EMISSION TEST REPORT

Report Title: TEST REPORT FOR THE MEASUREMENT OF AIR POLLUTANT EMISSIONS FROM AN ELECTRIC ARC FURNACE BAGHOUSE CONTROL SYSTEM

Test Date(s): August 8-10, 2016

Facility Information	
Name	Ervin Industries – Amasteel Division
Street Address	915 Tabor St.
City, County	Adrian, Lenawee
SRN	B1754

Facility Permit Information			
ROP No.:	MI-ROP-B1754-2013	PTI No.:	53-12B

Testing Contractor	
Company	Derenzo Environmental Services
Mailing Address	39395 Schoolcraft Road Livonia, Michigan 48150
Phone	(517) 324-1880
Project No.	1605017

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MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

RENEWABLE OPERATING PERMIT REPORT CERTIFICATION

Authorized by 1994 P.A. 451, as amended. Failure to provide this information may result in civil and/or criminal penalties.

Reports submitted pursuant to R 336.1213 (Rule 213), subrules (3)(c) and/or (4)(c), of Michigan's Renewable Operating Permit (ROP) program must be certified by a responsible official. Additional information regarding the reports and documentation listed below must be kept on file for at least 5 years, as specified in Rule 213(3)(b)(ii), and be made available to the Department of Environmental Quality, Air Quality Division upon request.

Source Name: Ervin Industries, Amasteel Division — County: Lenawee

Source Address: 915 Tabor St — City: Adrian

AQD Source ID (SRN): B1754 — ROP No.: B1754-2013 — ROP Section No.:

Please check the appropriate box(es):

☐ **Annual Compliance Certification (Pursuant to Rule 213(4)(c))**

Reporting period (provide inclusive dates): From _____ To _____

☐ 1. During the entire reporting period, this source was in compliance with **ALL** terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference. The method(s) used to determine compliance is/are the method(s) specified in the ROP.

☐ 2. During the entire reporting period this source was in compliance with all terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference, **EXCEPT** for the deviations identified on the enclosed deviation report(s). The method used to determine compliance for each term and condition is the method specified in the ROP, unless otherwise indicated and described on the enclosed deviation report(s).

☐ **Semi-Annual (or More Frequent) Report Certification (Pursuant to Rule 213(3)(c))**

Reporting period (provide inclusive dates): From _____ To _____

☐ 1. During the entire reporting period, **ALL** monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred.

☐ 2. During the entire reporting period, all monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred, **EXCEPT** for the deviations identified on the enclosed deviation report(s).

☒ **Other Report Certification**

Reporting period (provide inclusive dates): From 8/8/16 To 8/10/16

Additional monitoring reports or other applicable documents required by the ROP are attached as described:

Test Report for FG-0009 carbon monoxide and particulate emissions testing that occurred August 8-10, 2016. Testing was conducted in accordance with the approved Test Plan and the facility operated in compliance with the permit conditions or at the maximum routine operating conditions for the facility.

I certify that, based on information and belief formed after reasonable inquiry, the statements and information in this report and the supporting enclosures are true, accurate and complete

James Lemon	Plant Manager	(517) 265-6118
Name of Responsible Official (print or type)	Title	Phone Number
		9/23/16
Signature of Responsible Official		Date

* Photocopy this form as needed.

EQP 5736 (Rev 11-04)

EMISSION TEST REPORT
FOR THE
MEASUREMENT OF AIR POLLUTANT EMISSIONS
FROM AN ELECTRIC ARC FURNACE
BAGHOUSE CONTROL SYSTEM

ERVIN INDUSTRIES – AMASTEEL DIVISION
Adrian, Michigan

Test Date(s): August 8-10, 2016

1.0 INTRODUCTION

Ervin Industries – Amasteel Division (Ervin Amasteel) retained Derenzo Environmental Services to perform emissions testing on the gases exhausted from the positive pressure fabric filter baghouse used to control emissions from the electric arc furnace (EAF) processes operated at the Adrian, Michigan facility.

The facility is regulated by Michigan Department of Environmental Quality – Air Quality Division (MDEQ-AQD) Renewable Operating Permit MI-ROP-B1754-2013 and National Emission Standards for Hazardous Air Pollutants (NESHAP) for Area Sources: Electric Arc Furnaces (40 CFR Part 63 Subpart YYYYY). The facility was issued Permit to Install (PTI) No. 53-12B on April 1, 2016 for modification of the baghouse collection system. Scrap metal refining processes are collectively referred to as flexible emission group FG-0009 and the baghouse is referred to as Baghouse-0009 in PTI 53-12B.

Testing included emission measurements for particulate matter (PM), particulate matter less than 10 microns in aerodynamic diameter (PM10) and carbon monoxide (CO) for the EAF process exhausted from the positive pressure fabric filter baghouse. Opacity measurements were also performed for the baghouse exhaust gas.

The testing was conducted August 8-10, 2016 by Derenzo Environmental Services personnel Jason Logan, Daniel Wilson, and Blake Beddow. Assistance and process coordination was provided by Richard Payne, Plant Engineer, Ervin Amasteel.

The exhaust gas sampling and analysis was performed using procedures specified in the approved Test Protocol prepared by Derenzo Environmental Services dated June 3, 2016. Mr. Thomas Maza, Mr. Michael Gabor, and Mr. Scott Miller of the MDEQ-AQD were on site to observe portions of the test program.

2.0 REPORT CERTIFICATION

This test report was prepared by Derenzo Environmental Services based on the field sampling performed by Derenzo Environmental Services personnel on August 8-10, 2016. Facility process data were collected and provided by Ervin Amasteel employees or representatives.

Certain analyses were contracted to, and performed by, a third party laboratory. The laboratory analytical report is provided in its entirety in this report and its appendices.

I certify that I believe the information provided in this report and its appendices are true, accurate, and complete.

Report Prepared By:

Jason Logan
Environmental Consultant
Derenzo Environmental Services

Report Reviewed By:

Robert Harvey, P.E.
General Manager
Derenzo Environmental Services

This test report has been reviewed by Ervin Amasteel representatives and approved for submittal to the MDEQ-AQD. A Renewable Operating Permit Report Certification form (EQP-5736) signed by the Responsible Official accompanies this document.

3.0 SUMMARY OF TEST RESULTS

The EAF process exhaust gas from Baghouse-0009 was sampled for three (3) four-hour test periods using United States Environmental Protection Agency (USEPA) Reference Test Methods to determine particulate matter emission rates. The inlet duct to Baghouse-0009 was sampled for three heat lengths (batch cycles) for determination of carbon monoxide (CO) emission rates and factors. Opacity observations were conducted during daylight hours.

Table 3.1 presents a summary of measured exhaust gas flowrate and CO and PM emission rates and exhaust plume opacity compared to the emission standards specified in the applicable MDEQ permits and NESHAP. The data presented in Table 3.1 is the average of the three test periods. Data for individual test periods are presented at the end of this report in Tables 7.1 and 7.2.

Table 3.1 Summary of measured exhaust gas flowrate, particulate matter emission rates and exhaust plume opacity

Emission Unit	Exhaust Flow Rate (dscfm)	PM Emission Rate (lb/hr)	$PM_{10/2.5}$ Emission Rate (lb/hr)	CO Emission Factor (lb/T)	CO Emission Rate (lb/hr)	CO Emission Rate (ton/yr)	Opacity (%)
FG-0009 Baghouse-0009	193,940	0.11	0.73	0.52	14.2	62.0	0%
Limit	**-**	**5.9**	**5.9**	**3.0**	**90**	**322.5**	**-**

4.0 SOURCE DESCRIPTION

4.1 General Process Descriptions

Ervin Amasteel manufactures cast steel abrasives using a 30-megawatt (MW) electric arc furnace and heat-treating furnaces. Steel scrap is charged into the furnace and the furnace roof is then closed. Large electrodes are arced within the scrap to bring it to a molten state. Approximately 1% by weight of carbon, manganese, and silicon and small amount (less than 1%) of aluminum are added as alloys to meet final product quality standards. The molten metal is then poured into a ladle and the melt process is repeated. The facility performs the melt cycles, or "heats", during the evening (off peak) hours.

4.2 Emission Control System Description

Ervin Amasteel uses a direct-shell evacuation system (fourth hole roof connection) to collect emissions from the EAF during scrap metal melting. The collected superheated exhaust from the EAF enters a water-cooled duct system that terminates into dry ducting. The EAF exhaust temperature decreases when it is combined with collected fugitive emissions captured from furnace charging, tapping, and casting operations. The combined exhaust is ducted to the baghouse emission control device for particulate removal prior to being discharged to the ambient air. A fan installed between the melt shop and the baghouse induces the draft required for the fume collection system.

The emission control system has a maximum rated capacity of 293,000 actual cubic feet per minute (acfm) at 275 degrees Fahrenheit (°F). The fabric filter positive pressure baghouse consists of eight (8) separate compartments and has a rated particulate removal efficiency of 99.83%.

Appendix B presents diagrams of the sampling locations and baghouse layout.

4.3 Operating Conditions During the Test Event

The process was operated normally during the triplicate 240-minute PM test periods and three heat-length CO test periods. The facility processed between 23 and 30 tons of scrap steel per hour (ton/hr) during the CO test periods.

Process data and production rates are provided in Appendix A.

5.0 SAMPLING AND ANALYSIS PROCEDURES

Testing was performed to verify opacity, CO, filterable PM and total PM (PM_{10}) emission rates from the EAF exhausted via the positive-pressure baghouse. CO emission tests were conducted for three heat-lengths on the baghouse inlet duct. For PM sampling, each baghouse compartment was sampled for one hour and four compartments were sampled per test period (i.e. 240-minute tests). Four compartments were sampled for an extra hour for the third test. Isokinetic test methods and sampling trains were used to measure filterable and condensable PM emissions. Instrumental analyzers were used to measure CO concentration and diluent gases (oxygen and carbon dioxide content). During the second and third PM test, which did not run concurrently with the CO tests, moisture was determined via wet bulb/dry bulb technique and diluent gases were measured using Fyrite® combustion gas analyzers. The wet bulb temperatures and diluent gas content were measured during each pretest flow.

The following USEPA reference test methods and sampling trains were used to perform the emission compliance testing.

USEPA Method 1	Velocity and sampling locations were selected based on physical duct and stack measurements in accordance with USEPA Method 1.
USEPA Method 2	Exhaust gas velocity pressure and temperature using a Type-S Pitot tube connected to a red oil incline manometer and K-type thermocouple.
USEPA Method 3A	Exhaust gas O_2 and CO_2 content determined by instrumental analyzers
USEPA Method 3	A Fyrite® combustion analyzer was used to determine O2 and CO2 content of the exhaust gas during the second and third PM/CPM tests
USEPA Method 4	Exhaust gas moisture determined using the chilled impinger method (as part of the particulate sampling train) and wet bulb/dry bulb technique.
USEPA Method 5D	Procedure for determining particulate matter sampling locations and average exit velocity for positive pressure baghouse exhausts.
USEPA Method 9	Exhaust gas opacity during each sampling period was determined by a certified observer of visible emissions.
USEPA Method 10	Exhaust gas CO concentration measured using an instrumental analyzer.
USEPA Method 17	Filterable PM determined using isokinetic sampling procedures and analysis of the front half of the particulate matter sampling train
USEPA Method 202	Condensable PM determined using a dry impinger sample train.

Appendix C provides sample train drawings and detailed sampling procedures

5.1 Sampling Location and Velocity Measurements (USEPA Methods 1 and 2)

5.1.1 *Baghouse Inlet*

A single inlet duct contributes to the total air volume introduced into the baghouse. The gas velocity and volumetric flowrate for the inlet duct were measured using USEPA Methods 1 and 2.

Velocity measurement points were determined in accordance with the procedures specified in USEPA Method 1 and checked for cyclonic flow during the second velocity traverse. Velocity pressure measurements were performed at each traverse point using an S-type Pitot tube and red-oil manometer and temperature measurements at each traverse point were conducted using a K-type thermocouple and a calibrated digital thermometer.

Volumetric flowrate measurements were performed before and after each heat-length CO test run (pre-test and post-test velocity measurements). Flowrate measurements were also performed before each 240-minute PM test run, with the initial flowrate measurement used to calculate mass emissions for the first CO and PM test periods.

5.1.2 Baghouse Exhaust

The velocity at the baghouse exhaust sampling location was too low to accurately measure. Therefore, the measured inlet volumetric flowrate (total of three inlet ducts) was used to calculate the average baghouse exhaust exit velocity based on the total area of the baghouse exhaust measurement site in accordance with USEPA Method 5D. A matrix was developed to determine the locations of the isokinetic sampling points within each baghouse cell. Each cell was sampled for six 10-minute sampling points, with four cells consisting of a full four-hour test.

Appendix B provides drawings for the inlet duct and exhaust cell sampling locations.

5.2 Diluent Gas Sampling Procedures (USEPA Method 3/3A)

Carbon dioxide (CO_2) and oxygen (O_2) concentrations were measured concurrently with the CO test runs and the initial PM test run using an instrumental analyzer in accordance with Method 3A. A Servomex 4900 single beam single wavelength infrared (SBSW) Gas Analyzer was used to measure the CO_2 content in the exhaust gas. A Servomex 4900 Gas Analyzer equipped with a paramagnetic sensor was used to measure the O_2 content in the exhaust gas.

The flue gas was withdrawn continuously from the inlet duct of the baghouse using a heated Teflon sample line and sample pump. Moisture was removed from the sampled gas stream using a condenser and the conditioned (dried) gas samples were delivered to the instrumental analyzers.

For the last two PM test periods, Fyrite® combustion analyzers were used during the pretest flowrate measurements to determine O_2 and CO_2 content.

Additional information for the gas sampling and extraction system is provided in Appendix C.

5.3 Moisture Content (Method 4)

The exhaust gas moisture content for the PM test runs was determined by the condensate gain in chilled impingers in accordance with USEPA Method 4. Moisture content was determined as a component of the sampling train for PM (i.e., not as a separate measurement train).

Exhaust gas moisture content for the CO test runs was determined by using the wet bulb/dry bulb technique. The moisture content determination worksheet uses two equations to provide the percentage of moisture in an exhaust gas stream.

The following Equation was used to determine moisture content based on the wet bulb temperature and the dry bulb temperature.

$$\%H_2O = \frac{e'' - \frac{(P_a - e'')*(t_d - t_w)}{2{,}800 - 1.3*t_w}}{P_a} * 100$$

e"	vapor pressure of water at the wet bulb temperature (in. Hg)
P_a	absolute barometric pressure (in. Hg)
t_d	dry bulb temperature (°F)
t_w	wet bulb temperature (°F)

The vapor pressure (e") of water is required in the equation above, and can be determined using the following equation:

$$e'' = (6.07864*10^{-6})*(t_w)^3 - (1.00431*10^{-3})(t_w)^2 + (0.075602)*t_w - 1.69343$$

These equations are limited to stack temperatures between 50°F and 200°F. The stack temperatures during each flowrate were within this range.

5.4 Carbon Monoxide Concentration (Method 10)

Exhaust gas CO concentrations were determined during each sample period using a Non-Dispersive Infrared (NDIR) Gas Analyzer in accordance with USEPA Method 10.

Exhaust gas was withdrawn continuously from the inlet duct of the baghouse using a heated Teflon sample line, conditioned and delivered to the CO instrumental analyzer. Sampling was conducted at three points (16.7%, 50%, and 83.3%) within the stack cross-section for a minimum of 20 minutes per point to satisfy stratification requirements.

Appendix B presents sampling location diagrams.

Appendix C provides information regarding the gas sampling and extraction system.
Appendix D presents CO calculation sheets.
Appendix H presents raw CEM data.

Table 6.1 presents CO emission results and averages for each CO test period.

5.5 Particulate Matter Emissions (Methods 5D, 17 and 202)

USEPA Method 202 specifies that if the gas filtration temperature exceeds 30°C (85°F) then the filterable and condensable portions of particulate matter must be combined to determine total primary (direct) PM emissions. A combined USEPA Method 17/202 sample train was used to measure total particulate matter, which is reported as PM_{10}. The front half of the sample train (from the sampling nozzle to the filter) captured filterable PM; the back half of the sampling train (from the exit of the filter, through the dry impingers, to the condensable PM filter) captured condensable PM. PM sampling was conducted during periods of time where the facility processed scrap steel, i.e. during each heat. Testing was paused between each heat and is notated on the left side of the isokinetic field data sheets.

Based on the procedures in USEPA Method 5D for sampling particulate matter in positive pressure baghouse exhausts, particulate sampling was performed using a matrix of sampling points immediately downstream (above) the filter bags. There are 8 separate cells within the baghouse at Ervin Amasteel. Six (6) equally-spaced sampling points were designated within each cell for a total of 72 sampling locations. One test period consisted of sampling the six locations within four cells (24 sampling points per test period). Each point was measured for ten minutes resulting in a sampling period of 240 minutes. The sampling pump was turned off and all openings were covered while the sampling train moved between cells. The velocity at the sampling location was to be too low to accurately measure. Therefore, the measured inlet volumetric flowrate was used to calculate the average exit velocity based on the total area of the measurement site. The calculated average exit velocity was used in the isokinetic calculation required for Method 17 for determination of the orifice meter delta H.

Appendix D presents flowrate calculations and data sheets.

5.5.1 Filterable PM Emissions

Exhaust gas was withdrawn from each sample location using an appropriately-sized sample nozzle. The collected exhaust gas was passed through an in-stack filter placed just after the "goose-neck" nozzle. PM in the sampled gas stream was collected onto a pre-tared glass fiber filter. The stainless steel in-stack filter holder was connected to a sample probe and the sample probe was connected to an impinger train (described in the following section).

At the end of each 240-minute test period, the filter was recovered and the nozzle and front half of the filter holder was brushed and rinsed with acetone. Gravimetric analysis for recovered filterable PM samples was performed by Enthalpy Analytical, Durham, North Carolina.

5.5.2 Condensable PM Emissions

Following the Method 17 sampling filter and probe, the sample gas traveled through a condensable particulate matter (CPM) sampling train that consisted of an inline condenser, a dry knock-out impinger, a dry Greenberg-Smith impinger, and a non-heated PTFE CPM filter (with exhaust thermocouple). The dry impingers were immersed in tempered water, which is also circulated in the condenser to maintain the temperature of the sample gas between 65 and 85°F.

Chilled impingers were connected to the outlet of the CPM train to catch any remaining moisture in the sampled gas stream.

At the conclusion of each test period, the impingers were transported to the recovery area where they were weighed. A nitrogen purge was not conducted on the sample train. Only a few droplet of condensate were observed in the first two impingers (4.3 mL of condensate was the most collected in the CPM portion of the train during the three test periods). Upon completion of the test periods, the samples were recovered and the first two impingers, in-line condenser, back half of the method 17 filter holder, front half of the method 202 filter holder, connecting Teflon line, connecting glassware, and sample probe were rinsed with DI water, acetone and hexane in accordance with the Method 202 sample recovery procedures. The samples and recovered rinses were clearly and uniquely labeled and transferred to Enthalpy Analytical, Durham, North Carolina for analysis.

Appendix D presents PM emission calculation sheets.

Appendix E presents the Enthalpy Analytical laboratory report.

Table 7.1 presents emission results and averages for the PM test periods.

5.6 Opacity (Method 9)

USEPA Method 9 procedures were used to evaluate the opacity of the baghouse exhaust gas. Opacity readings were conducted during daylight hours for a 24 minute period near the start of the first heat.

In accordance with USEPA Method 9, the qualified observer stood at a distance sufficient to provide a clear view of the emissions with the sun oriented in the 140° sector to his back.

Opacity observations were made at the point of greatest opacity in the portion of the plume where condensed water vapor was not present. Observations were made and recorded at 15-second intervals for the duration of each observation period and reduced to six-minute averages.

All visual opacity determinations were be performed by a qualified observer in accordance with USEPA Method 9, Section 3.

Opacity test data and the observer certificate are presented in Appendix F.

5.7 Number and Length of Sampling Runs

The PM emission verification tests consisted of three (3), four-hour sampling periods. Four baghouse cells were tested during each test period, and four cells were tested twice.

Opacity observations were not required by the applicable NESHAP, ROP, or PTI, however in the test plan approval letter the MDEQ requested that opacity observations be conducted. Observations were performed by Ervin Amasteel personnel and consisted of one 24 minute period at the start of the first heat on August 8, 2016.

6.0 QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

Appendix G provides sampling equipment quality assurance and calibration data. A summary of these procedures is provided in this section.

6.1 Sample Location and Velocity Measurements

The representative flowrate locations were determined in accordance with USEPA Method 1 based on the measured distance to upstream and downstream disturbances. The flowrate location was determined to be acceptable based on the absence of significant cyclonic flow, which was measured and recorded on field data sheets. The inlet duct diagram is provided in Appendix B.

Prior to performing the initial velocity traverse each day, the S-type Pitot tube and manometer lines were leak-checked. These checks were made by blowing into the impact opening of the Pitot tube until 3 or more inches of water were recorded on the manometer, then capping the impact opening and holding it closed for 15 seconds to ensure that it was leak free. The static pressure side of the Pitot tube was leak-checked using the same procedure.

Prior to arriving onsite, the instruments used during the source test to measure exhaust gas properties and velocity (barometer, pyrometer, and Pitot tube) were calibrated to specifications in the sampling methods.

6.2 Dry Gas Meter Calibration and Isokinetic Sampling

The dry gas metering console was calibrated prior to and after the test event using the critical orifice calibration technique presented in USEPA Method 5. The metering console calibration exhibited no data outside the acceptable ranges presented in USEPA Method 5. The digital pyrometer in the gas

metering console was calibrated using a NIST traceable Omega® Model CL 23A temperature calibrator.

The sampling nozzle diameter was determined using the three-point calibration technique.

6.3 Particulate Matter Recovery and Analysis

All recovered particulate matter samples were stored and shipped in pre-rinsed glass sample bottles with Teflon® lined caps. The liquid level on each bottle was marked with a permanent marker prior to shipment and the caps were secured closed with tape. Samples of the reagents used in the test event (200 milliliters each of deionized high-purity water, acetone and hexane) were sent to the laboratory for analysis to verify that the reagents used to recover the samples have low particulate matter residues.

The glassware used in the condensable PM impinger trains was washed and rinsed prior to use in accordance with the procedures of USEPA Method 202. The glassware was not baked prior to use; therefore, a field train proof blank was recovered according to the option provided in USEPA Method 202. Analysis of the collected field train proof blank rinses (sample train rinse performed prior to use) indicated a total of 8.3 milligrams (mg) of recovered PM from the sample train. In addition, a field train recovery proof blank was performed following the first sampling period. Analysis of the field train recovery proof blank resulted in 5.0 mg of recovered PM from the sample train. The reported condensable PM test results were blank-corrected for 2 mg of condensable PM in the organic catch as per USEPA Method 202.

6.4 Laboratory QA/QC Procedures

The laboratory particulate matter analyses were conducted by a qualified third-party laboratory according to the appropriate QA/QC procedures specified in the associated USEPA test methods and included in the final reports provided by Enthalpy Analytical (Durham, North Carolina). The laboratory report is provided in Appendix E.

6.5 Instrument Calibration and System Bias Checks

At the beginning of each day of the testing program, initial three-point instrument calibrations were performed for the CO, CO_2 and O_2 analyzers by injecting calibration gas directly into the inlet sample port for each instrument. System bias checks were performed prior to and at the conclusion of each sampling period by introducing the upscale calibration gas and zero gas into the sampling system (at the base of the stainless steel sampling probe prior to the particulate filter and Teflon® heated sample line) and determining the instrument response against the initial instrument calibration readings.

The instruments were calibrated with USEPA Protocol 1 certified concentrations of CO_2, O_2, and CO in nitrogen and zeroed using nitrogen. A STEC Model SGD-710C ten-step gas divider was used to obtain intermediate calibration gas concentrations as needed.

6.6 Gas Divider Certification

A STEC Model SGD-710C 10-step gas divider was used to obtain appropriate calibration span gases. The ten-step STEC gas divider was NIST certified (within the last 12 months) with a primary flow standard in accordance with Method 205. When cut with an appropriate zero gas, the ten-step STEC gas divider delivered calibration gas values ranging from 0% to 100% (in 10% step increments) of the USEPA Protocol 1 calibration gas that was introduced into the system. The field evaluation procedures presented in Section 3.2 of Method 205 were followed prior to use of gas divider. The field evaluation yielded no errors greater than 2% of the triplicate measured average and no errors greater than 2% from the expected values.

7.0 TEST RESULTS AND DISCUSSION

7.1 Volumetric Flowrate

The measured volumetric flowrate at the baghouse inlet was adjusted using the dilution air flowrate equation in USEPA Method 5D (Equation 5D-3). The dilution air flowrate equation increased the measured volumetric flowrate by 0%, 14%, and 67% for tests 1, 2 and 3, respectively, depending on the difference between the measured temperatures at the baghouse inlet and exhaust gas sampling locations.

The adjusted exhaust gas flowrate results in a worst-case emissions scenario. It is extremely unlikely, particularly for the 67% flowrate increase in test 3, that an appreciable amount of dilution air is being introduced into the baghouse system through the reverse air cleaning process. The baghouse collection system is rated at 293,000 acfm, and the flowrate for test 3, with the addition of dilution air, was calculated to be 403,843 acfm. PM emissions from the baghouse exhaust at Ervin Amasteel are still within the specified limits at this high flowrate, however it is impossible for the collection system to operate at this parameter.

For the Ervin Amasteel process, the collected process gas temperature fluctuates throughout the heat. Therefore, the difference in measured temperature between the baghouse inlet and outlet is primarily a function of the time period in which the temperatures were measured; it is not an indication of air dilution. For this reason, two emission rates are presented in the results table, the PM emission rate based on the:

- Measured gas flowrate, which is more representative of the actual emission rate.
- Adjusted gas flowrate using USEPA Method 5D, equation 5D-3.

The molecular weight of the exhaust gas is similar to that of ambient air containing a minor amount (less than 1%) of carbon dioxide.

7.2 Measured Air Pollutant Emission Rates

7.2.1 Particulate Matter Emissions and Opacity

The filterable particulate matter emission rate (lb/hr PM) for the baghouse exhaust was calculated based on the amount of dry stack gas metered through the sampling system, the laboratory results for PM recovered from the front half of the sampling train (filter and nozzle/ filter housing rinses) and the adjusted exhaust gas volumetric flowrate.

The total particulate matter emission rate (PM_{10} lb/hr) in the baghouse exhaust was calculated based on the amount of dry stack gas metered through the sampling system, the laboratory results for filterable and condensable particulate matter recovered from the sampling train, and the adjusted exhaust gas volumetric flowrate.

The testing did not include particle size analysis. Therefore, the test results represent a worst-case scenario for PM_{10} mass emissions (all recovered PM was considered to be PM_{10}).

The baghouse exhaust gases exhibited no observable opacity (0%) during the observation period.

Test results in Table 7.1 indicate that Ervin Amasteel is operating within the following PM emission limits specified in PTI 53-12B, ROP-B1754-2013 and/or 40 CFR Part 63 Subpart YYYYY:

- 0.0052 grains PM per dry standard cubic foot (gr/dscf),
- 5.9 lb PM/hr, and
- 5.9 lb PM_{10}/hr.

7.2.2 Carbon Monoxide Emissions

The CO mass emission rate was calculated based on the measured CO concentration in the baghouse inlet duct and the inlet duct volumetric flowrate. The CO emission rate per ton of steel tapped (lb/ton) was calculated based on the weight of scrap that was tapped during a period of time and the elapsed time for each included heat.

The average CO concentration for each test period was between 13 and 24 ppmvd, with concentration spikes up to around 80ppm. The CO instrument was calibrated with a span of 200.1 ppm (bottle value) and two mid cuts were conducted during each system bias check at 120.1 ppm and 60 ppm to demonstrate instrument linearity. Drift correction was performed at the 60 ppm cut due to being closest to the concentration average.

Test results in Table 7.1 indicate that Ervin Amasteel is operating within the following CO emission limits set forth in PTI 53-12B and ROP-B1754-2013:

- 90 lb CO/hr on a three hour average,
- 3.0 lb CO/ton of melted steel, and
- 322.5 tons CO/year.

7.3 Variations from Normal Sampling Procedures or Operating Conditions

The testing was performed as described in the approved test protocol and specified USEPA test methods. During the test event the processes were operated normally, at or near normal maximum achievable capacity.

Table 7.1 Measured particulate matter emissions and opacity from Baghouse-0009 exhaust

Test No. Test Date: Test Period:	**ErvinPM-1** 8/8/16 20:10-01:52	**ErvinPM-2** 8/9/16 20:00-01:06	**ErvinPM-3** 8/10/16 01:38-06:27	**Three Test Average**
Exhaust Gas Properties				
Exhaust gas flow[1] (dscfm)	194,886	182,371	181,925	186,394
Exhaust gas flow[2] (dscfm)	194,886	207,767	303,105	235,253
Moisture (% H_2O)	2.2	2.6	2.8	2.5
CO_2 (%)	0.25	0.3	0.3	0.3
O_2 (%)	20.7	20.6	20.6	20.6
Opacity				
Highest 6-minute average (%)	0.0			0.0
Filterable Emissions				
Sample volume (dscf)	188.0	178.1	177.0	181.1
PM catch primary filter (mg)	0.0	0.0	0.00	0.0
PM Catch acetone rinse (mg)	0.93	0.54	0.50	0.66
Total filterable catch (mg)	0.93	0.54	0.50	0.66
Emission factor (gr/dscf)	7.63E-05	4.68E-05	4.36E-05	5.66E-05
Emission Rate (lb/hr)	0.13	0.083	0.11	0.11
PM Permit Limit (lb/hr)				*5.9*
Condensable Emissions				
Sample volume (dscf)	188.0	178.1	177.0	181.1
CPM catch inorganic (mg)	2.2	3.3	4.8	3.4
CPM catch organic (mg)	2.1	1.9	1.9	2.0
Total CPM catch (mg)	2.3	3.2	4.6	3.4
CPM emission rate (lb/hr)	0.31	0.50	1.1	0.62
Total PM Emissions (as PM10)				
Total Emission Rate[1] (lb/hr)	0.44	0.51	0.70	0.55
Total Emission Rate[2] (lb/hr)	0.44	0.58	1.16	0.73
Total PM Permit Limit (lb/hr)				*5.9*
Total Emission Rate (gr/dscf)	2.6E-04	3.2E-04	4.5E-04	3.4E-04
Total PM Permit Limit (gr/dscf)				*0.0052*

1. Based on measured gas flowrate to baghouse
2. Based on adjusted flowrate using USEPA Method 5D, equation 5D-3.

Table 7.2 Measured carbon monoxide emissions from Baghouse-0009 exhaust

Test No.	**CO-1**	**CO-2**	**CO-3**	**Three**
Test Date:	8/8/16	8/8/16	8/8/16	**Test**
Test Period:	19:15-20:40	21:00-22:28	23:11-00:32	**Average**
Exhaust Gas Properties				
Exhaust gas flow (dscfm)	178,846	189,078	213,896	193,940
Moisture (% H_2O)	2.3	1.8	2.6	2.3
CO_2 (%)	0.25	0.31	0.28	0.28
O_2 (%)	20.7	20.2	20.4	20.4
Tons scrap tapped per hour (T/hr)	23.2	27.7	30.1	27.0
Carbon Monoxide Emissions				
Concentration (ppmvd)	11.8	24.6	13.8	16.8
Emission Rate (lb/hr)	9.2	20.3	12.9	14.2
Emission Rate Permit Limit (lb/hr)				*90.0*
Emission Rate (ton/yr)	40.3	89.1	56.6	62.01
Emission Rate Permit Limit (ton/yr)				*322.5*
Emission Factor (lb CO/ton tapped)	0.40	0.74	0.43	0.52
Emission Factor Limit				*3.0*