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Mercury and Air Toxics Standard Particulate Matter and Hydrogen Chloride Emissions Test Report

Lansing Board of Water and Light
Eckert Station
Unit 5 ESP Outlet Duct
Lansing, Michigan
July 22, 2019

Revised Report Submittal Date
August 14, 2019

Project No. M192911E

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

Chicago, IL | Crown Point, IN | Concord, NC | Mendota Heights, MN | Denver, CO

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1.0 EXECUTIVE SUMMARY

MOSTARDI PLATT conducted a Mercury and Air Toxics Standards (MATS) filterable particulate matter and hydrogen chloride emissions test program for the Lansing Board of Water and Light at the Eckert Station on the Unit 5 ESP Outlet Duct in Lansing, Michigan on July 22, 2019. 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**
Unit 5 ESP Outlet Duct	July 22, 2019	Filterable Particulate Matter (FPM) and Hydrogen Chloride (HCl)

The purpose of the test program was to demonstrate FPM and HCl emissions qualify for the LEE designation as required by 40 CFR Part 63, Subpart UUUUU. 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	**Test Parameter**	**Emission Limits**	**LEE Emission Limits**	**Emission Rates**
Unit 5 ESP Outlet Duct	FPM	≤0.030 lb/mmBtu	≤0.015 lb/mmBtu	0.0077 lb/mmBtu
	FPM	≤0.20 lbs/1000 lbs of exhaust gases, corrected to 50% Excess Air	N/A	* 0.0069 dry lbs/1000 lbs of exhaust gases, corrected to 50% Excess Air
	FPM	≤0.20 lbs/1000 lbs of exhaust gases, corrected to 50% Excess Air	N/A	*0.0062 wet lbs/1000 lbs of exhaust gases, corrected to 50% Excess Air
	HCl	≤0.002 lb/mmBtu	≤0.001 lb/mmBtu	0.0007 lb/mmBtu

*Probe and filter were maintained at Method 5 MATS temperatures during testing

Emissions on lb/mmBtu basis were determined using a standard F_d-Factor of 9,820 dscf/mmBtu for sub-bituminous coal. Plant operating data as provided by Lansing Board of Water and Light is included in Appendix A.

The Stationary Source Audit Sample Program audit sample was obtained from ERA and analyzed by Mostardi Platt. The results of the audit sample were compared to the assigned value by ERA and found to be acceptable. The audit sample result and evaluation are appended to this report.

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 P.O. Box 13007 Lansing, Michigan 48912	Mr. Nathan Hude Environmental Regulatory Compliance (517) 490-3069 (cell phone) nathan.hude@lbwl.com
Test Facility	Lansing Board of Water and Light Eckert Station 601 Island Ave Lansing, Michigan 48901	
Testing Company Representative	Mostardi Platt 888 Industrial Drive Elmhurst, Illinois 60126	Mr. Stuart Burton Project Manager (630) 993-2100 sburton@mp-mail.com

The test crew consisted of Messrs. A. Riddle, B. Garcia, D. Merbeth, P. Coleman, and S. Burton of Mostardi Platt.

2.0 TEST METHODOLOGY

Emissions testing was conducted following the methods specified in 40CFR60, Appendix A. A schematic of the test section diagram is found in Appendix B and schematics of the sampling trains used are included in Appendix C. Calculation nomenclature and sample calculations are included in Appendix D. Laboratory analysis data are found in Appendix E. Copies of analyzer print-outs for each test run are included in Appendix F and field data sheets are found in Appendix G.

The following methodologies were used during the test program:

Method 1 Traverse Point Determination

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

TEST POINT INFORMATION				
Location	**Upstream Diameters**	**Downstream Diameters**	**Test Parameter**	**Number of Sampling Points**
Unit 5 ESP Outlet Duct	0.5	2.0	FPM, HCl	32

Method 2 Volumetric Flowrate Determination

Gas velocity was measured following Method 2, for purposes of calculating stack gas volumetric flow rate. An S-type pitot tube, differential pressure gauge, thermocouple and temperature readout were used to determine gas velocity at each sample point. All of the equipment used was calibrated in accordance with the specifications of the Method. Calibration data are presented in Appendix H.

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

Stack gas molecular weight was determined in accordance with Method 3A. An ECOM analyzer was used to determine stack gas oxygen and carbon dioxide content and, by difference, nitrogen content. All of the equipment used was calibrated in accordance with the specifications of the Method. Calibration data are presented in Appendix H and copies of the gas cylinder certifications are found in Appendix I.

Method 5 Filterable Particulate Matter (FPM) Determination

Stack gas FPM concentrations and emission rates were determined in accordance with USEPA Method 5, 40CFR60, Appendix A. An Environmental Supply Company, Inc. sampling train was used to sample stack gas at an isokinetic rate, as specified in the Method. Filter and probe temperatures were elevated to 320° Fahrenheit as described in 40CFR63, Subpart UUUUU. Particulate matter in the sample probe was recovered using an acetone rinse. The probe wash and filter catch were analyzed by Mostardi Platt in accordance with the Method in the Elmhurst, Illinois laboratory. Sample analysis data are found 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 26A Hydrogen Chloride (HCl) Determination

Stack gas HCl concentrations and emission rates were determined in accordance with Method 26A, 40CFR60, Appendix A. An Environmental Supply Company sampling train was used to sample stack gas, in the manner specified in the Method. Analyses of the samples collected were conducted by Mostardi Platt in the Elmhurst, Illinois laboratory. Sample analysis data are found 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.

3.0 TEST RESULT SUMMARIES

Client: Lansing Board of Water and Light
Facility: Eckert Station
Test Location: Unit 5 ESP Outlet Duct
Test Method: 5 MATS

Source Condition	Normal	Normal	Normal	
Date	7/22/19	7/22/19	7/22/19	
Start Time*	10:10	12:51	15:45	
End Time*	12:17	14:58	17:52	
	Run 1	Run 2	Run 3	Average
Stack Conditions				
Average Gas Temperature, °F	336.3	346.0	355.2	345.8
Flue Gas Moisture, percent by volume	10.2%	11.1%	11.2%	10.8%
Average Flue Pressure, in. Hg	28.41	28.41	28.41	28.41
Gas Sample Volume, dscf	71.414	70.241	70.335	70.663
Average Gas Velocity, ft/sec	53.340	53.152	53.537	53.343
Gas Volumetric Flow Rate, acfm	288,038	287,023	289,101	288,054
Gas Volumetric Flow Rate, dscfm	162,915	158,791	157,864	159,857
Gas Volumetric Flow Rate, scfm	181,364	178,553	177,812	179,243
Average $\%CO_2$ by volume, dry basis	13.2	14.0	13.7	13.6
Average $\%O_2$ by volume, dry basis	7.8	6.4	6.5	6.9
Isokinetic Variance	99.7	100.6	101.3	100.5
Standard Fuel Factor Fd, dscf/mmBtu	9,820.0	9,820.0	9,820.0	9,820.0
Filterable Particulate Matter (Method 5 MATS)				
grams collected	0.03158	0.00836	0.00923	0.01639
mg/dscm	15.617	4.203	4.634	8.1513
grains/acf	0.0039	0.0010	0.0011	0.0020
grains/dscf	0.0068	0.0018	0.0020	0.0035
lb/hr	9.528	2.500	2.740	4.923
Dry lbs particulate/1000 lbs of stack gas	0.0124	0.0033	0.0037	0.0065
Wet lbs particulate/1000 lbs of stack gas	0.0116	0.0031	0.0034	0.0060
Dry lbs particulate/1000 lbs of stack gas at 50%	0.0132	0.0036	0.0039	0.0069
Wet lbs particulate/1000 lbs of stack gas at 50%	0.0122	0.0030	0.0033	0.0062
lb/mmBtu (Standard Fd Factor)	0.0153	0.0037	0.0041	0.0077

*RM time changes to CEM time

Client:	**Lansing Board of Water and Light**
Facility:	**Eckert Station**
Test Location:	**Unit 5 Outlet Duct**
Test Method:	**26A MATS**

Source Condition	**High Load**	**High Load**	**High Load**	
Date	**7/22/19**	**7/22/19**	**7/22/19**	
Start Time	**11:10**	**13:51**	**16:45**	
End Time	**13:02**	**15:43**	**18:36**	
	Run 1	**Run 2**	**Run 3**	**Average**
Stack Conditions				
Average Gas Temperature, °F	344.8	344.7	351.8	347.1
Flue Gas Moisture, percent by volume	11.2%	11.5%	11.0%	11.2%
Average Flue Pressure, in. Hg	28.41	28.41	28.41	28.41
Gas Sample Volume, dscf	67.923	67.324	67.287	67.511
Average Gas Velocity, ft/sec	53.350	51.924	52.890	52.721
Gas Volumetric Flow Rate, acfm	288,092	280,388	285,604	284,695
Gas Volumetric Flow Rate, dscfm	159,334	154,584	156,911	156,943
Gas Volumetric Flow Rate, scfm	179,476	174,710	176,385	176,857
Average %CO_2 by volume, dry basis	13.2	14.0	11.8	13.0
Average %O_2 by volume, dry basis	7.8	6.4	6.8	7.0
Isokinetic Variance	99.8	102.0	100.4	100.7
Standard Fuel Factor Fd, dscf/mmBtu	9,820.0	9,820.0	9,820.0	9,820.0
Hydrogen Chloride (HCl) Emissions				
ug of sample collected	1625.00	1497.00	1567.00	1563.00
ppm	0.56	0.52	0.54	0.54
mg/dscm	0.84	0.79	0.82	0.82
lb/hr	0.504	0.455	0.483	0.481
lb/mmBtu (Standard Fd Factor)	0.0008	0.0007	0.0007	0.0007

*RM time changes to CEM time

4.0 CERTIFICATION

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

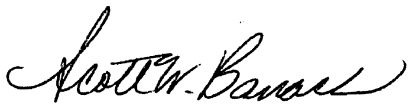
CERTIFICATION

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

Program Manager

Stuart L. Burton



Quality Assurance

Scott W. Banach

APPENDICES

Appendix A - Plant Operating Data

Average Data

Plant: Eckert Station
Interval: 1 Hour
Type: Roll
Report Period: 07/22/2019 10:00 Through 07/22/2019 18:59
Time Online Criteria: 1 minute(s)

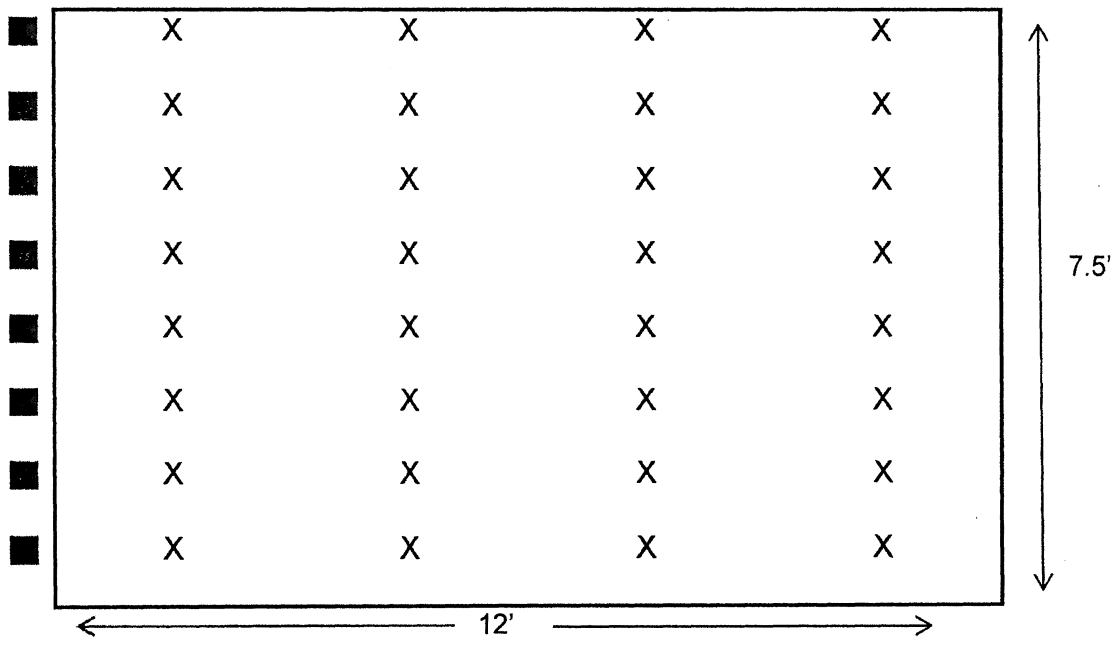
Source		UNIT05
Parameter		MW
Unit		(MW)
07/22/19	10:00	53
07/22/19	11:00	53
07/22/19	12:00	53
07/22/19	13:00	52
07/22/19	14:00	53
07/22/19	15:00	53
07/22/19	16:00	53
07/22/19	17:00	53
07/22/19	18:00	53

Average	53
Minimum	52
Maximum	53
Summation	476
Geometric Mean	53
Included Data Points	9
Total number of Data Points	9

F = Unit Offline **E = Exceedance** C = Calibration **S = Substituted** I = Invalid
M = Maintenance **T = Out Of Control** * = Suspect **U = Startup** **D = Shutdown**

Appendix B - Test Section Diagram

EQUAL AREA TRAVERSE FOR RECTANGULAR DUCTS



Job: Lansing Board of Water and Light
Eckert Station
Lansing, Michigan

Date: July 22, 2019

Test Location: Unit 5 ESP Outlet Duct

Length: 7.5 Feet

Width: 12 Feet

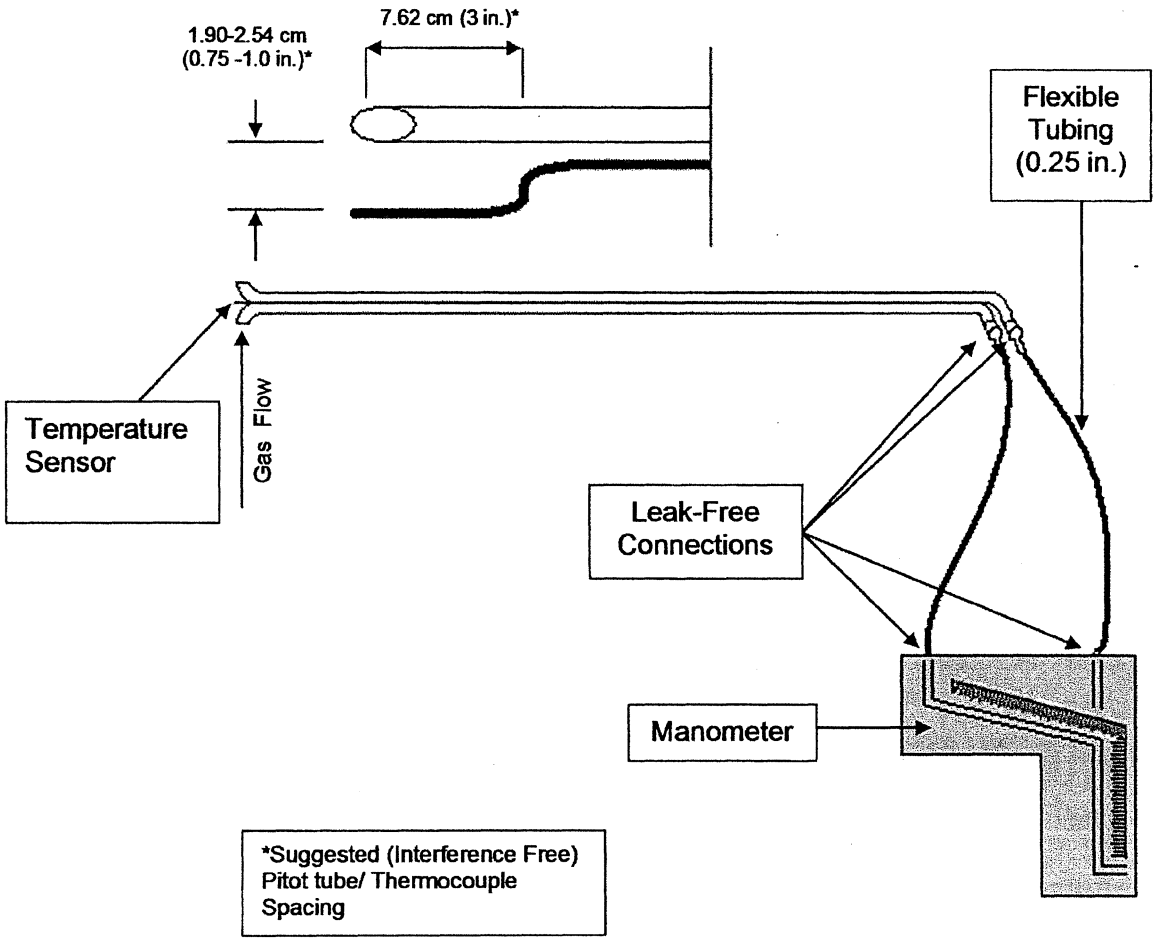
Area: 90.00 Square Feet

No. Test Ports: 8

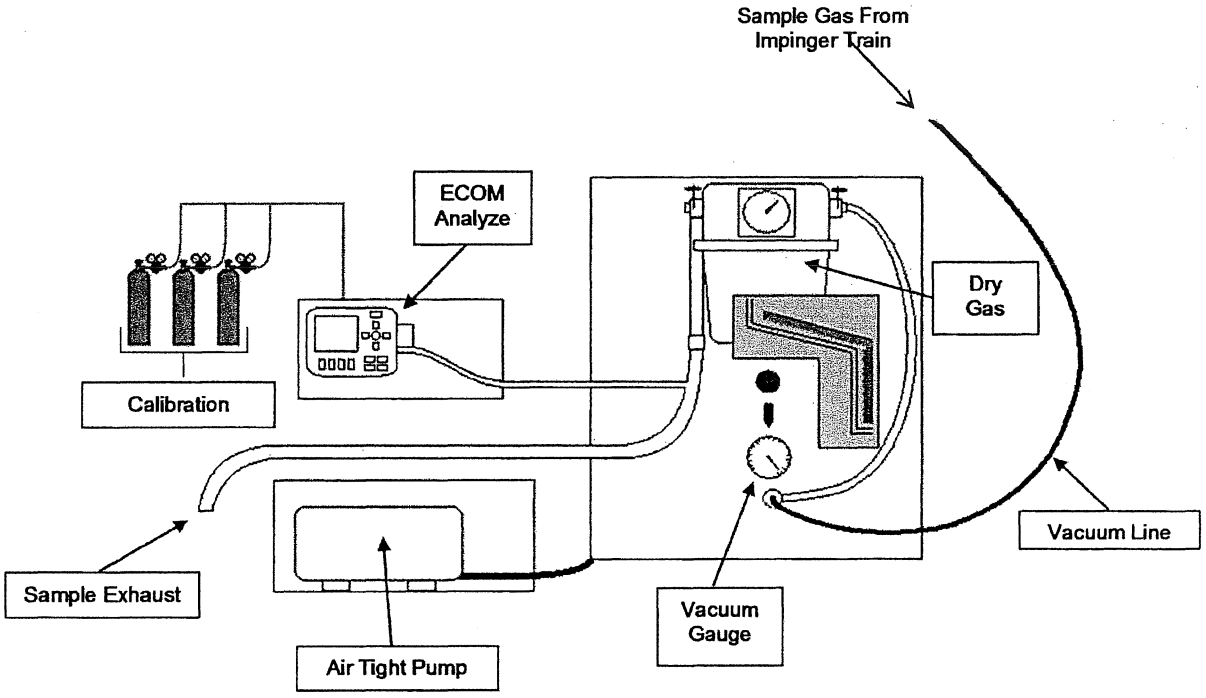
Tests Points per Port: 4

Appendix C - Sample Train Diagrams

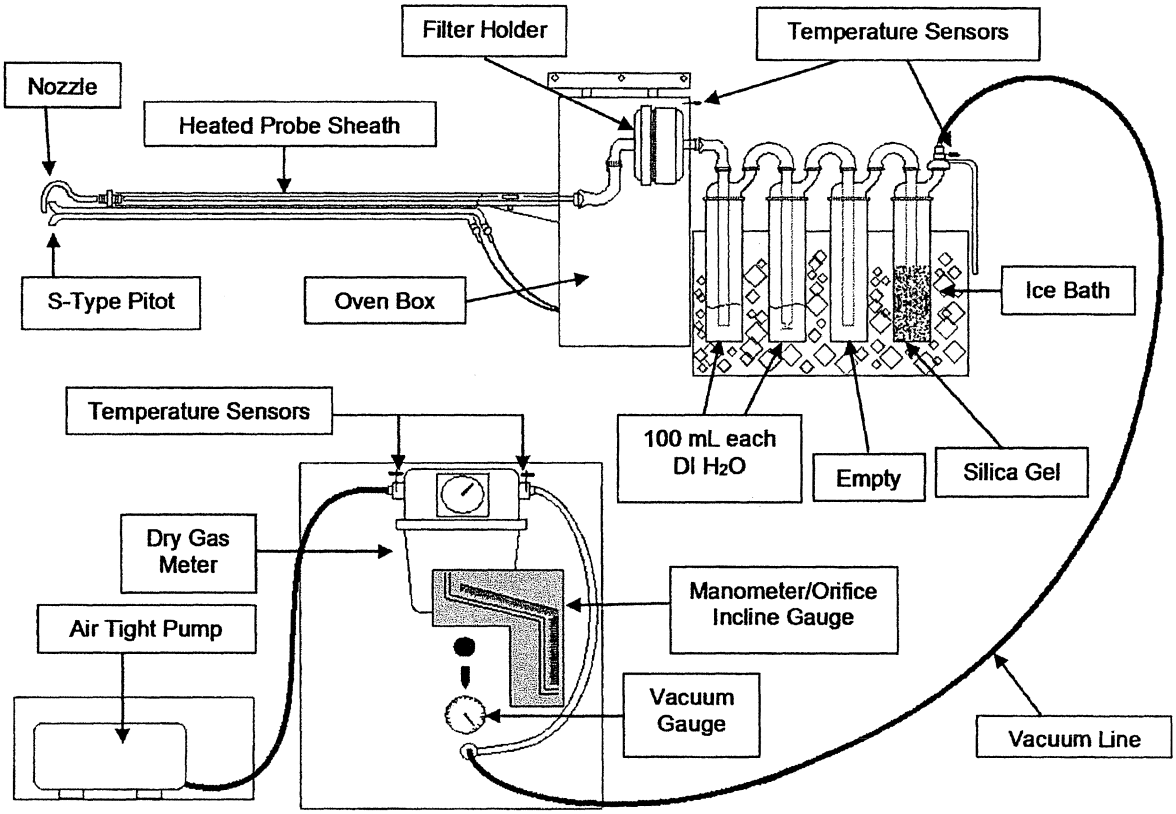
USEPA Method 2- Type S Pitot Tube Manometer Assembly



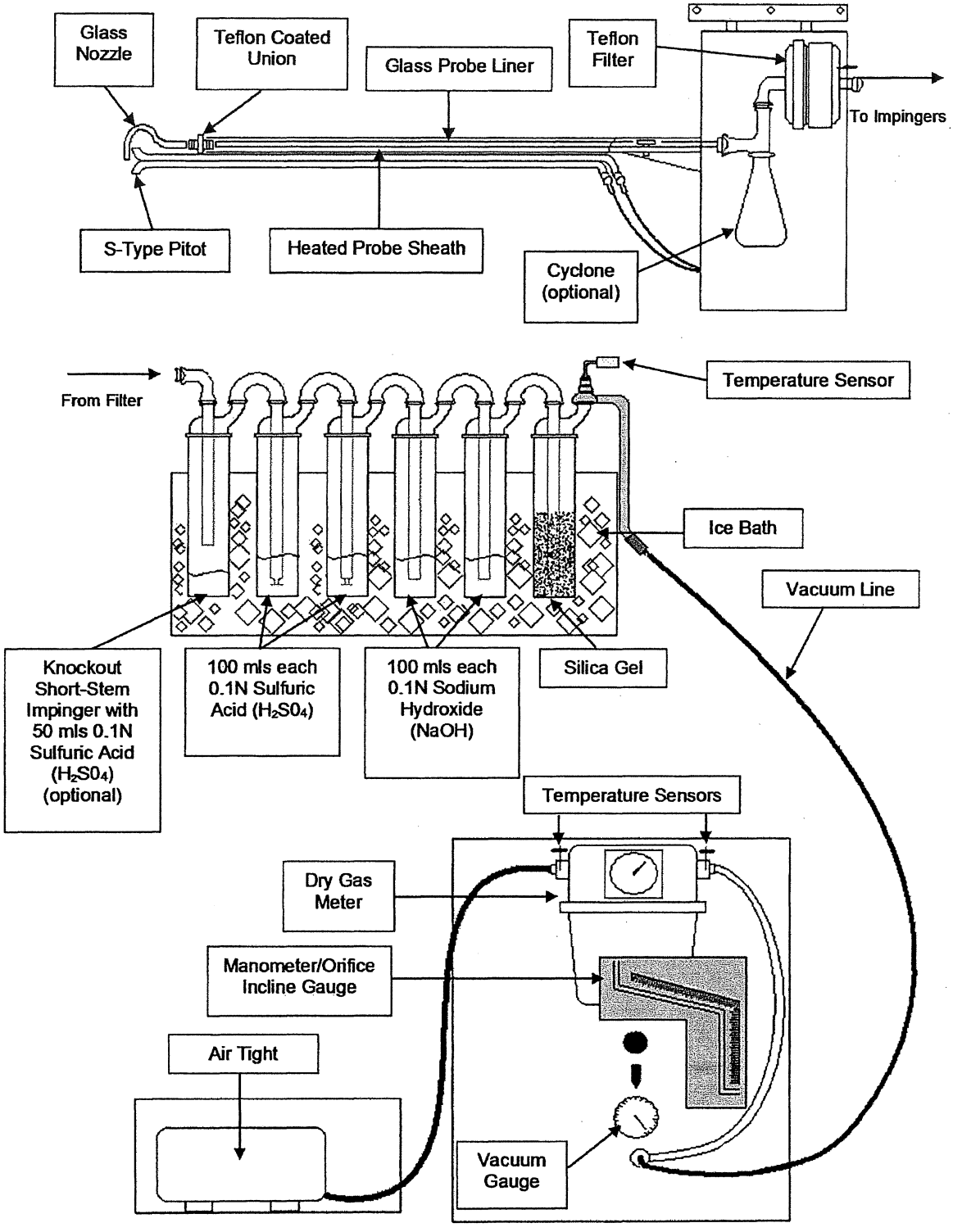
USEPA Method 3A - Integrated Oxygen/Carbon Dioxide Sample Train Diagram Utilizing ECOM To Measure from Sample Exhaust



USEPA Method 5- Particulate Matter Sample Train Diagram



USEPA Method 26A – HCl Sample Train Diagram



Appendix D - Calculation Nomenclature and Formulas