation Analyzer was used to determine carbon monoxide concentrations, in the manner specified in the Method. The instrument operated in the nominal range of 0 ppm to 100 ppm with the specific range determined by the high-level span calibration gas.

The Model 48i is based on the principle that CO absorbs infrared radiation at a wavelength of 4.6 microns. Because infrared absorption is a nonlinear measurement technique, it is necessary for the instrument electronics to transform the basic analyzer signal into a linear output. The Model 48i uses an exact calibration curve to accurately linearize the instrument output over any range up to a concentration of 10,000 ppm. The sample is drawn into the analyzer through the sample bulkhead. The sample flows through the optical bench. Radiation from an infrared source is chopped and then passed through a gas filter alternating between CO and N2. The radiation then passes through a narrow bandpass interference filter and enters the optical bench where absorption by the sample gas occurs. The infrared radiation then exits the optical bench and falls on an infrared detector. The CO gas filter acts to produce a reference beam which cannot be further attenuated by CO in the sample cell. The N_2 side of the filter wheel is transparent to the infrared radiation and therefore produces a measure beam which can be absorbed by CO in the cell. The chopped detector signal is modulated by the alternation between the two gas filters with an amplitude related to the concentration of CO in the sample cell. Other gases do not cause modulation of the detector signal since they absorb the reference and measure beams equally. Thus, the GFC system responds specifically to CO. The Model 48i outputs the CO concentration to the front panel display and the analog outputs.

Stack gas was delivered to the analyzer via a Teflon® sampling line, heated to a minimum temperature of 250°F. Excess moisture in the stack gas was removed using a refrigerated condenser. The entire system was calibrated in accordance with the Method, using USEPA protocol gases introduced at the probe, before and after each test run.

A list of calibration gases used and the results of all calibration and other required quality assurance checks are found in Appendix G. Copies of the gas cylinder certifications are found in Appendix H. This testing met the performance specifications as outlined in the Method

Method 25A Volatile Organic Compound (VOC) Determination

The Method 25A sampling and measurement system meets the requirements for sampling of volatile organic compounds (VOCs) set forth by the USEPA. In particular, it meets the requirements of USEPA Reference Method 25A, "Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer," 40CFR60, Appendix A. This method applies to the measurement of total gaseous organic concentration of hydrocarbons. With this method, gas samples are extracted from the sample locations through heated Teflon sample lines to the analyzers.

The FIDs used during this program was a Thermo 51i analyzer. It is a highly sensitive FID that provides a direct reading of total organic vapor concentrations with linear ranges of 0-100 ppm by volume. The instrument was calibrated using ultra-zero air and methane in air EPA Protocol standards. The calibrations were performed before and after sampling with calibration checks performed between each test run. Sample times and locations were logged simultaneously on data loggers.

Calculations were performed by computer or by hand. An explanation of the nomenclature and calculations along with the complete test results is included in the appendix. Also appended are calibration data and copies of the raw field data sheets.

3.0 TEST RESULT SUMMARIES

Lansing Board of Water and Light
Delta Energy Park Facility
EUCTGSC1 Stack
Gaseous Summary

Test No.	Date	Start Time	End Time	NO_x ppmvd	CO ppmvd	CO_2 % (dry)	O_2 % (dry)	Flowrate, DSCFM	Flowrate, SCFM	THC ppm as CH_4 (wet)
1	03/22/22	09:02	10:13	26.0	3.8	4.1	13.9	285,425	310,582	0.1
2	03/22/22	10:34	11:33	25.4	3.7	4.2	13.9	270,635	294,336	0.0
3	03/22/22	12:00	12:59	25.1	3.7	4.1	13.9	265,586	287,723	0.0
Average				25.5	3.7	4.1	13.9	273,882	297,547	0.0

Emission Rate Summary

Test No.	Date	Start Time	End Time	Fd Factor, dscf/MMBtu	O2 based NOx lb/MMBtu	O2 based CO lb/MMBtu	O2 based THC lb/MMBtu as CH4	NO_x lb/hr	CO lb/hr	THC lb/hr as CH_4
1	03/22/22	09:02	10:13	8,710.0	0.081	0.007	0.0003	53.16	4.73	0.08
2	03/22/22	10:34	11:33	8,710.0	0.079	0.007	0.0000	49.25	4.37	0.00
3	03/22/22	12:00	12:59	8,710.0	0.078	0.007	0.0000	47.76	4.28	0.00
Average				8,710.0	0.079	0.007	0.0001	50.06	4.46	0.03

4.0 CERTIFICATION

Mostardi Platt is pleased to have been of service to Lansing Board of Water & Light If you have any questions regarding this test report, please do not hesitate to contact us at 630-993-2100.

As the program manager, I hereby certify that this test report represents a true and accurate summary of emissions test results and the methodologies employed to obtain those results. The test program was performed in accordance with the test methods and the Mostardi Platt Quality Manual, as applicable.

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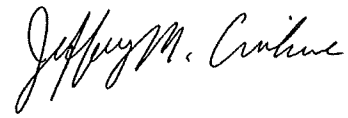
Program Manager

Christopher E. Jensen



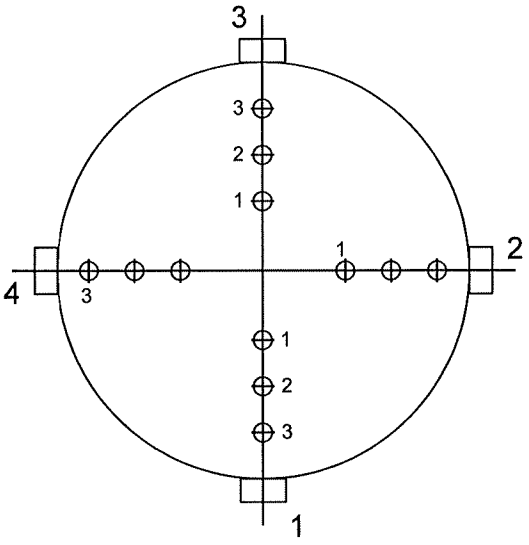
Quality Assurance

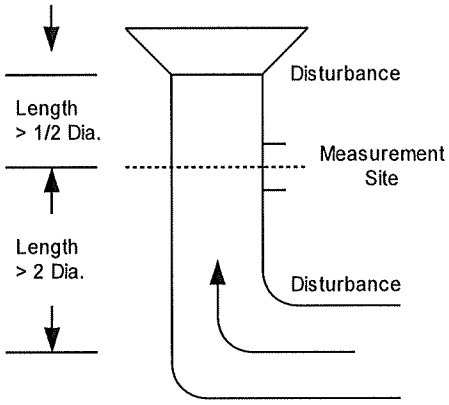
Jeffrey M. Crivlare

APPENDICES

Appendix A - Test Section Diagrams

EQUAL AREA TRAVERSE FOR ROUND DUCTS





Job: Lansing Board of Water & Light
Delta Energy Park

Date: March 22, 2022

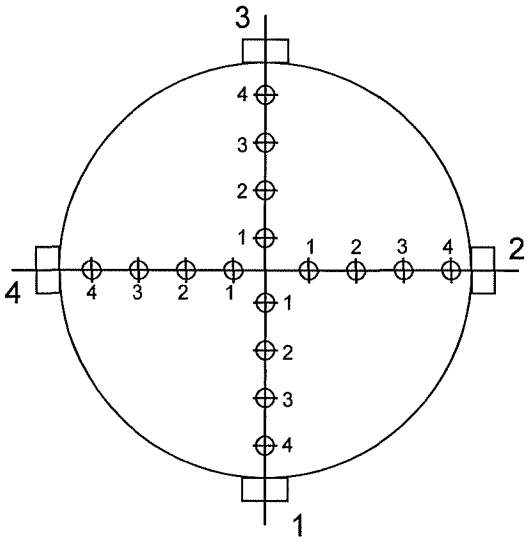
Test Location: EUCTGSC1 Stack

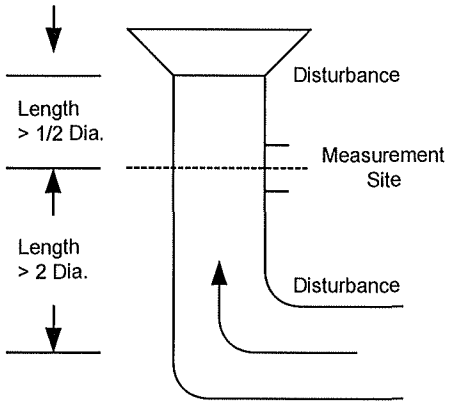
Duct Diameter: 12 Feet

Duct Area: 113.10 Square Feet

No. Points Across Diameter: 6

EQUAL AREA TRAVERSE FOR ROUND DUCTS

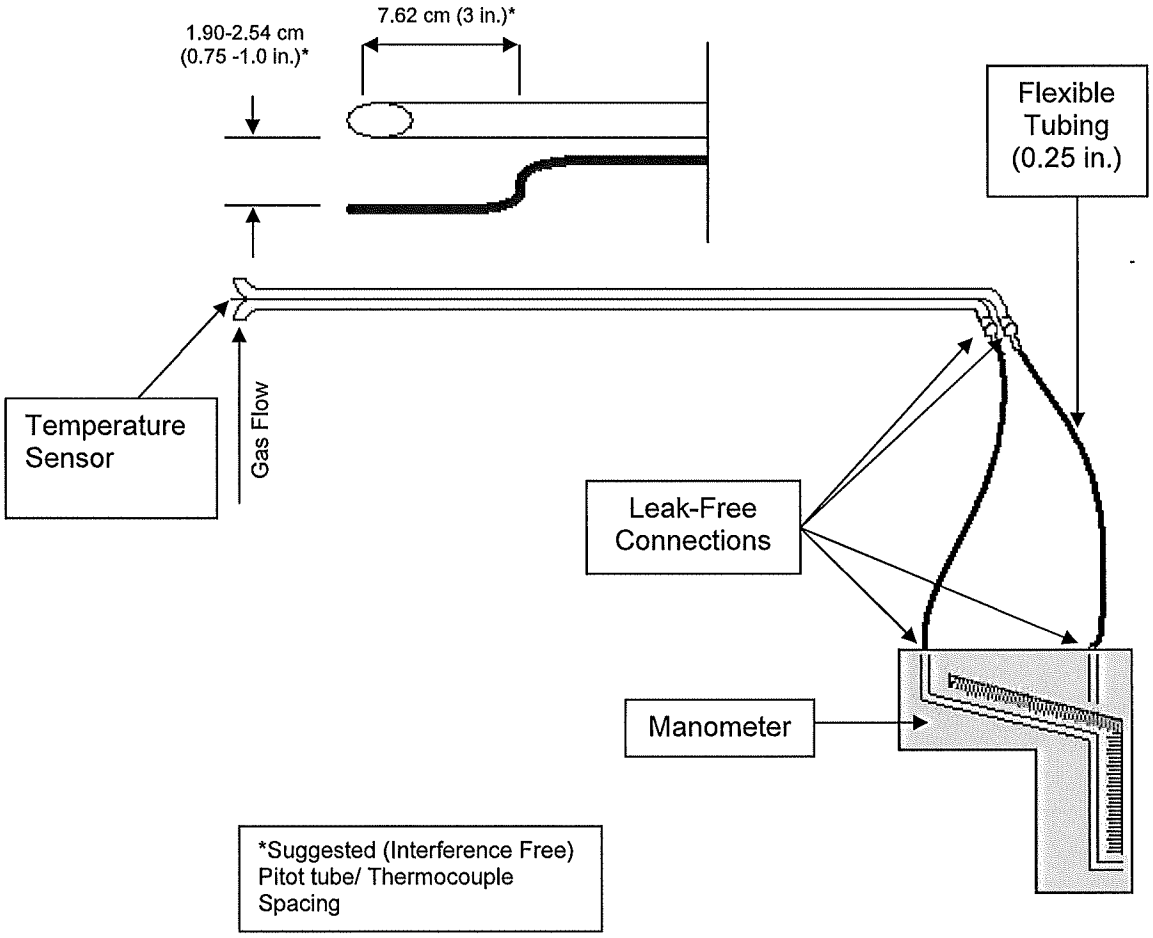




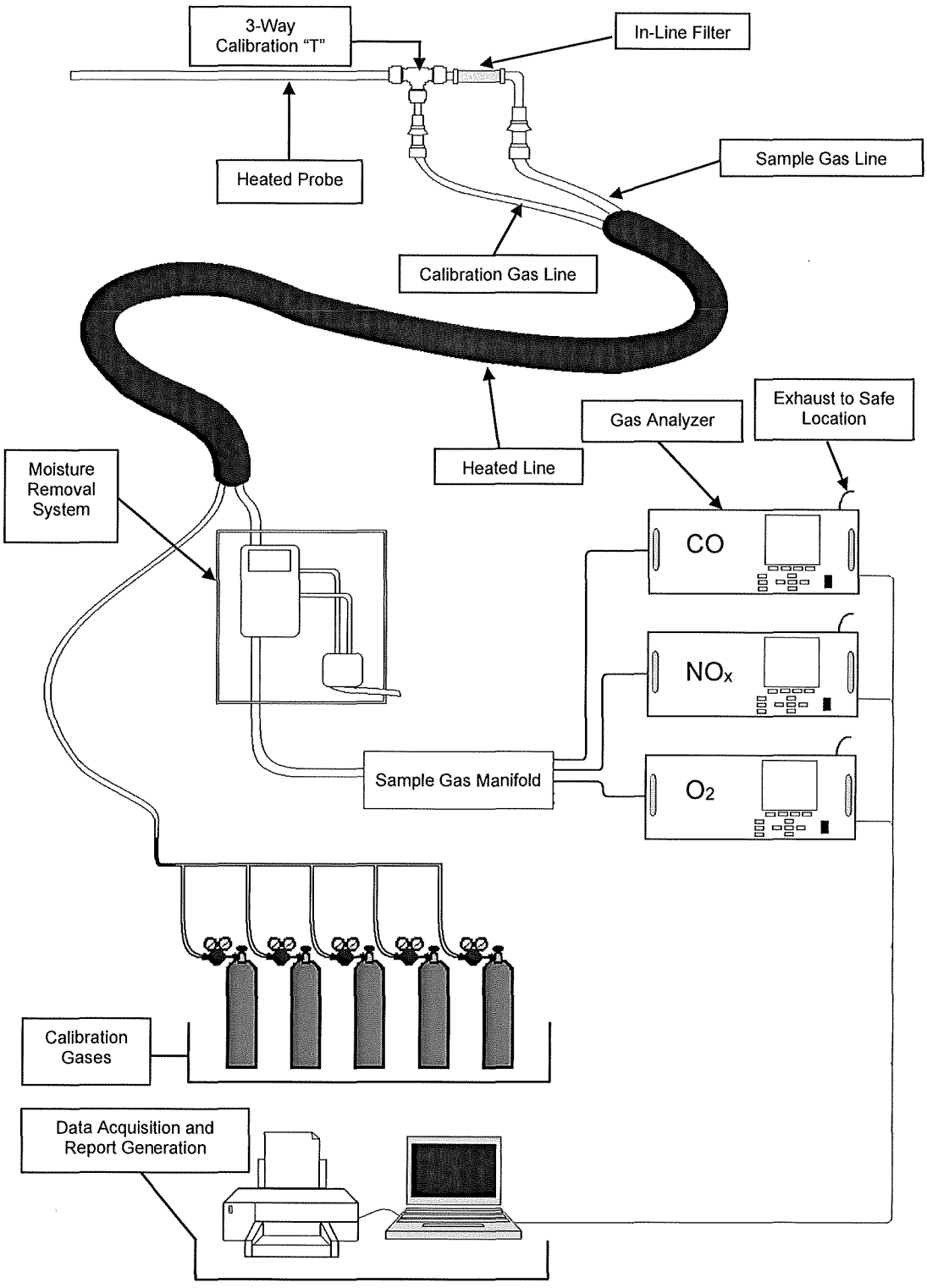
Job:	Lansing Board of Water and Light Delta Energy Park
Date:	March 22, 2022
Test Location:	EUCTGSC1 Stack
Duct Diameter:	12 Feet
Duct Area:	113.10 Square Feet
No. Points Across Diameter:	8
No. of Ports:	4
Port Length:	12 Inches

Appendix B - Sample Train Diagrams

USEPA Method 2 – Type S Pitot Tube Manometer Assembly



USEPA Methods 3A, 7E, and 10 Extractive Gaseous Sampling Diagram



USEPA Method 4- Moisture Content Sample Train Diagram