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Title V Compliance Test Program Test Report

Billerud Quinnesec LLC
Quinnesec Mill
Recovery Furnace Outlet
Quinnesec, Michigan
November 10 and 11, 2022

Report Submittal Date
January 4, 2023

Project No. M223101A

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

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

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1.0 EXECUTIVE SUMMARY

Mostardi Platt conducted a Title V compliance test program for Billerud Quinnesec LLC at the Quinnesec Mill on the Recovery Furnace Outlet on November 10 and 11, 2022. This report summarizes the results of the test program and test methods used.

Test locations, test dates, and test parameters are summarized below.

TEST INFORMATION		
Test Location	**Test Dates**	**Test Parameters**
Recovery Furnace Outlet	November 10 and 11, 2022	Filterable Particulate Matter (FPM), Particulate Matter less than 2.5 microns ($PM/PM_{2.5}$), Particulate Matter less than 10 microns (PM/PM_{10}) and Volatile Organic Compounds (VOC)

The purpose of the test program was to demonstrate compliance of the above emissions with the permitted limits. 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				
Location	**Test Date**	**Test Parameter**	**Emissions Limit**	**Emission Rate**
Recovery Furnace Outlet	11/11/2022	FPM	48.6 lb/hr	26.643 lb/hr
	11/10/2022	$PM_{2.5}$	42.1 lb/hr	24.107 lb/hr
		PM_{10}	45.7 lb/hr	25.779 lb/hr
	11/10/2022	VOC	As CH_4 50 ppmvd @ 8% O_2 and 27.4 lb/hr	3.1 ppmvd as CH_4 @ 8% O_2 and 2.2 lb/hr

Plant operating data as provided by Billerud Quinnesec LLC is included in Appendix A.

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

TEST PERSONNEL INFORMATION		
Location	**Address**	**Contact**
Test Facility	Billerud Quinnesec LLC U.S. Highway 2 Quinnesec, Michigan 49876	Ms. Paula Lafleur Environmental Engineer (906) 779-3494 (phone) Paula.lafleur@billerud.com
Testing Company Representative	Mostardi Platt 888 Industrial Drive Elmhurst, Illinois 60126	Mr. Daniel Kossack Project Manager (630) 993-2100 (phone) dkossack@mp-mail.com

The test crew consisted of Messrs. E. Thomas, J. Kukla, P. Coleman, and D. Kossack of Mostardi Platt.

2.0 TEST METHODOLOGY

Emissions testing were conducted following the methods specified in 40 CFR, Part 60, Appendix A. Schematics of the test section diagrams and sampling trains used are found in Appendix B and C, respectively. Calculation nomenclature and sample calculations are found in Appendix D. Sample analysis data are found in Appendix E. Copies of reference method data and field data sheets for each test run are included in Appendix F and G, respectively.

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	**Stack Dimensions (Feet)**	**Stack Area (Square Feet)**	**Upstream Diameters**	**Downstream Diameters**	**Test Parameter**	**Number of Sampling Points**
Recovery Furnace Outlet	8 x 12.25	98.00	>0.5	>2.0	FPM, $PM_{2.5}/PM_{10}$	27
					VOC	1

Gaseous Sampling Plan

A single test point was used to sample VOC at the Recovery Furnace Outlet.

Method 2 Volumetric Flowrate Determination

Gas velocity was measured following Method 2, for purposes of calculating stack gas volumetric flow rate at the outlet of the Recovery Boiler. 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. All locations have passed the null point pitot check and the results are on file.

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

Stack gas molecular weight was determined in accordance with Method 3A, 40 CFR, Part 60, Appendix A at the outlet of the Recovery Boiler. An ECOM analyzers 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 gas cylinder certifications are presented 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 at the outlet of the Recovery Boiler. An Environmental Supply Company, Inc. sampling train was used to sample stack gas at an isokinetic rate, as specified in the Method utilizing Pallflex TX40HI45 filters. Particulate matter in the sample probe was recovered using a water 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 25A Volatile Organic Concentration Determination

The Method 25A sampling and measurement system meets the requirements for sampling of VOCs set forth by the United States Environmental Protection Agency (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. A Thermo Scientific 51i analyzer was used to perform sampling.

The flame ionization detector (FID) used during this program was a Thermo Scientific 51i High-Temperature Total Hydrocarbon Analyzer. It is a highly sensitive FID that provides a direct reading of total organic vapor concentrations with linear ranges of 0-10, 100, 1000, and 10,000 ppm by volume. The instrument was calibrated using ultra-zero air and propane in air EPA Protocol standards. The calibrations were performed before and after sampling with calibration checks performed between each test run. Sampling was conducted continuously for three one-hour periods. Sample times and locations are logged simultaneously on data loggers.

All of the equipment used was calibrated in accordance with the specifications of the Method. Calibration data are presented in Appendix H. The gas cylinder certifications are found in Appendix I.

Method 201A Filterable Particulate Determination

Stack gas FPM concentrations and emission rates were determined in accordance with USEPA Method 201A, 40CFR51, Appendix M, for determination of particulate matter less than and greater than 2.5 microns. An Environmental Supply Company, Inc. sampling train was used to sample flue gas at a constant rate, as specified in the Method. Filterable particulate matter was separated into three fractions; one containing less than $PM_{2.5}$, the second greater than $PM_{2.5}$ and less than PM_{10}, and the third fraction greater than PM_{10}. The fractions are totaled to represent filterable particulate matter. 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 202 Condensable Particulate Determination

Stack gas condensable particulate concentrations and emission rates were determined in accordance with the Method 202, in conjunction with Method 5 filterable particulate sampling. Condensable particulate matter was collected in the impinger portion of the Method 201A sampling trains.

The condensable particulate matter (CPM) was collected in impingers, after filterable particulate material was collected, using Method 201A. The organic and aqueous fractions were then taken to dryness and weighed. The total of all fractions represents the CPM. Compared to the December 17, 1991 promulgated Method 202, this Method includes the addition of a condenser, followed by a water dropout impinger immediately after the final heated filter. One modified Greenburg Smith impinger and an ambient temperature filter follow the water dropout impinger.

CPM was collected in the water dropout, modified Greenburg Smith impinger and ambient filter portion of the sampling train as described in this Method. The impinger contents were purged with nitrogen (N_2) immediately after sample collection to remove dissolved sulfur dioxide (SO_2) gases from the impingers. The impinger solution was then extracted with DI water, acetone, and hexane. The organic and aqueous fractions were dried and the residues weighed. The total of the aqueous, organic, and ambient filter fractions represents the CPM. Laboratory 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 RESULTS SUMMARIES

Client: Billerud Quinnesec LLC
Facility: Quinnesec Paper Mill
Test Location: Recovery Furnace Outlet
Test Method: 5

Source Condition	Normal	Normal	Normal	
Date	11/11/22	11/11/22	11/11/22	
Start Time	7:20	9:00	10:33	
End Time	8:31	10:13	11:46	
	Run 1	Run 2	Run 3	Average
Stack Conditions				
Average Gas Temperature, °F	380.3	379.6	380.4	380.1
Flue Gas Moisture, percent by volume	25.7%	26.2%	24.1%	25.3%
Average Flue Pressure, in. Hg	28.52	28.52	28.52	28.52
Gas Sample Volume, dscf	52.806	53.667	53.499	53.324
Average Gas Velocity, ft/sec	87.795	88.420	87.835	88.017
Gas Volumetric Flow Rate, acfm	516,234	519,911	516,470	517,538
Gas Volumetric Flow Rate, dscfm	229,854	229,941	234,823	231,539
Gas Volumetric Flow Rate, scfm	309,195	311,673	309,310	310,059
Average %CO_2 by volume, dry basis	15.4	15.2	15.1	15.2
Average %O_2 by volume, dry basis	4.5	4.4	4.5	4.5
Isokinetic Variance	100.3	101.9	99.5	100.6
Filterable Particulate Matter (Method 5)				
grams collected	0.04695	0.04592	0.04630	0.04639
grains/acf	0.0061	0.0058	0.0061	0.0060
grains/dscf	0.0137	0.0132	0.0134	0.0134
lb/hr	27.026	26.023	26.879	26.643

Client:	**Billerud Corporation LLC**
Facility:	**Quinnesec Paper Mill**
Test Location:	**Recovery Furnace Outlet**
Test Method:	**201A/202**

Source Condition	Normal	Normal	Normal	
Date	11/10/22	11/10/22	11/10/22	
Start Time	9:31	12:28	15:15	
End Time	11:40	14:36	17:21	
	Run 1	Run 2	Run 3	Average
Stack Conditions				
Average Gas Temperature, °F	381.9	381.5	381.4	381.6
Flue Gas Moisture, percent by volume	26.8%	27.2%	28.2%	27.4%
Average Flue Pressure, in. Hg	28.50	28.50	28.50	28.50
Gas Sample Volume, dscf	31.459	31.489	32.323	31.757
Average Gas Velocity, ft/sec	88.021	85.639	87.048	86.903
Gas Volumetric Flow Rate, acfm	517,563	503,556	511,840	510,986
Gas Volumetric Flow Rate, dscfm	226,259	219,240	219,779	221,759
Gas Volumetric Flow Rate, scfm	309,186	300,961	305,960	305,369
Average %CO_2 by volume, dry basis	15.1	15.2	15.0	15.1
Average %O_2 by volume, dry basis	4.4	4.4	4.3	4.4
Isokinetic Variance	85.6	88.4	90.5	88.2
Filterable <PM2.5 (Method 201A)				
grams collected	0.01961	0.00972	0.01906	0.01613
grains/acf	0.0042	0.0021	0.0039	0.0034
grains/dscf	0.0096	0.0048	0.0091	0.0078
lb/hr	18.654	8.951	17.140	14.915
Filterable <PM10 (Method 201A)				
grams collected	0.02047	0.01135	0.02206	0.01796
grains/acf	0.0044	0.0024	0.0045	0.0038
grains/dscf	0.0100	0.0056	0.0105	0.0087
lb/hr	19.472	10.452	19.838	16.587
Condensable PM (Method 202)				
grams collected	0.01107	0.01059	0.00811	0.00992
grains/acf	0.0024	0.0023	0.0017	0.0021
grains/dscf	0.0054	0.0052	0.0039	0.0048
lb/hr	10.530	9.752	7.293	9.192
Total PM<2.5 (Method 201A/202)				
grams collected	0.03068	0.02031	0.02717	0.02605
grains/acf	0.0066	0.0043	0.0056	0.0055
grains/dscf	0.0150	0.0100	0.0130	0.0127
lb/hr	29.184	18.702	24.434	24.107
Total PM<10 (Method 201A/202)				
grams collected	0.03154	0.02194	0.03017	0.02788
grains/acf	0.0068	0.0047	0.0062	0.0059
grains/dscf	0.0155	0.0108	0.0144	0.0136
lb/hr	30.002	20.203	27.131	25.779

Billerud Quinnesec LLC Quinnesec, Michigan Recovery Furnace Gaseous Summary										
Test No.	Date	Start Time	End Time	O2 % (dry)	Moisture, %	Flowrate, SCFM	THC ppm as CH4 (wet)	THC ppm as CH4 (dry)	THC lb/hr as CH4	THC ppm as CH4 (dry) @ 8% O2
1	11/10/22	09:31	10:30	4.4	26.8	309,186	2.1	2.9	1.6	2.2
2	11/10/22	12:28	13:27	4.4	27.2	300,961	4.0	5.5	3.0	4.3
3	11/10/22	15:15	16:14	4.3	28.2	305,369	2.5	3.5	1.9	2.7
Average				4.4	27.4	305,172	2.9	3.9	2.2	3.1

4.0 CERTIFICATION

Mostardi Platt is pleased to have been of service to Billerud Quinnesec LLC. 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

Daniel Kossack — Program Manager

Scott W. Banach — Quality Assurance

APPENDICES

Appendix A - Plant Operating Data

Recovery Furnace - Operating/Process Data

Filterable PM Method 5	Start Time	End Time	BLS tons/hr	BLS KPPH	Natural Gas flow kscfh	Steam Flow	Opacity %
Run 1	11/11/22 7:20	11/11/22 8:31	91	182.0	0.0	594.7	12.5
Run 2	11/11/22 9:00	11/11/22 10:13	91	181.7	0.0	596.5	**
Run 3	11/11/22 10:33	11/11/22 11:46	91	182.0	0.0	592.8	11.9
		AVG	91	181.9	0.0	594.7	12.2

**probe interference - data invalid

Recovery Furnace Precipitator Operating Data

North Precipitator			TR 1		TR2		TR3		TR4		TR5		TR6	
Run	Start Time	End Time	volts (Kv1)	current	volts (Kv1)	current	volts (Kv1)	current	volts (Kv1)	current	volts (Kv1)	Current	volts (Kv1)	current
1	11/11/22 7:20	11/11/22 8:31	52.5	234.6	52.5	550.0	49.6	789.5	48.3	833.7	40.4	600.8	51.3	823.2
2	11/11/22 9:00	11/11/22 10:13	51.8	210.9	52.7	565.0	49.8	789.1	48.7	831.4	31.1	459.8	51.0	769.8
3	11/11/22 10:33	11/11/22 11:46	51.8	254.4	53.2	572.6	49.4	777.1	48.4	830.4	43.9	669.5	51.8	813.8

			TR7		TR8		TR9		TR10		TR11		TR12	
Run	Start Time	End Time	volts (Kv1)	current	volts (Kv1)	current	volts (Kv1)	current	volts (Kv1)	current	volts (Kv1)	current	volts (Kv1)	current
1	11/11/22 7:20	11/11/22 8:31	48.3	825.8	49.9	824.1	55.4	1039.4	56.8	1054.8	57.9	1055.7	58.2	1053.3
2	11/11/22 9:00	11/11/22 10:13	48.7	823.9	50.8	824.8	55.5	1039.5	56.9	1055.6	58.1	1055.2	58.5	1053.5
3	11/11/22 10:33	11/11/22 11:46	48.4	831.8	50.4	825.3	55.2	1039.5	56.9	1052.8	58.0	1052.8	58.4	1050.5

South Precipitator			TR 13		TR14		TR15		TR16		TR17		TR18	
Run	Start Time	End Time	volts (Kv1)	current	volts (Kv1)	current	volts (Kv1)	current	volts (Kv1)	current	volts (Kv1)	Current	volts (Kv1)	current
1	11/11/22 7:20	11/11/22 8:31	57.5	275.1	58.0	409.8	49.4	808.8	47.8	829.7	40.5	610.2	53.0	825.7
2	11/11/22 9:00	11/11/22 10:13	58.3	277.8	58.6	417.4	49.3	816.1	47.7	831.7	54.0	827.7	52.9	827.6
3	11/11/22 10:33	11/11/22 11:46	58.3	282.3	58.3	442.4	49.4	805.1	47.5	829.7	53.9	826.3	52.9	828.1

			TR19		TR20		TR21		TR22		TR23		TR24	
Run	Start Time	End Time	volts (Kv1)	current	volts (Kv1)	current	volts (Kv1)	current	volts (Kv1)	current	volts (Kv1)	current	volts (Kv1)	current
1	11/11/22 7:20	11/11/22 8:31	51.9	838.7	51.1	833.8	57.4	1059.1	57.3	1066.9	57.2	1051.7	56.9	1040.6
2	11/11/22 9:00	11/11/22 10:13	51.5	839.2	51.2	832.9	57.3	1059.7	57.4	1066.1	57.1	1050.6	57.0	1040.0
3	11/11/22 10:33	11/11/22 11:46	51.5	838.4	51.2	831.1	57.2	1059.7	57.3	1065.3	57.1	1050.1	56.9	1040.0

Recovery Furnace - Operating/Process Data

Particulate Method 201a/202	Start Time	End Time	BLS tons/hr	BLS KPPH	Natural Gas flow kscfh	Steam Flow	Opacity %
Run 1	11/10/22 9:31	11/10/22 11:40	91.0	182.0	1.9	600.3	12.9
Run 2	11/10/22 12:25	11/10/22 14:36	91.0	182.0	1.3	601.6	13.2
Run 3	11/10/22 15:15	11/10/22 17:21	91.1	182.1	1.0	603.0	12.7
		AVG	91.0	182.0	0.0	601.6	12.9

VOC Method 25A	Start Time	End Time	BLS tons/hr	BLS KPPH	Natural Gas flow kscfh	Steam Flow	Opacity %
Run 1	11/10/22 9:31	11/10/22 10:30	91.0	182.0	1.5	603.6	12.6
Run 2	11/10/22 12:25	11/10/22 13:25	91.0	182.0	1.9	599.3	13.2
Run 3	11/10/22 15:15	11/10/22 16:15	91.1	182.2	1.0	605.2	12.5
		AVG	91.0	182.1	0.0	602.7	12.8

Recovery Furnace Precipitator Operating Data

North Precipitator			TR 1		TR2		TR3		TR4		TR5		TR6	
Run	Start Time	End Time	volts (Kv1)	current	volts (Kv1)	current	volts (Kv1)	current	volts (Kv1)	current	volts (Kv1)	Current	volts (Kv1)	current
1	11/10/22 9:31	11/10/22 11:40	52.6	249.6	53.4	571.6	49.4	799.2	48.2	831.6	0.0	0.0	50.2	756.3
2	11/10/22 12:25	11/10/22 14:36	52.6	270.7	53.3	568.7	49.7	801.9	48.3	830.8	43.4	644.6	51.6	815.7
3	11/10/22 15:15	11/10/22 17:21	52.4	272.3	53.2	571.3	49.9	807.9	48.2	832.2	35.3	525.8	51.4	807.1

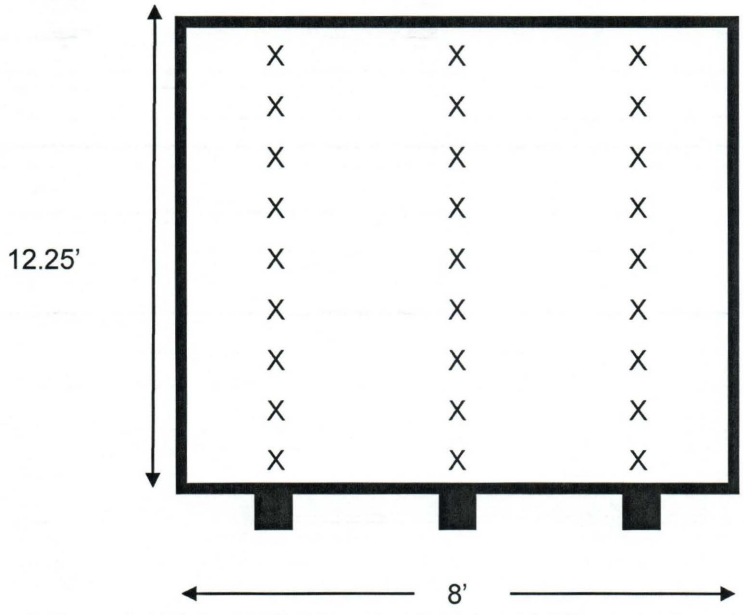
			TR7		TR8		TR9		TR10		TR11		TR12	
Run	Start Time	End Time	volts (Kv1)	current	volts (Kv1)	current	volts (Kv1)	current	volts (Kv1)	current	volts (Kv1)	current	volts (Kv1)	current
1	11/10/22 9:31	11/10/22 11:40	48.2	819.9	50.7	819.6	56.2	1038.2	57.0	1055.9	58.3	1051.5	58.5	1050.5
2	11/10/22 12:25	11/10/22 14:36	48.3	830.4	50.6	825.5	55.4	1038.6	57.0	1050.8	58.1	1050.0	58.6	1049.8
3	11/10/22 15:15	11/10/22 17:21	48.2	831.1	50.1	825.0	55.3	1039.8	56.8	1051.8	57.9	1050.8	58.4	1050.0

South Precipitator			TR 13		TR14		TR15		TR16		TR17		TR18	
Run	Start Time	End Time	volts (Kv1)	current	volts (Kv1)	current	volts (Kv1)	current	volts (Kv1)	current	volts (Kv1)	Current	volts (Kv1)	current
1	11/10/22 9:31	11/10/22 11:40	57.9	265.7	58.4	444.7	49.7	811.6	47.5	824.9	53.7	823.1	53.0	826.7
2	11/10/22 12:25	11/10/22 14:36	57.9	276.8	58.2	441.6	49.2	816.2	47.5	823.8	53.8	822.5	53.1	829.6
3	11/10/22 15:15	11/10/22 17:21	57.7	264.4	58.1	432.7	49.4	807.0	47.6	822.8	53.6	814.6	52.9	828.0

			TR19		TR20		TR21		TR22		TR23		TR24	
Run	Start Time	End Time	volts (Kv1)	current	volts (Kv1)	current	volts (Kv1)	current	volts (Kv1)	current	volts (Kv1)	current	volts (Kv1)	current
1	11/10/22 9:31	11/10/22 11:40	51.8	839.4	51.3	829.6	57.3	1059.9	57.4	1061.5	57.2	1050.0	57.1	1040.0
2	11/10/22 12:25	11/10/22 14:36	52.0	839.9	51.2	829.3	57.3	1055.8	57.4	1059.8	57.2	1050.0	57.0	1040.0
3	11/10/22 15:15	11/10/22 17:21	51.8	839.9	51.1	829.1	57.2	1059.4	57.3	1062.0	57.1	1050.0	56.9	1040.0

Appendix B - Test Section Diagrams

EQUAL AREA TRAVERSE
FOR RECTANGULAR DUCTS



Job: Billerud Quinnesec LLC
Quinnesec, Michigan

Date: November 10 and 11, 2022

Test Location: Recovery Boiler Outlet

Length: 8 Feet

Width: 12.25 Feet

Area: 98.00 Square Feet

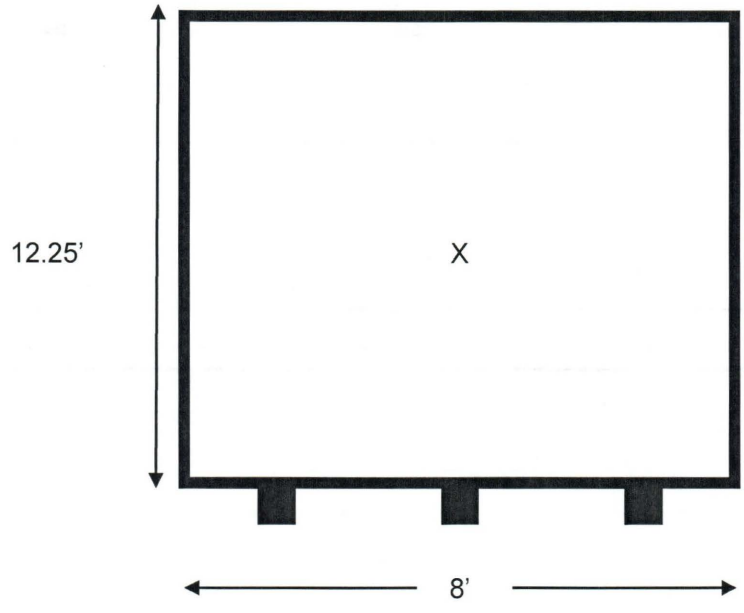
Upstream: Approximately 25 Feet
(2.6 Diameters)

Downstream: Approximately 90 Feet
(9.3 Diameters)

No. Test Ports: 3

Tests Points per Port: 9

GASEOUS TRAVERSE
FOR RECTANGULAR DUCTS



Job: Billerud Quinnesec LLC
Quinnesec, Michigan

Date: November 10, 2022 Test

Location: Recovery Boiler Outlet

Length: 8 Feet

Width: 12.25 Feet

Area: 98.00 Square Feet

Upstream: Approximately 20 Feet
(2.6 Diameters)

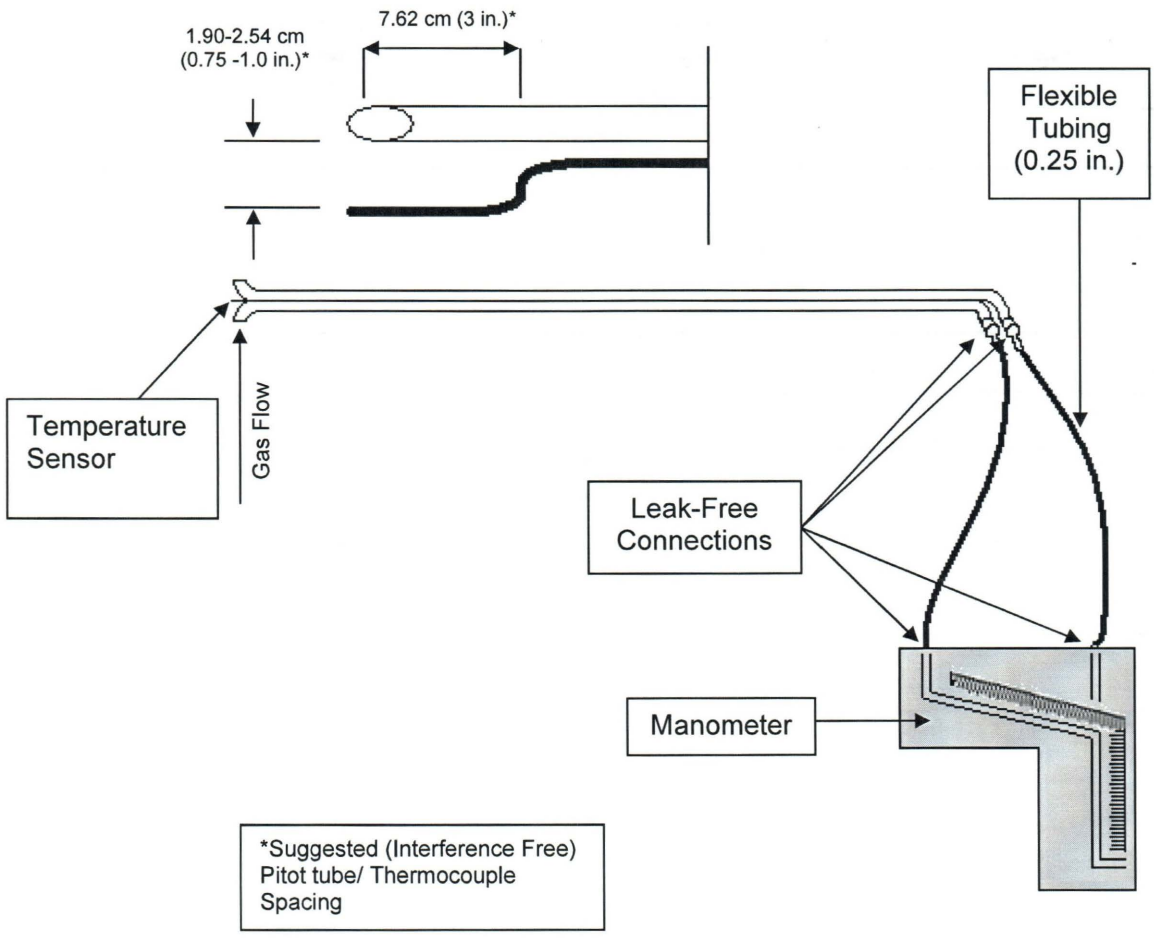
Downstream: Approximately 90 Feet
(9.3 Diameters)

No. Test Ports: 1

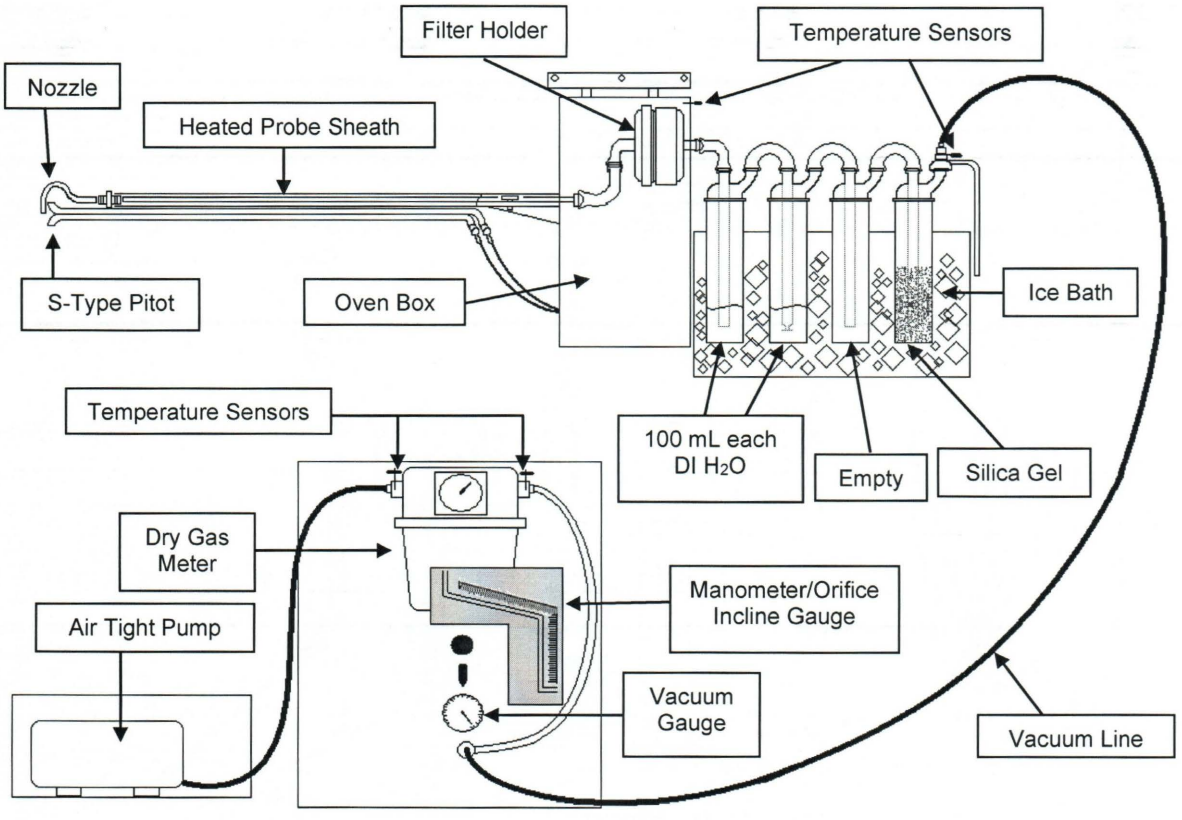
Tests Points per Port: 1

Appendix C - Sample Train Diagrams

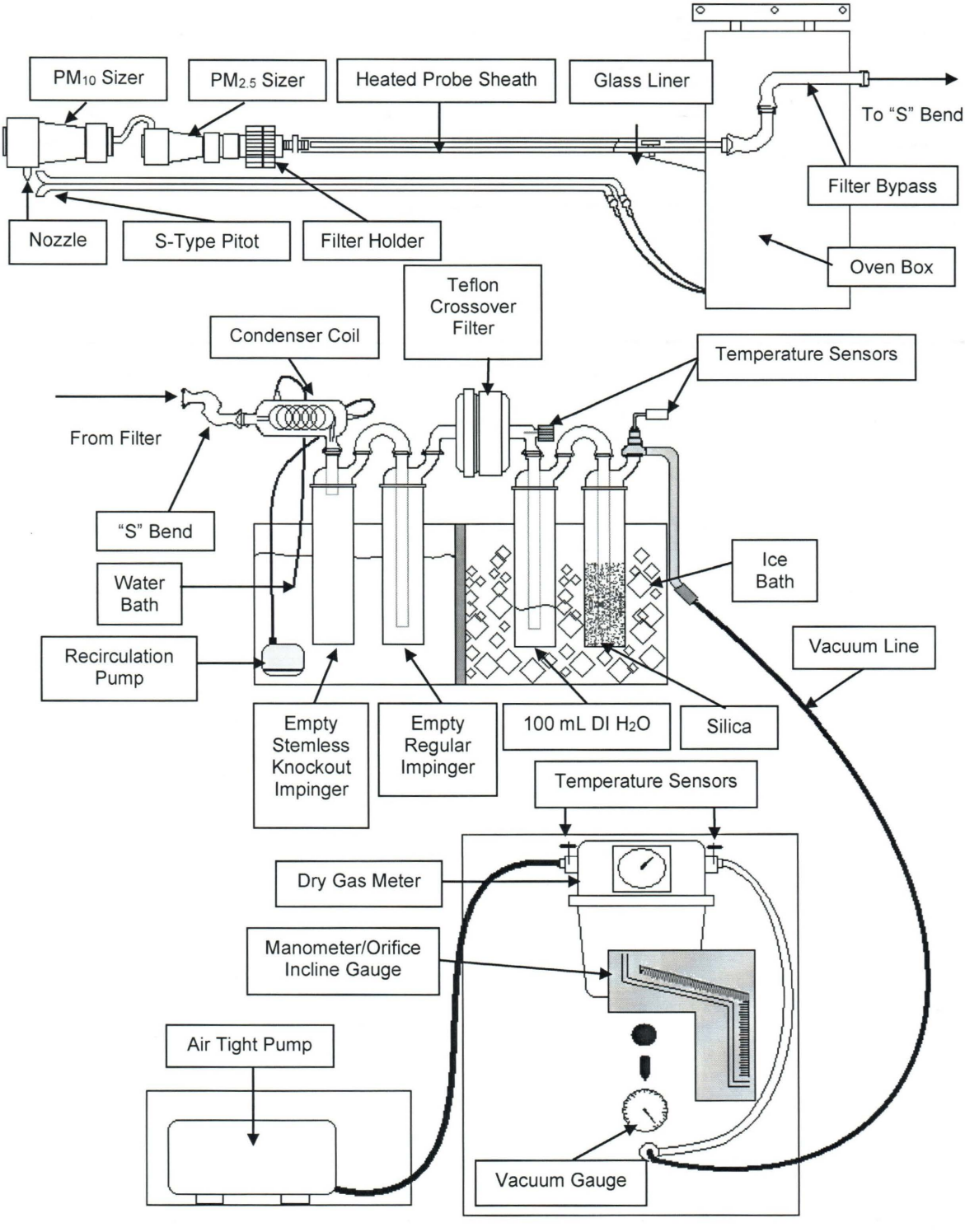
USEPA Method 2 – Type S Pitot Tube Manometer Assembly



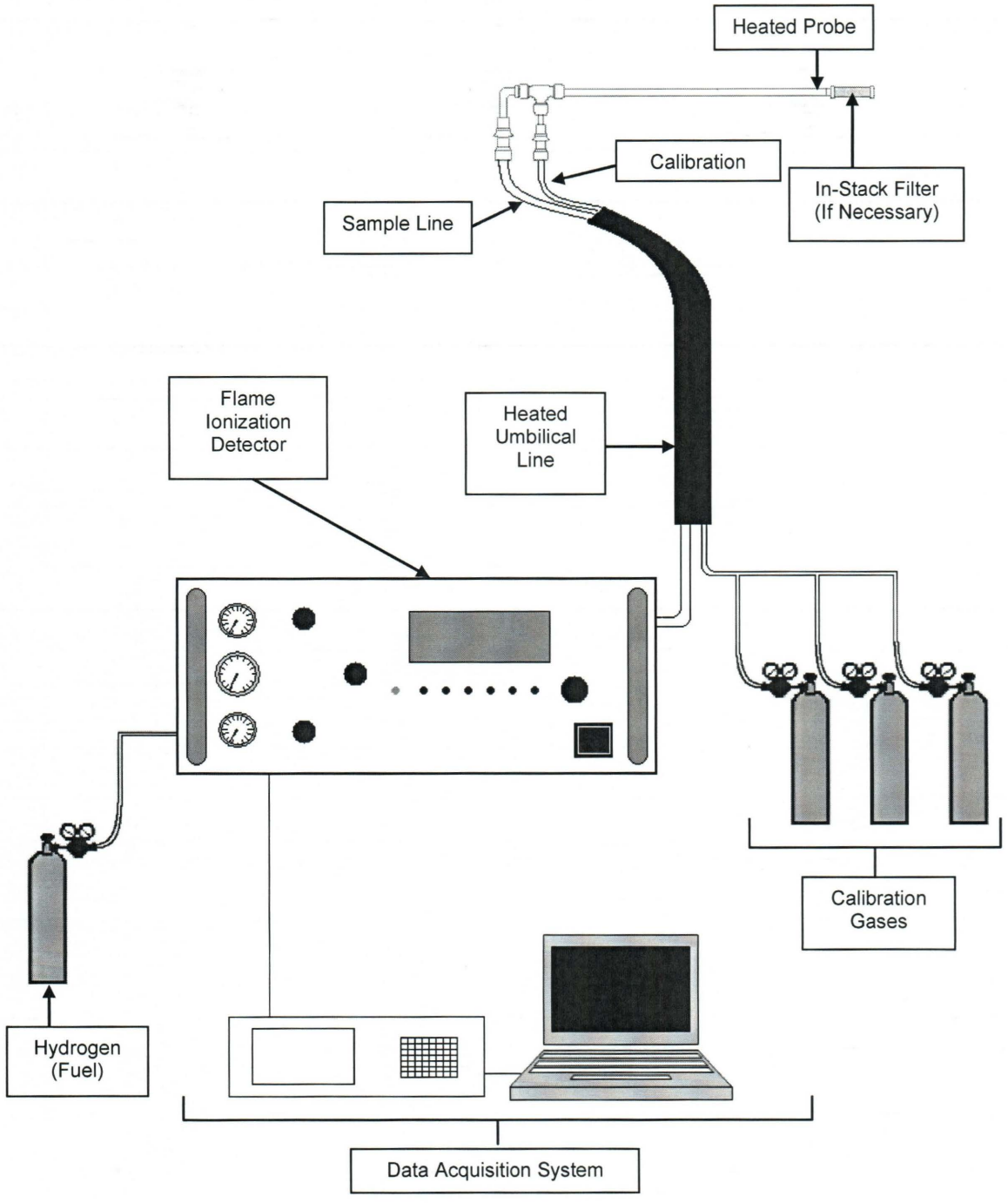
USEPA Method 5- Particulate Matter Sample Train Diagram



USEPA Method 201a/202- $PM_{10}/PM_{2.5}$ and Condensable Particulate Matter



USEPA Method 25A – Total Gaseous Organic Compound Sample Train



Appendix D - Calculation Nomenclature and Formulas