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October 29, 2015

Mr. Eric Grinstern
Michigan Department of Environmental Quality
Grand Rapids District, Air Quality Division
Unit 10
350 Ottawa Avenue
Grand Rapids, MI 49503

Re: Billet Reheat Furnace Stack Test Report

Dear Eric:

Please find the enclosed test report for the Billet Reheat Furnace Stack test which was conducted on July 17, 2015.

If you have any questions regarding this submittal, please contact me at 734-384-6544.

Sincerely,

Craig Metzger
Environmental Manager
Gerdau Monroe Mill

Enc. (s)

cc: Karen Kajiya-Mills – MDEQ
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2.0 SUMMARY AND DISCUSSION OF TEST RESULTS

2.1 Objectives and Test Matrix

The purpose of this test was to determine the emissions of CO and NO_x (as NO_2) at the BRF SVREHEAT-FRN Exhaust Stack during normal operating conditions. Testing was performed to satisfy emission testing requirements pursuant to MDEQ PTI No. 102-12A.

The specific test objectives for this test were to:

Measure the concentrations of oxygen (O_2), carbon dioxide (CO_2), CO and NO_x at the BRF SVREHEAT-FRN Exhaust Stack.

Measure the dry standard and actual volumetric flow rate of the stack gas at the BRF SVREHEAT-FRN Exhaust Stack.

Utilize the above variables to determine the emissions of CO and NO_x (as NO_2) at the BRF SVREHEAT-FRN Exhaust Stack during normal operating conditions.

Table 2.1 presents the sampling and analytical matrix log for this test.

2.2 Field Test Changes and Problems

No field test changes or problems occurred during the performance of this test that would bias the accuracy of the results of this test.

2.3 Presentation of Results

Two (2) sampling trains were utilized during each run at the BRF SVREHEAT-FRN Exhaust Stack to determine the emissions of NO_x (as NO_2) and CO. One sampling train measured the stack gas concentration of O_2, CO_2, NO_x, and CO. A second sampling train measured the stack gas volumetric flow rate and moisture content.

Table 2.2 displays the emissions of CO and NO_x (as NO_2) measured at the BRF SVREHEAT-FRN Exhaust Stack during normal operations.

Concentration values in Table 2.2 denoted with a '<' were measured to be below the minimum detection limit (MDL) of the applicable analytical method. Mass emission rates denoted with a '<' in Table 2.2 were calculated utilizing the applicable MDL concentration value instead of the "as measured" concentration value.

The graphs that present the raw, uncorrected concentration data measured in the field by the EPA Method 3A, 7E, and 10 sampling systems at the BRF SVREHEAT-FRN are located in the Field Data section of the Appendix.

			EPA TEST METHODS UTILIZED				
			M1/M2 (Flow)	M3A (O_2/CO_2)	M4 (%H_2O)	M7E (NO_x)	M10 (CO)
Date	**Run No.**	**Sampling Location**	**Sampling Time / Duration (min)**	**Sampling Time / Duration (min)**	**Sampling Time / Duration (min)**	**Sampling Time / Duration (min)**	**Sampling Time / Duration (min)**
7/17/2015	1	BRF SVREHEAT-FRN Exhaust Stack	8:20 - 9:31 60	8:20 - 9:31 60	8:20 - 9:31 60	8:20 - 9:31 60	8:20 - 9:31 60
7/17/2015	2	BRF SVREHEAT-FRN Exhaust Stack	10:49 - 11:58 60	10:49 - 11:58 60	10:49 - 11:58 60	10:49 - 11:58 60	10:49 - 11:58 60
7/17/2015	3	BRF SVREHEAT-FRN Exhaust Stack	12:21 - 13:30 60	12:21 - 13:30 60	12:21 - 13:30 60	12:21 - 13:30 60	12:21 - 13:30 60

All times are Eastern Daylight Time.

Table 2.1 - Sampling and Analytical Matrix

	BRF SVREHEAT-FRN Exhaust Stack			
	Run 1	**Run 2**	**Run 3**	**Average**
Production Rate (tons of steel/hr)*	61.59	70.89	101.58	78.02
Natural Gas Usage Rate (MMSCF/hr)*	4.8	4.2	9.0	6.0
Nitrogen Oxides Mass Emission Rate (lb/MMSCF) (as NO_2)	1.5	1.6	0.94	1.2
Nitrogen Oxides Mass Emission Rate (lb/hr) (as NO_2)	7.1	6.7	8.4	7.4
Nitrogen Oxides Concentration (ppmvd)	26.1	29.6	21.9	25.9
Carbon Monoxide Mass Emission Rate (lb/MMSCF)†	<0.034	<0.033	<0.026	<0.030
Carbon Monoxide Mass Emission Rate (lb/hr)†	<0.16	<0.14	<0.23	<0.18
Carbon Monoxide Concentration (ppmvd)†	<1.00	<1.00	<1.00	<1.00
Stack Gas Average Flow Rate (acfm)	65,318	53,727	102,219	73,754
Stack Gas Average Flow Rate (scfm)	41,304	34,384	59,788	45,159
Stack Gas Average Flow Rate (dscfm)	37,719	31,555	53,700	40,991
Stack Gas Average Velocity (fpm)	3,051	2,510	4,775	3,445
Stack Gas Average Static Pressure (in-H_2O)	-0.21	-0.29	-0.94	-0.48
Stack Gas Average Temperature (°F)	352	342	416	370
Stack Gas Percent by Volume Moisture (%H_2O)	8.68	8.23	10.18	9.03
Measured Stack Inner Diameter (in)‡	62.8 X 62.5	62.8 X 62.5	62.8 X 62.5	62.8 X 62.5
Percent by Volume Carbon Dioxide in Stack Gas (%-dry)	3.88	3.42	4.88	4.06
Percent by Volume Oxygen in Stack Gas (%-dry)	13.88	14.81	12.36	13.68
Percent by Volume Nitrogen in Stack Gas (%-dry)	82.24	81.77	82.76	82.26

* Production and process data was provided by Gerdau Macsteel Monroe personnel.

† The "<" symbol indicates that compound was not present in quantities above the Minimum Detection Limit (MDL) of the analytical method.

‡ The BRF SVREHEAT-FRN Exhaust Stack was elliptical in shape.

Table 2.2 - Emission Results

3.0 PLANT AND SAMPLING LOCATION DESCRIPTIONS

3.1 Process Description and Operation

Gerdau Macsteel Monroe is a producer of Special Bar Quality (SBQ) Steel. Scrap metal is loaded into baskets and taken to a melt shop. An Electric Arc Furnace (EAF) is charged with the scrap metal. Electrodes are lowered into the scrap, and the melting process begins. The molten steel is transferred from the EAF by ladle and moved to a Ladle Refining Station (LRS) where it is chemically balanced and impurities are removed. The refined molten steel is sent through a continuous caster and formed into billets which are then reheated in a Billet Reheat Furnace (BRF), fed into a mill on a conveyor, and rolled into the desired shape.

The EAF is a refractory lined cylindrical vessel made of steel plates and having a bowl-shaped hearth and a dome-shaped roof. Water-cooled panels are used for the shell and roof to reduce refractory costs. Three (3) electrodes, powered by a transformer, are mounted on a superstructure above the furnace and are lowered and raised through ports in the furnace roof. The electrodes convey the energy for melting the steel scrap. Supplemental energy is provided by an oxy-fuel burner and an oxygen/coke lance which swing into the slag door area and operate during the melting / refining process. The furnace is mounted on curved rockers, which allow tilting for slagging and bottom tapping. The BRF (EUBILLETREHEATWB) is equipped with multiple burners in three (3) combustion zones to uniformly heat billets and hold them at the desired temperature(s). The BRF was in operation for this test event.

Figure 3.1 depicts the process and sampling location schematic.

3.2 Control Equipment Description

During this test, emissions from the BRF were uncontrolled.

3.3 Flue Gas Sampling Locations

The BRF SVREHEAT-FRN was elliptical in shape with measured inner diameters of 62.8-inches and 62.5-inches. The stack was oriented in the vertical plane and was accessed from a permanent platform. Two (2) 3.0-inch I.D. sampling ports were located 90° apart from one another at a location that met EPA Method 1, Section 11.1.1 criteria. Prior to emissions sampling, the stack was traversed to verify the absence of cyclonic flow. An average yaw angle of 4.4° was measured. Therefore, the sampling location also met EPA Method 1, Section 11.4.2 criteria. During emissions sampling, the stack was traversed for stack gas volumetric flow rate, moisture content, O_2, CO_2, NO_x and CO concentration determinations.

Figure 3.2 schematically illustrates the traverse point and sample port locations utilized.

3.4 Process Sampling Location

The EPA Reference Test Methods performed did not specifically require that process samples were to be taken during the performance of this testing event. It is in the best knowledge of Air Compliance Testing that no process samples were obtained and therefore no process sampling location was identified in this report.

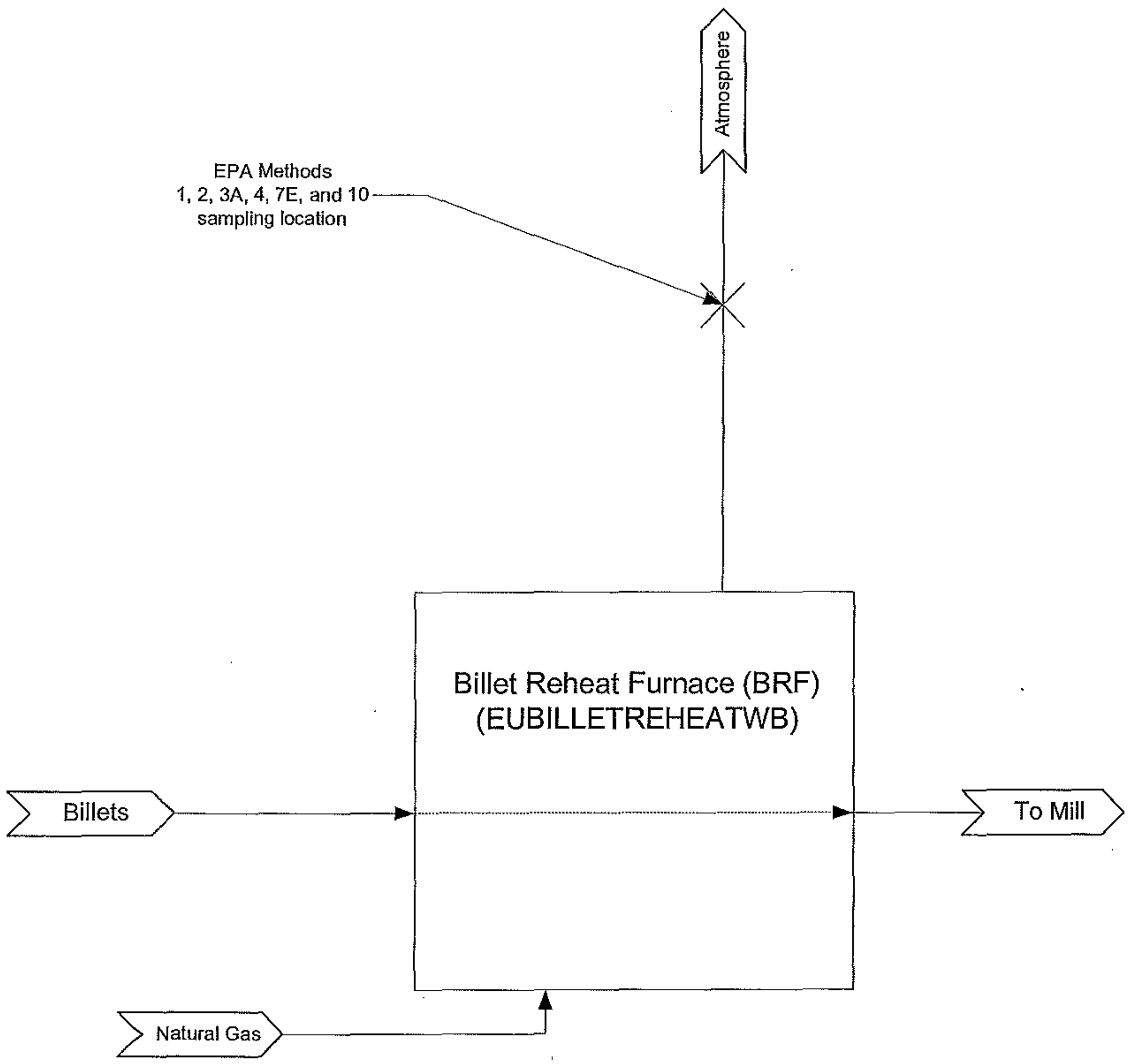
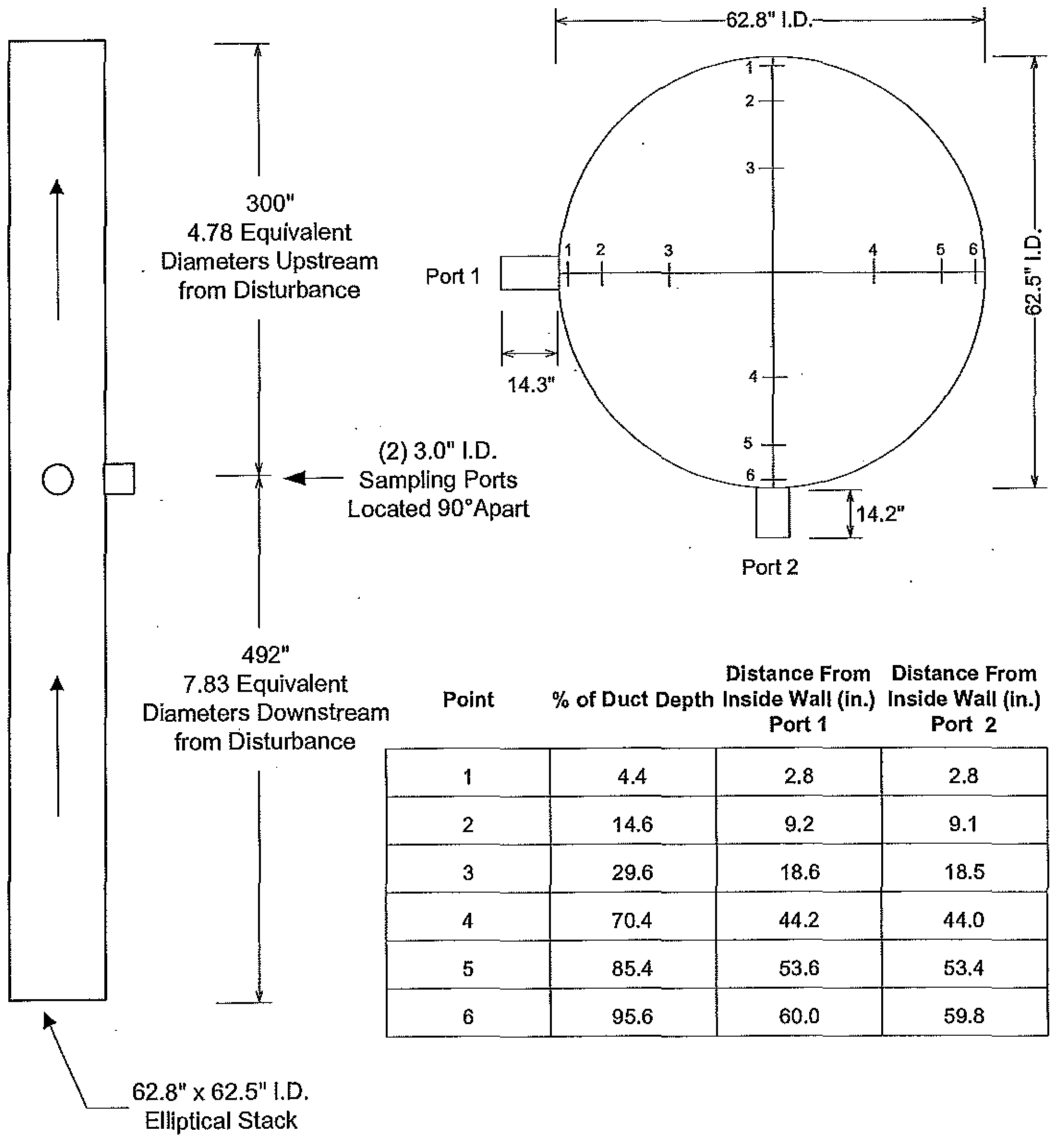


Figure 3.1 - BRF Process and Sampling Location Schematic



Point	% of Duct Depth	Distance From Inside Wall (in.) Port 1	Distance From Inside Wall (in.) Port 2
1	4.4	2.8	2.8
2	14.6	9.2	9.1
3	29.6	18.6	18.5
4	70.4	44.2	44.0
5	85.4	53.6	53.4
6	95.6	60.0	59.8

Figure 3.2 - BRF SVREHEAT-FRN Exhaust Stack Traverse Point Location Drawing

4.0 SAMPLING AND ANALYTICAL PROCEDURES

4.1 Test Methods

4.1.1 EPA Method 1: *"Sample and Velocity Traverses for Stationary Sources"*
Principle: To aid in the representative measurement of pollutant emissions and/or total volumetric flow rate from a stationary source, a measurement site where the effluent stream is flowing in a known direction is selected, and the cross-section of the stack is divided into a number of equal areas. A traverse point is then located within each of these equal areas. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.2 EPA Method 2: *"Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S)"*
Principle: The average gas velocity in a stack is determined from the gas density and from measurement of the average velocity head with a Type S (Stausscheibe or reverse type) pitot tube. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.3 EPA Method 3A: *"Determination of Oxygen and / or Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)"*
Principle: A gas sample is continuously extracted from the effluent stream. A portion of the sample stream is conveyed to an instrumental analyzer(s) for determination of O_2 and CO_2 concentration(s). This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.4 EPA Method 4: *"Determination of Moisture Content in Stack Gases"*
Principle: A gas sample is extracted at a constant rate from the source; moisture is removed from the sample stream and determined either volumetrically or gravimetrically. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.5 EPA Method 7E: *"Determination of Nitrogen Oxides Emissions from Stationary Sources (Instrumental Analyzer Procedure) (Concentrations assumed less than 2,000ppm)"*
Principle: A sample is continuously extracted from the effluent stream; a portion of the sample stream is conveyed to an instrumental chemiluminescent analyzer for determination of NO_x concentration. Performance specifications and test procedures are provided to ensure reliable data. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.6 EPA Method 10: *"Determination of Carbon Monoxide Emissions from Stationary Sources (Concentrations assumed less than 10,000 ppm)"*
Principle: An integrated or continuous gas sample is extracted from a sampling point and analyzed for carbon monoxide (CO) content using a Luft-type nondispersive infrared analyzer (NDIR) or equivalent. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

The sampling trains utilized during this testing project are depicted in Figures 4.1 and 4.2.

4.2 Procedures for Obtaining Process Data

Process data was recorded by Gerdau Monroe Mill personnel utilizing their typical record keeping procedures. Recorded process data was provided to Air Compliance Testing, Inc. personnel at the conclusion of this test event. The process data is located in Table 2.2 and in the Process Data section of the Appendix.

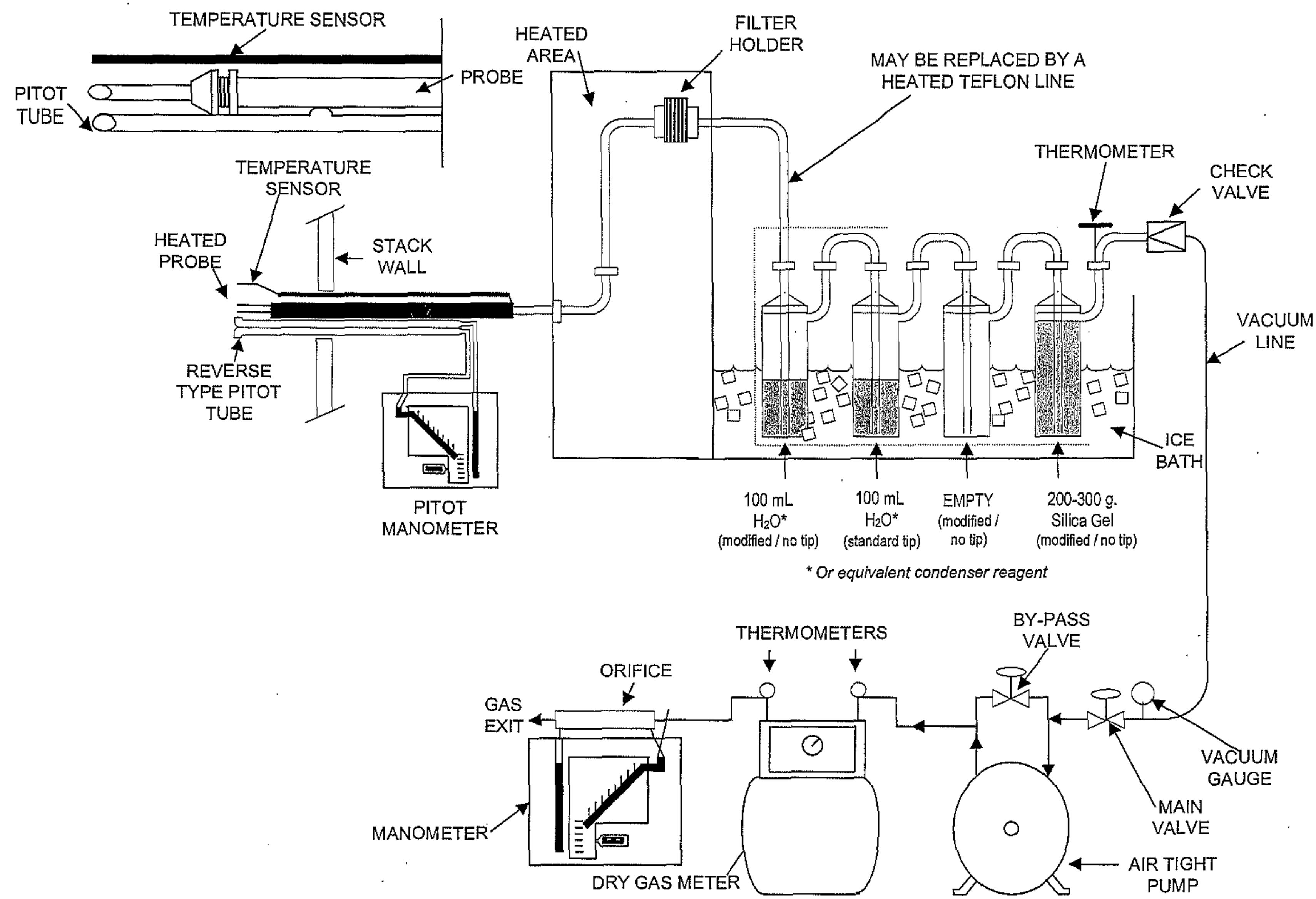


Figure 4.1 - EPA Method 4 Sampling Train Schematic

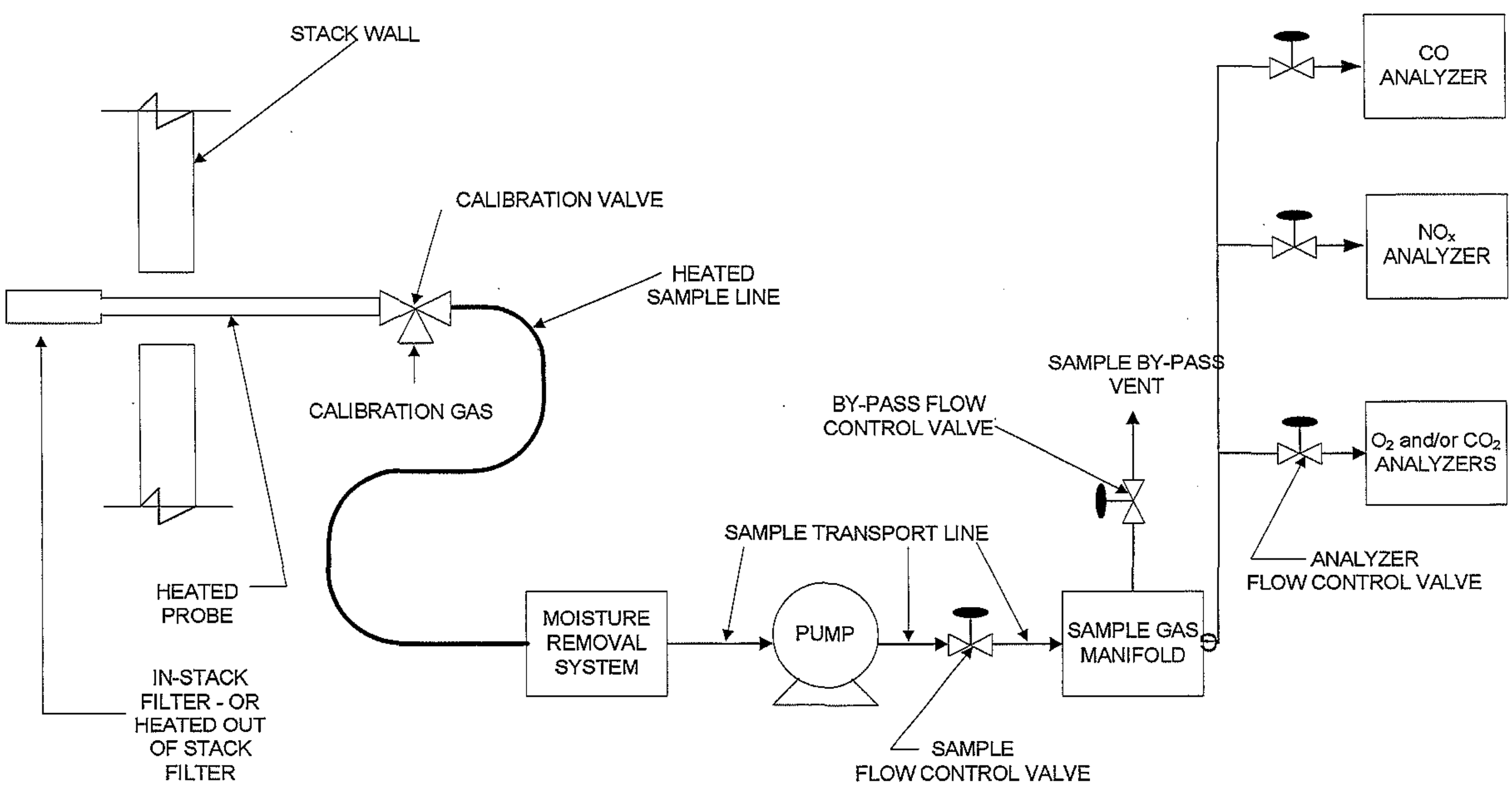


Figure 4.2 - EPA Method 3A, 7E, and 10 Sampling Train Schematic

5.0 INTERNAL QA/QC ACTIVITIES

5.1 QA Audits

Tables 5.1 - 5.5 illustrate the QA audits that were performed during this test.

All meter boxes and sampling trains used during sampling performed within the requirements of their respective methods as is shown in Tables 5.1 and 5.2. All pre-test and post-test leak checks were well below the applicable limit. Minimum metered volumes were also met where applicable.

Tables 5.3.1 - 5.3.4 illustrate the oxygen, carbon dioxide, nitrogen oxides, and carbon monoxide calibration audits which were performed during this test (and integral to performing EPA Method 3A, 7E, and 10 correctly) were all within the Measurement System Performance Specifications of ±3% of span for the Zero and Calibration Drift Checks, ±5% of span for the System Calibration Bias Checks, and ±2% of span for the Calibration Error Checks.

Table 5.4 displays the NO_2 to NO converter efficiency check. The converter efficiency check was conducted as per the procedures contained in EPA Method 7E, Section 8.2.4.1 which requires a conversion of at least 90%. As shown an average converter efficiency of 100.37% was achieved for the NO_x analyzer utilized at the SVREHEAT-FRN Exhaust Stack.

Table 5.5 displays the EPA Method 205 field evaluation of the calibration gas dilution system utilized during this test event. As shown, the average concentration output at each dilution level was within ±2% of the predicted value. The average concentration output of the mid-level gas was also within ±2% of the certified concentration.

5.2 QA/QC Problems

No QA/QC problems occurred during this test event.

	BRF SVREHEAT-FRN Exhaust Stack		
Method 5 Sampling Train	**Run 1**	**Run 2**	**Run 3**
Leak Rate Observed (Pre/Post) (cfm)	0.000 / 0.000	0.000 / 0.000	0.000 / 0.000
Applicable Method Allowable Leak Rate (cfm)	< 0.020	< 0.020	< 0.020
Acceptable	Yes	Yes	Yes
Volume of Dry Gas Collected (dscf)	37.897	37.551	37.179
Recommended Volume of Dry Gas Collected (dscf)	21.000	21.000	21.000
Acceptable	Yes	Yes	Yes

Table 5.1 - Sample Train Audit Results

BRF SVREHEAT-FRN Exhaust Stack - EPA Method 4 Sampling Train				
Pre-Test Dry Gas Meter Calibration Factor (Y)	**Average Post-Test Dry Gas Meter Calibration Check Value (Yqa)**	**Post Test Dry Gas Meter Calibration Check Value Difference From Pre-Test Calibration Factor (%)**	**Applicable Method Allowable Difference (%)**	**Acceptable**
1.0039	1.0180	1.41%	5.00%	Yes

Table 5.2 - Dry Gas Meter Audit Results

	BRF SVREHEAT-FRN Exhaust Stack					
Oxygen Analyzer (% as O_2)	Run 1	Acceptable	Run 2	Acceptable	Run 3	Acceptable
Analyzer Span During Test Run (%)	23.2	YES	23.2	YES	23.2	YES
Initial System Calibration Response for Zero Gas (%)	0.07	N/A	0.07	N/A	0.05	N/A
Final System Calibration Response for Zero Gas (%)	0.07	N/A	0.05	N/A	0.05	N/A
Actual Concentration of the Upscale Calibration Gas (%)	11.00	N/A	11.00	N/A	11.00	N/A
Initial System Calibration Response for Upscale Gas (%)	10.94	N/A	10.98	N/A	10.98	N/A
Final System Calibration Response for Upscale Gas (%)	10.98	N/A	10.98	N/A	10.94	N/A
Initial System Calibration Bias for Zero Gas (% of Span)	0.17	YES	0.17	YES	0.09	YES
Final System Calibration Bias for Zero Gas (% of Span)	0.17	YES	0.09	YES	0.09	YES
Initial System Calibration Bias for Upscale Gas (% of Span)	-0.26	YES	-0.09	YES	-0.09	YES
Final System Calibration Bias for Upscale Gas (% of Span)	-0.09	YES	-0.09	YES	-0.26	YES
System Drift for Zero Gas (% of Span)	0.00	YES	-0.09	YES	0.00	YES
System Drift for Upscale Gas (% of Span)	0.17	YES	0.00	YES	-0.17	YES
Analyzer Calibration Error for Zero Gas (% of Span)	0.13	YES	0.13	YES	0.13	YES
Analyzer Calibration Error for Mid-Level Gas (% of Span)	0.00	YES	0.00	YES	0.00	YES
Analyzer Calibration Error for High-Level Gas (% of Span)	0.09	YES	0.09	YES	0.09	YES

Table 5.3.1 - EPA Method 3A (Oxygen) Analyzer Calibration and QA

Carbon Dioxide Analyzer (% as CO_2)	BRF SVREHEAT-FRN Exhaust Stack					
	Run 1	Acceptable	Run 2	Acceptable	Run 3	Acceptable
Analyzer Span During Test Run (%)	23	YES	23	YES	23	YES
Initial System Calibration Response for Zero Gas (%)	0.08	N/A	0.14	N/A	0.19	N/A
Final System Calibration Response for Zero Gas (%)	0.14	N/A	0.19	N/A	0.13	N/A
Actual Concentration of the Upscale Calibration Gas (%)	10.87	N/A	10.87	N/A	10.87	N/A
Initial System Calibration Response for Upscale Gas (%)	10.83	N/A	10.89	N/A	10.92	N/A
Final System Calibration Response for Upscale Gas (%)	10.89	N/A	10.92	N/A	10.78	N/A
Initial System Calibration Bias for Zero Gas (% of Span)	0.35	YES	0.61	YES	0.83	YES
Final System Calibration Bias for Zero Gas (% of Span)	0.61	YES	0.83	YES	0.57	YES
Initial System Calibration Bias for Upscale Gas (% of Span)	-0.39	YES	-0.13	YES	0.00	YES
Final System Calibration Bias for Upscale Gas (% of Span)	-0.13	YES	0.00	YES	-0.61	YES
System Drift for Zero Gas (% of Span)	0.26	YES	0.22	YES	-0.26	YES
System Drift for Upscale Gas (% of Span)	0.26	YES	0.13	YES	-0.61	YES
Analyzer Calibration Error for Zero Gas (% of Span)	0.00	YES	0.00	YES	0.00	YES
Analyzer Calibration Error for Mid-Level Gas (% of Span)	0.22	YES	0.22	YES	0.22	YES
Analyzer Calibration Error for High-Level Gas (% of Span)	0.00	YES	0.00	YES	0.00	YES

Table 5.3.2 - EPA Method 3A (Carbon Dioxide) Analyzer Calibration and QA

	BRF SVREHEAT-FRN Exhaust Stack					
Nitrogen Oxide Analyzer	Run 1	Acceptable	Run 2	Acceptable	Run 3	Acceptable
Analyzer Span During Test Run (ppm)	50	YES	50	YES	50	YES
Initial System Calibration Response for Zero Gas (ppm)	-0.1	N/A	0.0	N/A	0.1	N/A
Final System Calibration Response for Zero Gas (ppm)	0.0	N/A	0.1	N/A	0.0	N/A
Actual Concentration of the Upscale Calibration Gas (ppm)	25.0	N/A	25.0	N/A	25.0	N/A
Initial System Calibration Response for Upscale Gas (ppm)	24.4	N/A	24.9	N/A	24.6	N/A
Final System Calibration Response for Upscale Gas (ppm)	24.9	N/A	24.6	N/A	24.9	N/A
Initial System Calibration Bias for Zero Gas (% of Span)	-0.02	YES	0.22	YES	0.44	YES
Final System Calibration Bias for Zero Gas (% of Span)	0.22	YES	0.44	YES	0.22	YES
Initial System Calibration Bias for Upscale Gas (% of Span)	-1.04	YES	-0.08	YES	-0.78	YES
Final System Calibration Bias for Upscale Gas (% of Span)	-0.08	YES	-0.78	YES	-0.14	YES
System Drift for Zero Gas (% of Span)	0.24	YES	0.22	YES	-0.22	YES
System Drift for Upscale Gas (% of Span)	0.96	YES	-0.70	YES	0.64	YES
Analyzer Calibration Error for Zero Gas (% of Span)	-0.20	YES	-0.20	YES	-0.20	YES
Analyzer Calibration Error for Mid-Level Gas (% of Span)	-0.12	YES	-0.12	YES	-0.12	YES
Analyzer Calibration Error for High-Level Gas (% of Span)	-0.04	YES	-0.04	YES	-0.04	YES

Table 5.3.3 - EPA Method 7E Analyzer Calibration and QA

	BRF SVREHEAT-FRN Exhaust Stack					
Carbon Monoxide Analyzer	**Run 1**	**Acceptable**	**Run 2**	**Acceptable**	**Run 3**	**Acceptable**
Analyzer Span During Test Run (ppm)	50	YES	50	YES	50	YES
Initial System Calibration Response for Zero Gas (ppm)	0.04	N/A	1.02	N/A	0.03	N/A
Final System Calibration Response for Zero Gas (ppm)	1.02	N/A	0.03	N/A	-0.07	N/A
Actual Concentration of the Upscale Calibration Gas (ppm)	25	N/A	25	N/A	25	N/A
Initial System Calibration Response for Upscale Gas (ppm)	25	N/A	26	N/A	25	N/A
Final System Calibration Response for Upscale Gas (ppm)	26	N/A	25	N/A	24	N/A
Initial System Calibration Bias for Zero Gas (% of Span)	-0.60	YES	1.36	YES	-0.62	YES
Final System Calibration Bias for Zero Gas (% of Span)	1.36	YES	-0.62	YES	-0.82	YES
Initial System Calibration Bias for Upscale Gas (% of Span)	-1.00	YES	0.92	YES	-0.06	YES
Final System Calibration Bias for Upscale Gas (% of Span)	0.92	YES	-0.06	YES	-1.90	YES
System Drift for Zero Gas (% of Span)	1.96	YES	-1.98	YES	-0.20	YES
System Drift for Upscale Gas (% of Span)	1.92	YES	-0.98	YES	-1.84	YES
Analyzer Calibration Error for Zero Gas (% of Span)	0.68	YES	0.68	YES	0.68	YES
Analyzer Calibration Error for Mid-Level Gas (% of Span)	0.70	YES	0.70	YES	0.70	YES
Analyzer Calibration Error for High-Level Gas (% of Span)	0.32	YES	0.32	YES	0.32	YES

Table 5.3.4 - EPA Method 10 Analyzer Calibration and QA

Date / Time	Cylinder Concentration (ppm NO2)	Analyzer Concentration (ppm NOx)	Conversion Efficiency (%)	Required Conversion Efficiency (%)	Acceptable (yes/no)
7/16/2015 14:41	51.8	51.56	99.54	90.00	Yes
7/16/2015 14:42	51.8	51.95	100.29	90.00	Yes
7/16/2015 14:44	51.8	52.17	100.71	90.00	Yes
7/16/2015 14:45	51.8	52.28	100.93	90.00	Yes
AVERAGE	51.80	51.99	100.37	90.00	Yes

Analyzer Serial Number: 42CHL-69298-363

Cylinder Number: CC500261

Table 5.4 - NOx Converter Efficiency Check

	Calibration Tag Value (%)	Dilution Ratio	Predicted Diluted Value (%)	Injection 1 Response (%)	Injection 2 Response (%)	Injection 3 Response (%)	Average Response (%)	Difference From Predicted (%)	Acceptable (yes/no)
Dilution Level 1	23.15	2.105	11.00	11.05	11.00	11.02	11.02	0.21	yes
Dilution Level 2	23.15	1.543	15.00	15.00	14.99	15.00	15.00	-0.02	yes
Mid-Level Gas	11.1	-	-	11.19	11.18	11.16	11.18	0.69	yes

Analyzer Serial Number: U10034

Dilution System Serial Number: 4918

Table 5.5 - EPA Method 205 Gas Dilution System Calibration and QA