

Compliance Stack Emission Test Report

Determination of Particulate Matter Under 2.5- μ m, Particulate Matter Under 10- μ m, Nitrogen Oxides, and Total Gaseous Organics Emissions

EPA Methods 1, 2, 3, 3A, 4, 7E, 25A, 201A, and 202

**Electric Arc Furnace (EAF)
Vacuum Tank Degasser (VTD)
Ladle Metallurgy Furnace (LMF)
Billet Reheat Furnace (BRF)**

Test Date(s): April 27-28, 2016

Source Location: Monroe, Michigan

Report Number: 160408.1.0

Report Date: June 16, 2016

Scope ID: 10617

Prepared For:

Gerdau Monroe Mill
3000 E Front St
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Prepared By:

Air Compliance

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A Division of Montrose Air Quality Services



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STATEMENT OF REVIEW AND CERTIFICATION

We the undersigned, CERTIFY that:

- To the best of our knowledge, the report has been checked for completeness, and the results presented are accurate, error-free, legible, representative of the actual emissions measured during the test, and conform to the requirements of ASTM D7036-04, "Standard Practice for Competence of Air Emission Testing Bodies (AETBs)."
- The results of the Compliance Stack Emission Test Report emission testing conducted on April 27-28, 2016 are a product of the application of the United States Environmental Protection Agency (US EPA) Stationary Source Sampling Methods listed in 40 CFR Part 60, Appendix A, and 40 CFR Part 51, Appendix M, that were in effect at the time of this test.
- All raw data, calculations, and other materials necessary to confirm and validate the reported emissions results and observations have been reviewed to ensure data quality and completeness.

A handwritten signature in black ink, appearing to read "Robt J Lisy Jr", written over a horizontal line.

Robert J. Lisy, Jr., District Manager

6/16/2016

Date

A handwritten signature in black ink, appearing to read "Tatum Strickler", written over a horizontal line.

Tatum Strickler, Director - Quality Assessment and Accreditation

6/16/2016

Date

1.0 INTRODUCTION

1.1 Summary of Test Program

Gerdau Monroe Mill, located in Monroe, Michigan contracted Air Compliance Testing, Inc. of Cleveland, Ohio to conduct compliance stack emission testing of their Electric Arc Furnace (EAF) (EUEAF), two (2) Vacuum Tank Degassers (VTD) (EUVTD), Ladle Metallurgy Furnace (LMF) (EULMF), and Billet Reheat Furnace (EUBILLETREHEATWB). Testing was performed to satisfy emissions testing requirements pursuant to Michigan Department of Environmental Quality (MDEQ) Permit-to-Install (PTI) No. 102-12A. The testing was performed on April 27-28, 2016.

Simultaneous sampling were performed at the EAF/VTD SVBH01 Exhaust and LMF SVBHLMF Exhaust to determine the emissions of nitrogen oxide (NO_x) (as NO₂), total gaseous organics (TGO), particulate matter under 2.5-µm (PM_{2.5}), and particulate matter under 10-µm (PM₁₀). Sampling was also performed at the BRF SVREHEAT-FRN Exhaust Stack to determine the emissions of nitrogen oxides (NO_x) (as NO₂). Testing was conducted while the EAF, VTD, and LMF were operating at maximum rated capacity and while the BRF was operating at normal conditions. During this test, emissions from the EAF and VTD were controlled by a direct evacuation control (DEC) unit and the DVBAGHOUSE-01 baghouse, and emissions from the LMF were controlled by the DVLMFBAGHOUSE baghouse. Emissions from the BRF were uncontrolled.

The test methods that were conducted during this test were EPA Methods 1, 2, 3, 3A, 4, 7E, 25A, 201A, and 202.

1.2 Key Personnel

The key personnel who coordinated this test program (and their phone numbers) were:

Craig Metzger, Environmental Manager, Gerdau Monroe Mill, 734-243-3468

Karen Kajiya-Mills, TPU Supervisor, Air Quality Division, Michigan Department of Environmental Quality (MDEQ), 517-284-6780

Mark Dziadosz, Michigan Department of Environmental Quality-Air Quality Division, 586-753-3745

Eric Grinstern, Environmental Quality Specialist, Michigan Department of Environmental Quality, 616-356-0266

Robert Lisy QI, District Manager, Air Compliance Testing, Inc., 800-372-2471

Peter Becker QI, Project Manager, Air Compliance Testing, Inc., 800-372-2471

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 NO_x (as NO₂), TGO, PM_{2.5}, and PM₁₀ at the EAF/VTD SVBH01 Exhaust and LMF SVBHLMF Exhaust during operations at the maximum rated capacity for the EAF, VTD, and LMF. The purpose of the test was also to determine the emissions of CO and NO_x (as NO₂) at the BRF SVREHEAT-FRN Exhaust Stack during normal operating conditions. Testing was performed to satisfy the emissions testing requirements pursuant to MDEQ Permit-to-Install No. 102-12A.

The specific test objectives for this test are as follows:

Simultaneously measure the concentrations of NO_x, TGO, filterable PM_{2.5} and PM₁₀, and condensible PM (CPM) at the EAF/VTD SVBH01 Exhaust and LMF SVBHLMF Exhaust.

Simultaneously measure the dry standard and actual volumetric flow rate of the stack gas at the EAF/VTD SVBH01 Exhaust and LMF SVBHLMF Exhaust.

Utilize the above variables to determine the emissions of NO_x (as NO₂), TGO, PM_{2.5}, and PM₁₀ at the EAF/VTD SVBH01 Exhaust and LMF SVBHLMF Exhaust during operations at the maximum rated capacity for the EAF, VTD, and LMF.

Measure the concentrations of oxygen (O₂) and NO_x at the BRF SVREHEAT-FRN Exhaust Stack.

Utilize the above variables to determine the emissions of NO_x (as NO₂) at the BRF SVREHEAT-FRN Exhaust Stack during normal operating conditions.

Tables 2.1.1 and 2.1.2 present the sampling and analytical matrix log for this test.

2.2 Field Test Changes and Problems

During Run 2, there was a power outage to the CEMS trailer performing EPA Method 7E and 25A sampling at the EAF/VTD SVBH01 Exhaust. The on-site MI DEQ administrator instructed the Air Compliance Testing, Inc. test crew to continue performing the Run 2 EPA Method 201A/202 sampling and resume CEMS sampling with the next isokinetic run. EPA Method 201A/202 Run 3 was performed concurrently with CEMS Run 2, and a fourth run, to obtain stack gas volumetric flow rate and moisture content, was conducted concurrently with CEMS Run 3.

2.3 Presentation of Results

Two (2) sampling trains were utilized during each run at the EAF/VTD SVBH01 Exhaust and LMF SVBHLMF Exhaust to determine the emissions of NO_x (as NO₂), TGO, PM_{2.5}, and PM₁₀. At each location, one sampling train measured stack gas volumetric flow rate, dry molecular weight, moisture content, and filterable PM_{2.5}, filterable PM₁₀, and condensible PM, while a second sampling train measured the concentrations of NO_x and TGO.

Tables 2.2.1 and 2.2.2 display the emissions of PM_{2.5}, PM₁₀, NO_x (as NO₂), and TGO measured at the EAF/VTD SVBH01 Exhaust and LMF SVBHLMF Exhaust during operations at the maximum rated capacity for the EAF, VTD, and LMF.

Table 2.3 displays the combined emissions of PM_{2.5}, PM₁₀, NO_x (as NO₂), and TGO measured at the EAF SVBH01 Exhaust and LMF SVBHLMF Exhaust during operations at the maximum rated capacity for the EAF, VTD, and LMF.

Concentration values in Tables 2.2.1, 2.2.2, and 2.3 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 Tables 2.2 and 2.3 were calculated utilizing the applicable MDL concentration value instead of the "as measured"

One (1) sampling train was utilized during each run at the BRF SVREHEAT-FRN Exhaust Stack to determine the emissions of NO_x (as NO₂). One sampling train measured the stack gas concentration of O₂ and NO_x.

Table 2.4 displays the emissions of NO_x (as NO₂) measured at the BRF SVREHEAT-FRN Exhaust Stack during normal operating conditions.

The graphs that present the raw, uncorrected concentration data measured in the field by the EPA Method 3A, 7E, and 25A sampling systems at the EAF/VTD SVBH01 Exhaust, LMF SVBHLMF Exhaust, and BRF SVREHEAT-FRN are located in the Field Data section of the Appendix.

EPA TEST METHODS UTILIZED											
Date	Run No.	CEMS Run No.	Sampling Location	M1/M2	M3	M4	M201A	M202	M7E	M25A	
				(Flow)	(Dry Mol. Wt.)	(%H ₂ O)	(Filterable PM ₁₀)	(CPM)	(NO _x)	(TGO)	
				Sampling Time / Duration (min)	Sampling Time / Duration (min)	Sampling Time / Duration (min)	Sampling Time / Duration (min)	Sampling Time / Duration (min)	Sampling Time / Duration (min)	Sampling Time / Duration (min)	
4/28/2016	1	1	EAF/VTD SVBH01 Exhaust	8:49 - 10:05 56.5	8:49 - 10:05 56.5	8:49 - 10:05 56.5	8:49 - 10:05 56.5	8:49 - 10:05 56.5	8:49 - 10:02 67	8:49 - 10:02 67	
4/28/2016	2		EAF/VTD SVBH01 Exhaust	11:48 - 13:10 63.75	11:48 - 13:10 63.75	11:48 - 13:10 63.75	11:48 - 13:10 63.75	11:48 - 13:10 63.75	-	-	
4/28/2016	3	2	EAF/VTD SVBH01 Exhaust	15:03 - 16:12 55.5	15:03 - 16:12 55.5	15:03 - 16:12 55.5	15:03 - 16:12 55.5	15:03 - 16:12 55.5	15:03 - 16:15 68	15:03 - 16:15 68	
4/28/2016	4	3	EAF/VTD SVBH01 Exhaust	17:28 - 17:48 13	17:28 - 18:28 60	17:28 - 18:28 60	-	-	17:28 - 18:48 80	17:28 - 18:48 80	
4/28/2016	1	1	LMF SVBHLMF Exhaust	8:49 - 10:05 56.5	8:49 - 10:05 56.5	8:49 - 10:05 56.5	8:49 - 10:05 56.5	8:49 - 10:05 56.5	8:49 - 10:02 67	8:49 - 10:02 67	
4/28/2016	2		LMF SVBHLMF Exhaust	11:48 - 13:10 63.75	11:48 - 13:10 63.75	11:48 - 13:10 63.75	11:48 - 13:10 63.75	11:48 - 13:10 63.75	-	-	
4/28/2016	3	2	LMF SVBHLMF Exhaust	15:03 - 16:12 55.5	15:03 - 16:12 55.5	15:03 - 16:12 55.5	15:03 - 16:12 55.5	15:03 - 16:12 55.5	15:03 - 16:15 68	15:03 - 16:15 68	
4/28/2016	4	3	LMF SVBHLMF Exhaust	17:28 - 17:48 10	17:28 - 18:28 60	17:28 - 18:28 60	-	-	17:28 - 18:48 80	17:28 - 18:48 80	

All times are Eastern Daylight Time.

Table 2.1.1 - Sampling and Analytical Matrix

Date	Run No.	Sampling Location	EPA TEST METHODS UTILIZED	
			M3A (O ₂)	M7E (NO _x)
			Sampling Time / Duration (min)	Sampling Time / Duration (min)
4/27/2016	1	BRF SVREHEAT-FRN Exhaust Stack	9:17 - 10:29 60	9:17 - 10:29 60
4/27/2016	2	BRF SVREHEAT-FRN Exhaust Stack	10:40 - 11:49 60	10:40 - 11:49 60
4/27/2016	3	BRF SVREHEAT-FRN Exhaust Stack	12:00 - 13:07 60	12:00 - 13:07 60

All times are Eastern Daylight Time.

Table 2.1.2 - Sampling and Analytical Matrix

	EAF/VTD SVBH01 Exhaust				LMF SVBHLMF Exhaust			
	Run 1	Run 2	Run 3	Average	Run 1	Run 2	Run 3	Average
PM _{2.5} Emissions (lb/hr)*	<57.2	<66.6	<53.3	<59.1	<57.2	<26.7	<50.4	<44.7
PM _{2.5} Concentration (gr/dscf)*	<0.021	<0.022	<0.018	<0.020	<0.027	<0.012	<0.023	<0.020
PM ₁₀ Emission Rate (lb/hr)*	57.4	67.6	53.9	59.7	<57.3	<26.8	<50.5	<44.9
PM ₁₀ Concentration (gr/dscf)*	0.021	0.022	0.019	0.020	<0.027	<0.012	<0.023	<0.021
Stack Gas Average Flow Rate (acfm)	387,262	427,171	408,091	407,508	271,423	289,414	283,772	281,536
Stack Gas Average Flow Rate (scfm)	332,832	366,953	347,986	349,257	249,999	268,273	263,702	260,658
Stack Gas Average Flow Rate (dscfm)	324,910	359,669	336,870	340,483	245,437	265,554	260,256	257,082
Stack Gas Average Velocity (fpm)	3,899	4,301	4,109	4,103	4,150	4,426	4,339	4,305
Stack Gas Average Static Pressure (in-H ₂ O)	-2.10	-2.00	-1.20	-1.77	-0.25	-0.45	-0.65	-0.45
Stack Gas Average Temperature (°F)	137	138	143	139	100	97	94	97
Stack Gas Percent by Volume Moisture (%H ₂ O)	2.38	1.99	3.19	2.52	1.82	1.01	1.31	1.38
Measured Stack Inner Diameter (in)†	134.8 X 135.1	134.8 X 135.1	134.8 X 135.1	134.8 X 135.1	109.5	109.5	109.5	109.5
Percent by Volume Carbon Dioxide in Stack Gas (%-dry)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Percent by Volume Oxygen in Stack Gas (%-dry)	20.50	20.50	20.50	20.50	20.67	20.50	20.50	20.56
Percent by Volume Nitrogen in Stack Gas (%-dry)	79.50	79.50	79.50	79.50	79.33	79.50	79.50	79.44

* The "<" symbol indicates that the pollutant was not present in quantities above the Minimum Detection Limit (MDL) of the analytical method in at least one sample fraction.

† The EAF/VTD SVBH01 Exhaust was elliptical in shape.

Table 2.2.1 - Emission Results - EAF and LMF

	EAF/VTD SVBH01 Exhaust				LMF SVBHLMF Exhaust			
	Run 1	Run 2	Run 3	Average	Run 1	Run 2	Run 3	Average
Nitrogen Oxides Emissions (as NO ₂) (lb/hr)*	15.6	11.7	11.7	14.7	2.63	<2.54	<2.54	2.57
Nitrogen Oxides Concentration (as NO ₂) (ppmvd)*	6.68	4.66	4.66	6.09	1.50	<1.17	<1.17	1.28
Total Gaseous Organic Emissions (lb/hr as propane)	5.41	6.91	6.91	5.80	5.97	9.76	9.76	7.68
Total Gaseous Organic Concentration (ppmvw as propane)	2.37	2.78	2.78	2.43	3.55	4.69	4.69	4.08
Stack Gas Average Flow Rate (acfm)	387,262	408,091	430,764	408,706	271,423	283,772	330,286	295,160
Stack Gas Average Flow Rate (scfm)	332,832	347,986	361,690	347,502	249,999	263,702	304,835	272,845
Stack Gas Average Flow Rate (dscfm)	324,910	336,870	351,662	337,814	245,437	260,256	303,041	269,578
Stack Gas Average Velocity (fpm)	3,899	4,109	4,337	4,115	4,150	4,339	5,050	4,513
Stack Gas Average Static Pressure (in-H ₂ O)	-2.10	-1.20	-1.10	-1.47	-0.25	-0.65	-0.33	-0.41
Stack Gas Average Temperature (°F)	137	143	153	144	100	94	98	97
Stack Gas Percent by Volume Moisture (%H ₂ O)	2.38	3.19	2.77	2.78	1.82	1.31	0.59	1.24
Measured Stack Inner Diameter (in)†	134.8 X 135.1	134.8 X 135.1	134.8 X 135.1	134.8 X 135.1	109.5	109.5	109.5	109.5
Percent by Volume Carbon Dioxide in Stack Gas (%-dry)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Percent by Volume Oxygen in Stack Gas (%-dry)	20.50	20.50	20.50	20.50	20.67	20.50	20.50	20.56
Percent by Volume Nitrogen in Stack Gas (%-dry)	79.50	79.50	79.50	79.50	79.33	79.50	79.50	79.44

* The "<" symbol indicates that the pollutant was not present in quantities above the Minimum Detection Limit (MDL) of the analytical method in at least one sample fraction.

† The EAF/VTD SVBH01 Exhaust was elliptical in shape.

Table 2.2.2 - Emission Results - EAF and LMF

	Combined EAF/VTD/LMF Exhaust			
	Run 1	Run 2	Run 3	Average
Liquid Steel Produced (ton)*	235	274	250	253
Rate of Liquid Steel Produced (ton/hr)*	78	76	102	86
PM _{2.5} Emissions (lb/ton-liquid steel)†	<1.46	<1.24	<1.02	<1.24
PM _{2.5} Emissions (lb/hr)†	<114.4	<94.5	<104.4	<104.4
PM ₁₀ Emissions (lb/hr)†	<114.8	<94.5	<104.4	<104.5
	Run 1	Run 2	Run 3	Average
Liquid Steel Produced (ton)*	235	250	234	240
Rate of Liquid Steel Produced (ton/hr)*	78	102	94	91
Nitrogen Oxides Emissions (lb/ton liquid steel) (as NO ₂)	0.23	<0.14	<0.15	<0.17
Nitrogen Oxides Emissions (lb/hr) (as NO ₂)†	18.2	<14.3	<14.3	<15.6
Total Gaseous Organic Emissions (lb/ton-liquid steel)	0.145	0.163	0.178	0.162
Total Gaseous Organic Emissions (lb/hr as propane)	11.4	16.7	16.7	14.9

* Process Data provided by Gerdau Monroe Mill personnel.

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

Table 2.3 - Combined EAF/LMF Emission Results

	BRF SVREHEAT-FRN Exhaust Stack			
	Run 1	Run 2	Run 3	Average
Production Rate (tons of steel/hr)*	95.9	86.0	89.7	90.5
Natural Gas Usage Rate (MMSCF/hr)*	0.111	0.105	0.121	0.112
Nitrogen Oxides Mass Emission Rate (lb/MMBtu) (as NO ₂)	0.046	0.054	0.039	0.046
Nitrogen Oxides Concentration (ppmvd)	13.5	16.0	12.8	14.1
Measured Stack Inner Diameter (in)†	62.7 X 62.6	62.7 X 62.6	62.7 X 62.6	62.7 X 62.6
Percent by Volume Oxygen in Stack Gas (%-dry)	14.56	14.43	13.77	14.26

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

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

Table 2.4 - Emission Results - BRF