Derenzo and Associates, Inc.
Environmental Consultants

EMISSION TEST REPORT

Title	Compliance Test Report for Verification of Carbon Monoxide Emissions from an Electric Arc Furnace
Report Date	July 15, 2014
Test Date(s)	June 17-18, 2014

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

Facility Permit Information	
State Registration No.: B1754	ROP No.: MI-ROP-B1754-2013

Testing Contractor	
Company	Derenzo and Associates, Inc.
Mailing Address	39395 Schoolcraft Road Livonia, Michigan 48150
Phone	(734) 484-3880
Project No.	1404009

DEQ

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 Amasteel County: Lenawee

Source Address: 915 Tabor Street 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 ______ To ______

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

Test report for the verification of carbon monoxide emission rates from the electric arc furnace fume collection, prepared by Derenzo and Associates, Inc., dated July 14, 2014.

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

Name of Responsible Official (print or type)	Title	Phone Number
James Lemon	Plant Manager	517-265-6118

Signature of Responsible Official: [signature]

Date: 7/14/14

* Photocopy this form as needed.

EQP 5736 (Rev 11-04)

COMPLIANCE TEST REPORT
FOR THE
VERIFICATION OF
CARBON MONOXIDE EMISSIONS FROM AN
ELECTRIC ARC FURNACE

1.0 INTRODUCTION

Ervin Amasteel, a division of Ervin Industries, Inc., State Registration Number (SRN) B1754 retained Derenzo and Associates, Inc. to conduct testing for the determination of carbon monoxide (CO) emissions from the exhaust of the Electric Arc Furnace (EAF) at the Ervin Amasteel Tabor Street facility located in Adrian, Michigan.

Testing was conducted following the provisions specified in the Michigan Department of Environmental Quality, Air Quality Division (MDEQ-AQD) Renewable Operating Permit (ROP) No. MI-ROP-B1754-2013. Section No. 5 for Emission Unit EU-0009 of the ROP requires Ervin Amasteel to verify carbon monoxide (CO) emission rates for the EAF.

The compliance testing was performed by Derenzo and Associates, Inc. (Derenzo and Associates), an environmental consulting and testing company founded in 1989. Derenzo and Associates representatives Michael Brack, Daniel Wilson, and Jason Logan performed the field sampling and measurements June 17-18, 2014.

The exhaust gas sampling and analysis was performed using procedures specified in the Test Plan dated May 16, 2014.

Appendix A contains a copy of the test plan approval letter.

Questions regarding this emission test report should be directed to:

Mr. Michael Brack, QSTI
Sr. Project Manager
Derenzo and Associates, Inc.
39395 Schoolcraft Rd.
Livonia, MI 48150
(734) 464-3880

Mr. Richard Payne
Plant Engineer
Ervin Industries, Amasteel Division
915 Tabor Street
Adrian, MI 49221
(517) 265-6118

RECEIVED
JUL 16 2014
AIR QUALITY DIV.

2.0 SUMMARY OF TEST RESULTS

Performance testing for the exhaust of the enclosure that is used to control the emissions from the EAF verified that the unit operated in compliance with the emission limits specified in ROP No. MI-ROP-B1754-2013.

The exhaust from the EAF enclosure was monitored for three (3) test periods during which the CO, oxygen (O_2) and carbon dioxide (CO_2) exhaust gas concentrations were measured using instrumental analyzers. Exhaust gas moisture content was determined by dry bulb/wet bulb methodology. Velocity pressure measurements were performed near the beginning and ending of each test using a Pitot tube for exhaust gas velocity and volumetric flowrate calculations. The testing was performed for the entire duration of three separate heat cycles.

Table 2.1 presents a summary of the measured CO emission rates for Ervin Amasteel.

Table 2.1 Summary of measured CO emission rates for the EAF

Test ID	Test Duration (minutes)	Total Metal Melted (tons)	Measured CO Emission Rates (lb/hr)	Measured CO Emission Factors (lb/ton melted)
Test No. 1	85	40.7	5.80	0.20
Test No. 2	178*	41.0	26.59	1.92
Test No. 3	89	40.8	15.01	0.55
Three Test Average	117	40.8	15.80	0.89
Permitted Limits		-	*90.0*	*3.00*

*Intermittent process interruptions lengthened the sampling time.

3.0 SOURCE DESCRIPTION

3.1 General Process Description

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 bringing it to a molten state, which meets quality standards of the facility. When in a molten state, approximately one percent (%) by weight of carbon, manganese and silicon and a fraction of a percent of aluminum are added as alloys. The molten metal is then poured into a ladle and the melt process is repeated. The facility performs the melt cycles, called "heats," during the evening (off peak) hours.

3.2 Rated Capacities, Type and Quantity of Raw Materials Used

Nominal quantity of steel scrap consumed is approximately 30 tons per hour (TpH). The furnace vessel itself is lined with a consumable refractory material, earthen in nature.

Each heat uses approximately 80,000 pounds (lbs) of scrap material, and is melted to a temperature of approximately 3,100 degrees Fahrenheit (°F), prior to being poured into the ladle.

3.3 Emission Control System Description

Emissions from melting the scrap metal are directed to a large positive-pressure fabric-filter baghouse prior to discharge to the atmosphere. The furnace emissions are captured using an enclosure that is connected to a 'dirty' air fan that dicharges to a water-cooled duct system and terminates into dry ducting. The captured furnace fume gas is combined with fugitive emissions captured from furnace charging, tapping, and casting operations, which lowers the gas temperature, and directed to the baghouse system.

The emission test sampling was conducted at a point prior to (or upstream) of the baghouse fan. Precautions were made to assure that measurements are not affected by the potential dilution effect of the negative pressure (vacuum) at the sampling location.

The emission collection system has a maximum rated capacity of 293,000 actual cubic feet per minute (acfm) at 275°F. The rated particulate removal efficiency of the fabric filter baghouse is 99.83 %.

3.4 Process Operating Conditions During the Compliance Testing

During the compliance test program the three-test average final melt weight of the metal processed in the EAF was 40.8 tons per heat. The three-test average heat time was 117 minutes.

Appendix B provides operating records for the EAF.

4.0 <u>SAMPLING AND ANALYTICAL PROCEDURES</u>

A test plan for the compliance testing was prepared by Ervin Amasteel and Derenzo and Associates and reviewed by the MDEQ-AQD. This section provides a summary of the sampling and analytical procedures that were used during the test and presented in the test plan.

4.1 Sampling Locations (USEPA Method 1)

The location of the sample ports meets the USEPA Method 1 criteria for a representative sample location. The inner diameter of the duct is 113.5 inches. The duct is equipped with two (2) 4.75 inch sample ports, opposed 90°, that provided a sampling location 1,200 inches (10.57 duct diameters) downstream and 216 inches (1.90 duct diameters) upstream from any flow disturbance.

Velocity pressure traverse locations for the sampling points were determined in accordance with USEPA Method 1.

Appendix C provides diagrams of the performance test sampling location.

4.2 Exhaust Gas Velocity Determination (USEPA Method 2)

Exhaust gas velocity pressure and temperature were measured at the sampling location near the beginning and ending of each one-hour sampling period in accordance with USEPA Method 2. An S-type Pitot tube connected to a red-oil manometer was used to determine velocity pressure. Gas temperature was measured using a K-type thermocouple mounted to the Pitot tube. The Pitot tube and connective tubing were periodically leak-checked to verify the integrity of the measurement system.

The absence of cyclonic flow for each sampling location was verified using the S-type Pitot tube and oil manometer. The Pitot tube was positioned at several representative velocity traverse points with the planes of the face openings of the Pitot tube perpendicular to the stack cross-sectional plane. The Pitot tube was then rotated to determine the null angle (rotational angle as measured from the perpendicular, or reference, position at which the differential pressure is equal to zero).

4.3 Exhaust Gas Molecular Weight Determination (USEPA Methods 3A and 4)

CO_2 and O_2 content in the exhaust gas stream was measured continuously throughout each test period in accordance with USEPA Method 3A. The exhaust gas CO_2 and O_2 contents were monitored using a Servomex 4900 analyzer that utilizes non-dispersive infrared (NDIR) technology to monitor CO_2 concentrations and a paramagnetic sensor to monitor O_2 concentrations.

During each pollutant sampling period, a continuous sample of the exhaust gas stream was extracted from the duct using a stainless steel probe connected to a Teflon® heated sample line. The sampled gas was conditioned by removing moisture prior to being introduced to the analyzer; therefore, measurement of O_2 and CO_2 concentrations correspond to standard dry gas conditions. The instrument was calibrated using appropriate calibration gases to determine accuracy and system bias (described in Section 4.5.1 of this document).

Appendix D presents gas sampling procedures and diagrams for the USEPA Method 3A sampling train.

Moisture determinations for the exhaust gas stream was determined using the USEPA Method 4 approximation technique consisting of wet bulb-dry bulb temperature measurements using a type-K thermocouple and calibrated digital pyrometer. The moisture content is calculated using a vapor pressure equation and verified against a psychometric chart.

Appendix F presents calculations for moisture content determination.

4.4 Pollutant Concentration Measurements (USEPA Method 10)

CO pollutant concentration in the exhaust from the EAF was determined using a Fuji Model ZRF NDIR CO analyzer.

Three (3) sampling periods were performed for the EAF exhaust. Each sampling period encompassed an entire heat (melting cycle). Throughout each test period, a continuous sample of the EAF exhaust gas was extracted from the exhaust duct using the Teflon® heated sample line and gas conditioning system described Appendix D of this document, and delivered to the instrumental analyzers. The sample probe is moved to three positions across the diameter of the duct to provide a representative sample of the exhaust gas.

Instrument response for each analyzer was recorded on an ESC Model 8816 data logging system that monitored the analog output of the instrumental analyzers continuously and logged data as one-minute averages. Prior to, and at the conclusion of each test, the instruments were calibrated using appropriate upscale calibration and zero gas to determine analyzer calibration error and system bias (described in Section 4.5.1 of this document).

Sampling times were recorded on field data sheets.

Since the static pressure within the duct was slightly less than atmospheric pressure, the sample port openings were covered, as much as possible, in order to minimize the introduction of ambient air.

Appendix D presents gas sampling procedures and diagrams for the USEPA Method 10 sampling train.

4.5 Instrumental Analyzer Quality Assurance Verification

4.5.1 Instrument Calibration and System Bias Checks

At the beginning of the testing program, initial three-point instrument calibrations were performed 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 appropriate 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 verifying 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.

4.5.2 Sampling System Response Time Determination

The response time of the sampling system was determined prior to the compliance test program by introducing upscale gas and zero gas, in series, into the sampling system using a tee connection at the base of the sample probe. The elapsed time for the analyzer to display a reading of 95% of the expected concentration was determined using a stopwatch.

The Servomex 4900 CO_2 analyzer exhibited the longest system response time at 60 seconds. Results of the response time determinations were recorded on field data sheets. Each test period commenced once the sample probe had been in place for at least twice the longest system response time.

5.0 TEST RESULTS AND DISCUSSION

5.1 Operating Conditions During the Compliance Test

During the compliance test program the three-test average final melt weight of the metal processed in the EAF was 40.8 tons per heat. The three-test average heat time was 117 minutes.

5.2 Air Pollutant Sampling Results

The gas stream exhausted from the EAF (prior to the baghouse) was sampled for three (3) separate heat test periods (tap-to-tap) during the compliance testing performed June 17-18, 2014. Instrumental analyzers were used to measure concentrations of CO, O_2 and CO_2 in the EAF exhaust. Moisture content was determined by wet bulb-dry bulb temperature measurements and velocity pressure measurements were performed near the beginning and ending of each sampling period using a Pitot tube for exhaust gas velocity determination.

The average measured CO concentration in the EAF exhaust gas was 16.3 parts per million by volume, dry basis (ppmvd). Using the measured exhaust gas volumetric flowrate of 221,922 dry standard cubic feet per minute (dscfm), this results in an average calculated emission rate of 15.8 lb CO/hr and an emission rate of 0.89 lb CO/ton metal melted based on the average melt weight of 40.8 tons metal melted per heat.

Tables 5.1 presents measured gas conditions and pollutant emission rates for the EAF exhaust gas stream.

Appendix F provides field data and calculations for the EAF exhaust.

Appendix G provides raw instrumental analyzer response data for each test period.

5.3 Emission Compliance Determination

ROP No. MI-ROP-B1754-2013 issued to Ervin Amasteel specifies maximum allowable CO emission rates of 90.0 lb/hr and 3.0 lb/ton steel melted. Results of the test program verify compliance with the allowable CO emission rates.

5.4 Variations from Normal Sampling Procedures or Operating Conditions

The testing was performed in accordance with the Test Plan dated May 16, 2014 and specified USEPA test methods. All instrument calibrations and sampling period results satisfied the quality assurance verifications required by USEPA Methods 3A, 7E, and 10. No variations from the normal operating conditions occurred during the testing program.

Report Prepared By:

Daniel Wilson
Environmental Consultant

Reviewed By:

Robert Harvey, P.E.
General Manager

Table 5.1. Measured exhaust gas conditions and air pollutant emission rates for the EAF exhaust gas stream

Test No. Test date Test period (24-hr clock)	1 6/17/2014 1920-2045	2 6/17/2014 2105-0003	3 6/18/2014 0038-0207	Three-Test Average
Heat final melt weight (tons)	40.7	41.0	40.8	40.8
Melt cycle time (minutes)	85	178	89	117
Exhaust gas composition				
CO_2 content (% vol)	0.18	0.14	0.17	0.17
O_2 content (% vol)	20.9	20.9	20.8	20.9
Moisture (% vol)	1.6	1.6	2.1	1.8
Exhaust gas flowrate (dscfm)	220,643	219,584	225,539	221,922
Carbon monoxide emission rates				
CO conc. (ppmvd)	6.0	27.7	15.2	16.3
CO emissions (lb/hr) †	5.80	26.6	15.0	15.8
CO emissions (lb/ton melted) †	0.20	1.92	0.55	0.89

† The allowable CO emissions specified in ROP No. MI-ROP-B1754-2013 are 90.0 lb CO/hr and 3.00 lb CO/ton steel melted.