mostardi platt

Compliance Emission Test Report

Lasing Board of Water and Light
Delta Energy Park Facility
EUCTGHRSG3
Lansing, Michigan
September 21 and 22, 2022

Report Submittal Date
October 26, 2022

Project No. M223707A

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

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1.0 EXECUTIVE SUMMARY

Mostardi Platt conducted a compliance emission test program for Lansing Board of Water and Light at the Delta Energy Park Facility in Lansing, Michigan on the EUCTGHRSG3 on September 21 and 22, 2022. This report summarizes the results of the test program and test methods used.

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

TEST INFORMATION		
Test Location	**Test Dates**	**Test Parameters**
EUCTGHRSG3	September 21 and 22, 2022	Filterable Particulate Matter (FPM), Condensable Particulate Matter (CPM), Total Particulate Matter (TPM), Carbon Monoxide (CO), and Volatile Organic Compound (VOC)

The purpose of this test program was to demonstrate compliance with permitted limits while operating EUCTGHRSG3 at maximum achievable load in accordance with Permit to Install 74-18C.

Selected results of the test program are summarized below. A complete summary of emission test results follows the narrative portion of this report.

Test Results				
Test Location	**Date**	**Test Parameter**	**Emission Limits**	**Emission Rates**
EUCTGHRSG3	9/21/22 and 9/22/22	Total Particulate Matter (TPM)	$PM_{2.5}$ 6.02 lb/hr	2.716 lb/hr
			PM_{10} 6.02 lb/hr	2.716 lb/hr
	9/21/22	CO	9.0 lb/hr	1.9 lb/hr
		VOC	5.0 lb/hr	0.1 lb/hr

Summary of operating data as provided by Lansing Board of Water and Light are found in Appendix A.

The gas cylinders used to perform the CO and VOC are summarized below.

GAS CYLINDER INFORMATION				
Parameter	**Gas Vendor**	**Cylinder Serial Number**	**Cylinder Value**	**Expiration Date**
Propane	Airgas	SG9179783CAL	0.0 ppm	5/3/2029
Propane	Airgas	CC313139	10.05 ppm	2/22/2027
Propane	Airgas	CC84160	20.39 ppm	12/27/2029
Propane	Airgas	CC69724	29.94 ppm	12/22/2028
CO_2	Airgas	CC89183	0.0%	3/15/2030
CO_2	Airgas	CC280498	9.913%	4/18/2030
CO_2	Airgas	XC022692B	18.68%	12/26/2025
O_2	Airgas	CC89183	0.0%	3/15/2030
O_2	Airgas	CC280498	10.03%	4/18/2030
O_2	Airgas	XC022692B	19.13%	12/26/2025
CO	Airgas	CC280498	0.0 ppm	4/18/2030
CO	Airgas	CC89183	23.84 ppm	3/15/2030
CO	Airgas	ALM-055143	49.81 ppm	6/8/2029

The identification of individuals associated with the test program is 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	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 74-18C	
Testing Company Personnel	Mostardi Platt 888 Industrial Drive Elmhurst, Illinois 60126	Tim Russ Senior Project Manager 630-993-2100 (phone) truss@mp-mail.com
Testing Company Personnel		Joshua Kukla Test Engineer
		Ryan Spoolstra Test Engineer
		Scott McGough Test Engineer
		Tiernan Long Test Engineer
		Joshua Jimenez Test Technician

2.0 TEST METHODOLOGY

Emission testing was conducted following the methods specified in 40CFR60, Appendix A and 40CFR51, Appendix M. Schematics of the test section diagrams and sampling trains used are included in Appendix B and C, respectively. Calculation nomenclature and example calculations are included in Appendix D. Appendix E includes laboratory sample analysis. Copies of reference method data sheets and field data sheets for each test run are included in Appendix F and G, respectively.

The following methodology was used during the test program:

Method 1 Traverse Point Determination

Test measurement points were selected in accordance with Method 1. The characteristics of each measurement location are summarized below.

TEST POINT INFORMATION				
Location	**Upstream Diameters**	**Downstream Diameters**	**Test Parameter**	**Number of Sampling Points**
EUCTGHRSG3	1.7	8.3	TPM	24
			$CO/VOC/O_2/CO_2$	12

Method 3A Oxygen (O_2)/Carbon Dioxide (CO_2) Determination

CO_2 and O_2 concentrations were measured to determine exhaust gas molecular weight in accordance with Method 3A. An ECOM analyzer was used to determine stack gas O_2 and CO_2 content and, by difference, nitrogen content. All the equipment used was calibrated in accordance with the specifications of the Method. Calibration data are presented in Appendix H and copies of gas cylinder certifications are included in Appendix I.

Method 5 Filterable Particulate Matter Determination

Exhaust gas FPM concentrations and emission rates were determined in accordance with Method 5. An Environmental Supply Company sampling train was used to sample stack gas at an isokinetic rate, as specified in the Method. Particulate matter in the sample probe was recovered using an acetone wash. The probe wash and filter catch were analyzed by Mostardi Platt in accordance with the Method. Laboratory analysis data are included in Appendix E. All of the equipment used was calibrated in accordance with the specifications of the Method. Calibration data are presented in Appendix H.

Method 202 Condensable Particulate Determination

Stack gas condensable particulate matter concentrations and emission rates were determined in accordance with USEPA Method 202, in conjunction with Method 5B or 5 filterable particulate sampling. This method applies to the determination of condensable particulate matter (CPM) emissions from stationary sources. It is intended to represent condensable matter as material that condenses after passing through a filter and as measured by this method.

The CPM was collected in the impinger portion of the Method 5 (Appendix A, 40CFR60) type sampling trains. The impinger contents were immediately purged after each run with nitrogen (N_2) to remove dissolved sulfur dioxide (SO_2) gases from the impinger contents. The impinger solution was then extracted with hexane. The organic and aqueous fractions were then taken to dryness

and the residues weighed. A correction was made for any ammonia present due to laboratory analysis procedures. The total of both fractions represents the CPM.

Laboratory analysis data are included in Appendix E. All the equipment used was calibrated in accordance with the specifications of the Method. Calibration data are presented in Appendix H.

Method 10 Carbon Monoxide (CO) Determination

Stack gas CO concentrations and emission rates were determined in accordance with Method 10. A Fischer 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 a range of 0 ppm to 100 ppm with the specific range determined by the high-level span calibration gas of 49.81 ppm.

The Model 48i operates on the principle that CO absorbs infrared radiation at a wavelength of 4.6 microns. Because infrared absorption is a non-linear measurement technique, it is necessary to transform the basic analyzer signal into a linear output. The Model 48i uses an internally stored 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 Model 48i 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 N2 side of the filter wheel is transparent to the infrared radiation and therefore produces a measurement 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, 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 certified calibration 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 H. Copies of the gas cylinder certifications are found in Appendix I. This testing met the performance specifications as outlined in the Method.

Method 25A Volatile Organic Compound (VOC) Determination

Total hydrocarbon (THC) concentrations and emission rates were determined in accordance with Method 25A. A VIG 20 Flame Ionization Detector (FID) was used to determine THC concentrations. Stack gas was delivered to the system via a Teflon® sampling line, heated to a minimum temperature of 300°F.

The system was calibrated before and after each test run using certified calibration gases of propane for the THC determination. Calibration data are presented in Appendix H, field sheets are presented in Appendix G, and copies of gas certifications are presented in Appendix I.

3.0 TEST RESULT SUMMARIES

Client: Lansing Board of Water & Light
Facility: Delta Energy Park
Test Location: EUCTGSC3
Test Method: 5/202

Source Condition	Normal	Normal	Normal	
Date	9/21/22	9/22/22	9/22/22	
Start Time	15:15	7:20	10:10	
End Time	17:38	9:37	12:27	
	Run 1	Run 2	Run 3	Average
Stack Conditions				
Average Gas Temperature, °F	1031.9	1029.3	1030.6	1030.6
Flue Gas Moisture, percent by volume	8.2%	8.2%	7.7%	8.0%
Average Flue Pressure, in. Hg	28.95	28.95	28.95	28.95
Gas Sample Volume, dscf	88.06	88.951	89.584	88.865
Average Gas Velocity, ft/sec	102.888	103.759	104.245	103.631
Gas Volumetric Flow Rate, acfm	686,708	692,522	695,765	691,665
Gas Volumetric Flow Rate, dscfm	215,950	217,996	220,096	218,014
Gas Volumetric Flow Rate, scfm	235,182	237,584	238,483	237,083
Average $\%CO_2$ by volume, dry basis	4.0	4.2	4.1	4.1
Average $\%O_2$ by volume, dry basis	13.8	13.7	13.6	13.7
Isokinetic Variance	102.6	102.7	102.4	102.6
Standard Fuel Factor Fd, dscf/mmBtu	8,710.0	8,710.0	8,710.0	8,710.0
Filterable Particulate Matter (Method 5)				
grams collected	0.00253	0.00269	0.00435	0.00319
grains/acf	0.0001	0.0001	0.0002	0.0001
grains/dscf	0.0004	0.0005	0.0007	0.0005
lb/hr	0.821	0.872	1.413	1.035
lb/1000 lb of stack gas	0.001	0.001	0.001	0.001
lb/mmBtu (Standard Fd Factor)	0.0016	0.0017	0.0027	0.0020
Condensable Particulate Matter (Method 202)				
grams collected	0.01296	0.00081	0.00177	0.00518
grains/acf	0.0007	0.0000	0.0001	0.0003
grains/dscf	0.0023	0.0001	0.0003	0.0009
lb/hr	4.203	0.263	0.575	1.680
lb/1000 lb of stack gas	0.004	0.000	0.001	0.002
lb/mmBtu (Standard Fd Factor)	0.0083	0.0005	0.0011	0.0033
Total Particulate Matter (5/202)				
grams collected	0.01549	0.00350	0.00612	0.00837
grains/acf	0.0008	0.0001	0.0003	0.0004
grains/dscf	0.0027	0.0006	0.0010	0.0014
lb/hr	5.024	1.135	1.988	2.716
lb/1000 lb of stack gas	0.005	0.001	0.002	0.003
lb/mmBtu (Standard Fd Factor)	0.0099	0.0022	0.0038	0.0053

Lansing Board of Water & Light Delta Energy Park EUCTGHRSG3 (simple cycle stack) Gaseous Summary Normal Load									
Test No.	Date	Start Time	End Time	CO ppmvd	CO_2 % (dry)	O_2 % (dry)	Moisture, %	Flowrate, DSCFM	Flowrate, SCFM
1	09/21/22	15:45	16:49	2.1	4.2	13.9	8.2	215,950	235,182
2	09/22/22	07:20	08:19	1.8	4.2	13.8	8.2	217,996	237,584
3	09/22/22	10:10	11:09	2.0	4.2	13.9	7.7	220,096	238,483
Average				2.0	4.2	13.9	8.0	218,014	237,083

Emission Rate Summary				
Test No.	Date	Start Time	End Time	CO lb/hr
1	09/21/22	15:45	16:49	2.0
2	09/22/22	07:20	08:19	1.7
3	09/22/22	10:10	11:09	1.9
Average				1.9

Lansing Board of Water & Light Delta Energy Park EUCTGHRSG3 (simple cycle stack) Gaseous Summary Normal Load								
Test No.	Date	Start Time	End Time	THC ppm as C_3H_8 (wet)	Moisture, %	Flowrate, DSCFM	Flowrate, SCFM	VOC as C3H8 lb/hr
1	09/21/22	15:45	16:44	0.0	8.2	215,950	235,182	0.0
2	09/22/22	07:20	08:19	0.1	8.2	217,996	237,584	0.2
3	09/22/22	10:10	11:09	0.1	7.7	220,096	238,483	0.2
Average				0.1	8.0	218,014	237,083	0.1

4.0 CERTIFICATION

Mostardi Platt is pleased to have been of service to Whiting Clean Energy. If you have any questions regarding this test report, please do not hesitate to contact us at 630-993-2100.

As project 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, and the test program was performed in accordance with the methods specified in this test report.

MOSTARDI PLATT

Timothy E. Russ — Program Manager

Scott W. Banach — Quality Assurance

APPENDICES

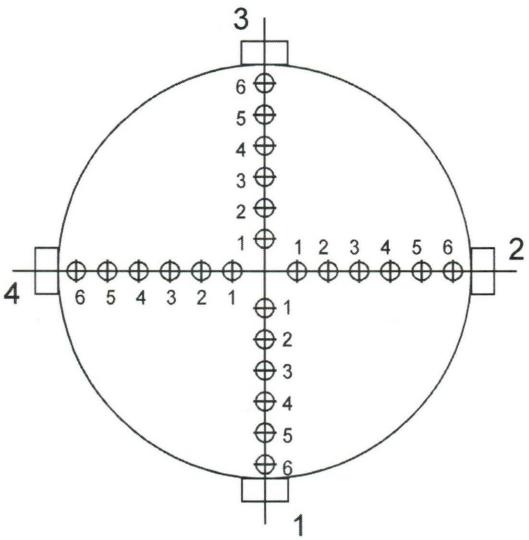
Appendix A - Plant Operating Data

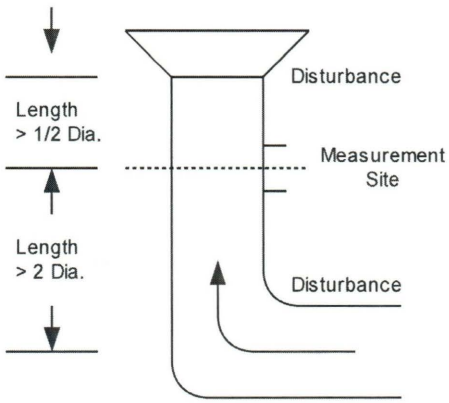
EUCTGHRSG3 Bypass Operational Data

Date/Time	CTGHRSG3 B_GASFLW (HSCFH) Value	CTGHRSG3 B_HEATIN (MMBTU/HR) Value	CTGHRSG3 LOADCTMW (MW) Value
Run1			
09/21/2022 15:00	4652.7	488.5	50
09/21/2022 15:15	4662.1	489.5	50
09/21/2022 15:30	4666.7	490	50
09/21/2022 15:45	4678.3	491.2	50
09/21/2022 16:00	4692.5	492.7	51
09/21/2022 16:15	4688.1	492.3	51
09/21/2022 16:30	4701.6	493.7	51
09/21/2022 16:45	4727.5	496.4	51
09/21/2022 17:00	4751	498.9	51
09/21/2022 17:15	4756.4	499.4	51
09/21/2022 17:30	4758.9	499.7	51
09/21/2022 17:45	4756.9	499.5	51
Averages:	4707.7	494.3	50.7
Run2			
9/22/2022 7:15	5006.4	525.7	55
9/22/2022 7:30	5011.8	526.2	55
9/22/2022 7:45	5010.2	526.1	55
9/22/2022 8:00	5010.3	526.1	55
9/22/2022 8:15	5016.7	526.8	55
9/22/2022 8:30	5011.7	526.2	55
9/22/2022 8:45	5014.5	526.5	55
9/22/2022 9:00	5014.9	526.6	55
9/22/2022 9:15	5007.1	525.7	55
9/22/2022 9:30	5001.8	525.2	55
9/22/2022 9:45	4993.4	524.3	55
Averages:	5009.0	525.9	55.0
Run3			
9/22/2022 10:00	4986.9	523.6	55
9/22/2022 10:15	4992.5	524.2	55
9/22/2022 10:30	4991.1	524.1	55
9/22/2022 10:45	4988.9	523.8	55
9/22/2022 11:00	4985.8	523.5	55
9/22/2022 11:15	4989.1	523.9	55
9/22/2022 11:30	4996.9	524.7	55
9/22/2022 11:45	4992.7	524.2	55
9/22/2022 12:00	4992.9	524.3	55
9/22/2022 12:15	4987	523.6	55
9/22/2022 12:30	4746.1	498.3	52
Averages:	4968.2	521.7	54.7

Appendix B - Test Section Diagrams

EQUAL AREA TRAVERSE FOR ROUND DUCTS





Job: Lansing Board of Water & Light

Delta Energy Park

Lansing, MI

Date: September 21 and 22, 2022

Test Location: EUCTGHRSG3 (Simple cycle)

Duct Diameter: 11.901 Feet

Duct Area: 111.24 Square Feet

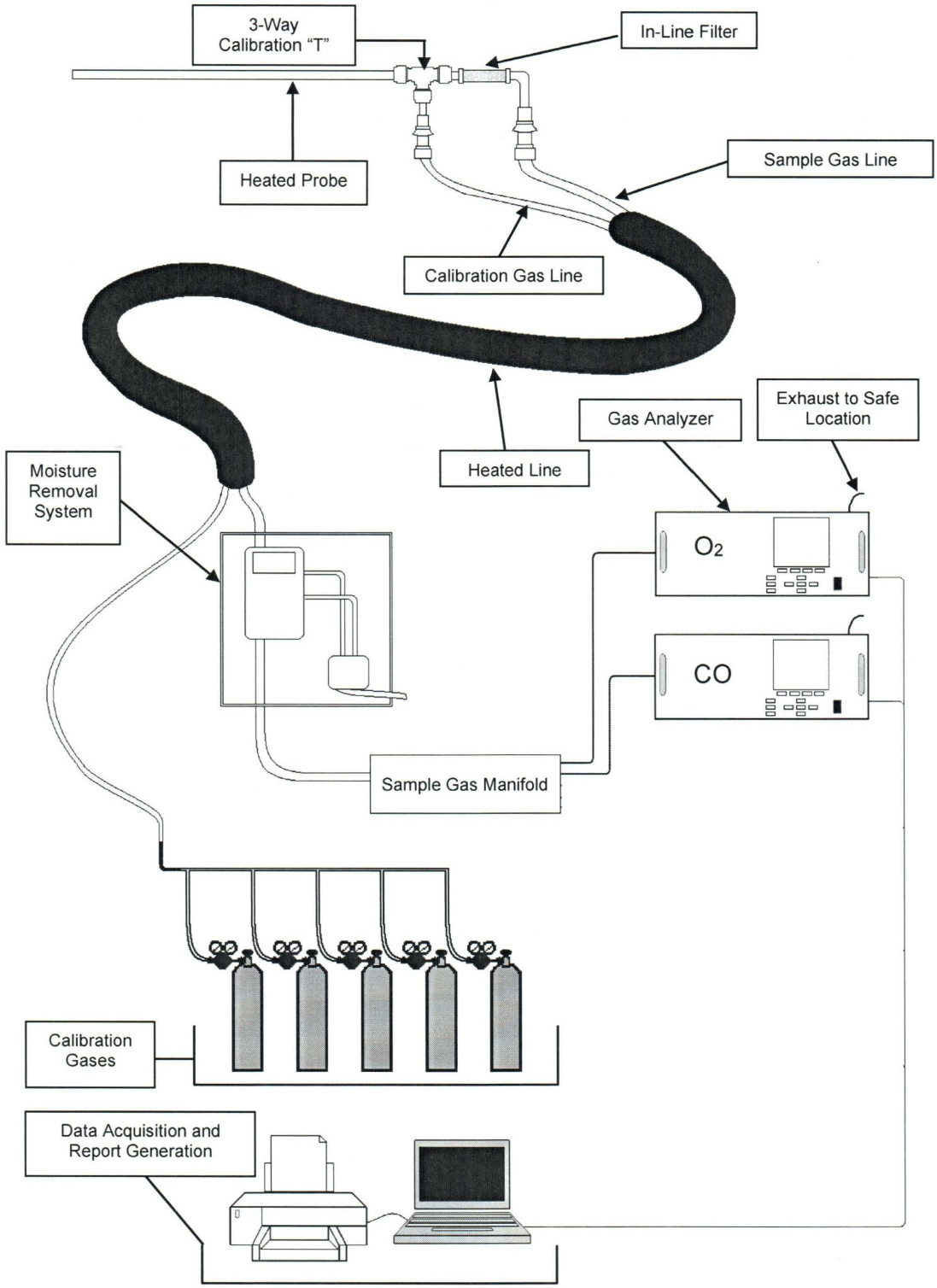
No. Points Across Diameter: 12

No. of Ports: 4

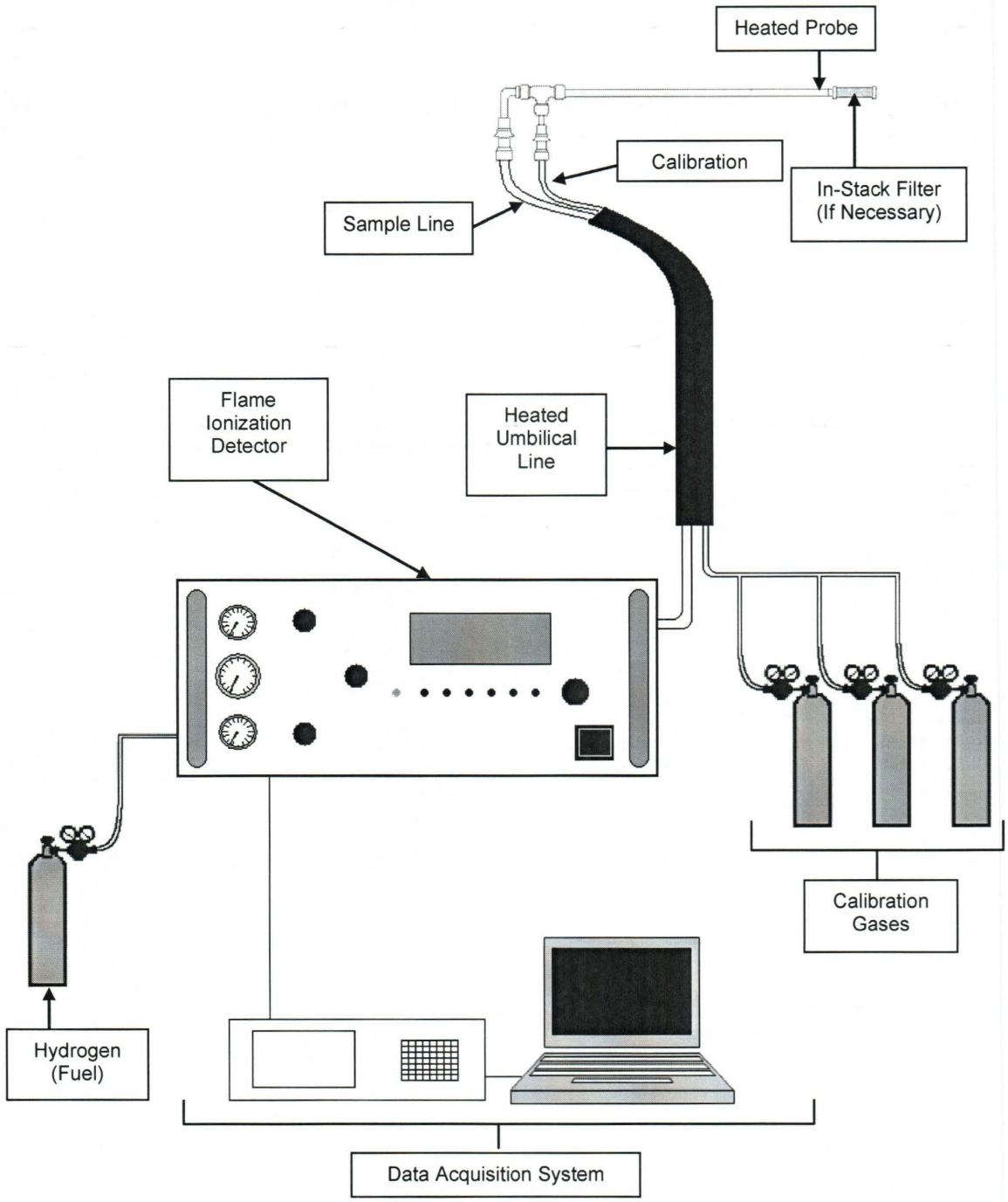
Port Length: 6 Inches

Appendix C - Sample Train Diagrams

USEPA Methods 3A and 10 Extractive Gaseous Sampling Diagram



USEPA Method 25A – Total Gaseous Organic Compound Sample Train



USEPA Method 5/202- Filterable/Condensable Particulate Matter