BTEC Inc.

Line 6 DC-67 Emissions Test Report

Prepared for:

General Motors

Saginaw, Michigan

GM SMCO
1629 N. Washington St.
Saginaw, Michigan

Project No. 14-4533.01
August 13, 2014

BT Environmental Consulting, Inc.
4949 Fernlee Avenue
Royal Oak, Michigan 48071
(248) 548-8070

BTEC Inc.

Executive Summary

BT Environmental Consulting, Inc. (BTEC) was retained by General Motors LLC (GM) to conduct a compliance evaluation of particulate matter (PM) emission rates from the EU-6ML-DC-67 exhaust stack associated with the with Mold Line 6 at the GM Saginaw Metal Casting Operations (SMCO) located in Saginaw, Michigan. Sampling was conducted on June 25th, 2014.

Testing consisted of triplicate 60-minute test runs. Sampling was performed utilizing United States Environmental Protection Agency (USEPA) test methods. The results of the emissions test program are highlighted by Table E-I.

Table E-I
Overall Results Summary
Sampling Dates: June 25, 2014

Source	Pollutant*	Average Test Result	Emission Limit (PM_{10})
EU-6ML-DC-67	PM	0.93 lbs/hr	2.1 lbs/hr
		0.004 lb/1000 exhaust gas, dry	0.01 lb/1000 exhaust gas, dry

*PM is representative of PM_{10}.

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: GM LLC Saginaw Metal Casting Operations — County: Saginaw

Source Address: 1629 N. Washington — City: Saginaw

AQD Source ID (SRN): B1991 — ROP No.: 2009a — ROP Section No.: 1

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**

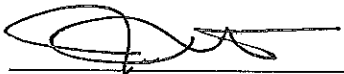
Reporting period (provide inclusive dates): From 8-22-2014 To 8-22-2014

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

EU-6ML-DC-67 Stack Test Certification, Project No. 14-4533.01

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

John Lancaster	Plant Manager	989-757-1432
Name of Responsible Official (print or type)	Title	Phone Number



Signature of Responsible Official — Date: 8/22/14

* Photocopy this form as needed.

EQP 5736 (Rev 11-04)

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1. Introduction

BT Environmental Consulting, Inc. (BTEC) was retained by General Motors LLC (GM) to conduct a compliance evaluation of particulate matter (PM) emission rates from the EU-6ML-DC-67 exhaust stack associated with the with Mold Line 6 at the GM Saginaw Metal Casting Operations (SMCO) located in Saginaw, Michigan. Sampling was conducted on June 25th, 2014.

The Air Quality Division (AQD) of Michigan's Department of Environmental Quality has published a guidance document entitled "Format for Submittal of Source Emission Test Plans and Reports" (December 2013). The following is a summary of the emissions test program and results in the format suggested by the aforementioned document.

1.a Identification, Location, and Dates of Test

The source tested is located at the GM Saginaw Metal Casting Operations located in Saginaw, Michigan. Testing on all sources was conducted June 25th, 2014.

1.b Purpose of Testing

The purpose of the testing is to demonstrate compliance with Michigan Renewable Operating Permit MI-ROP-B1991-2009a.

1.c Source Description

EU-6MLDC-67 is associated with aluminum degate on Mold Line 6 (Cells #1 - #5, Unit #9 secondary scalping screen located in the basement).

1.d Test Program Contact

The contact for information regarding the test program as well as the test report is:

Jennifer Tegen
GECS - Facility Air Compliance & Permit
GM Warren Technical Center
30200 Mound Road - Bldg 1-11, Mailcode: 480-111-1N
Warren, MI 48090-9010
Phone: 810-706-1319
jennifer.tegen@gm.com

Renee M Mietz, CHMM
Sr. Environmental Project Engineer
Saginaw Metal Casting Operations
1629 North Washington Avenue
Mailcode: 486-629-011
Saginaw, Michigan 48605
Phone: 313-608-1169
renee.mietz@gm.com

1.e Test Personnel

Names and affiliations for personnel who were present during the testing program are summarized by Table 2.

Table 2
Test Personnel

Name	Affiliation
Jennifer Tegen	GM-WTC
Renee Mietz	GM-SMCO
Barry Boulianne	BTEC
Paul Molenda	BTEC

2. Summary of Results

Sections 2.a through 2.d summarize the results of the emissions test program.

2.a Operating Data

Process and control equipment operating data relevant to the emissions test program is provided in Appendix A.

2.b Applicable Permit

The emission units tested for Mold Line 6 are included in Renewable Operating Permit (ROP) No. MI-ROP-B1991-2009a.

2.c Results

The results of the emissions test program are summarized by Table 1. Detailed results for are summarized in Tables 4.

2.d Emission Regulation Comparison

The Emission regulations are summarized by the following table.

Table 3
MI-ROP-B1991-2009a Emission Limitations

Emission Unit	Pollutant	Permit Limit
EU-6ML-DC-67	PM_{10}	0.01 lb / 1,000 lb of exhaust gas, dry
		2.1 lb / hr

3. Source Description

Sections 3.a through 3.e provide a detailed description of the process.

3.a Process Description

The Mold Line 6 process generates aluminum engine heads. The mold line activity includes molten aluminum, generation of a greensand mold, pouring, cooling, shakeout, or removal of the casting, and the finishing operations. To generate the casting package, a two part resin is used to coat sand and molded sand grains are packed together into a form (a core) and cured with an amine catalyst, DMIPA. DMIPA is scrubbed out of the air with H_2SO_4. At the same time, sand, clay and water are 'mulled' together (greensand as there are no chemical binders) and then packed into a large base and a cover mold that will form the outside of the casting, it is called a 'greensand' mold. The core is set into the "greensand" molds, the cover, made of greensand, and is placed on top. The cover has a pouring cup, which acts as a funnel for the aluminum. Aluminum is melted to 1370-1450° F and poured into the mold to create the casting. The casting is cooled and the loose sand is shaken from the part. The (heads) parts are then processed through a heat treat oven, quenched with water to set up the microstructure of the key places on the casting and excess sand is cleaned from the ports using a water blast. Then the parts have an initial machining phase prior to inspection and shipping.

3.b Process Flow Diagram

Due to the simplicity of the Mold Line 6 operations, a process flow diagram is not necessary.

3.c Raw and Finished Materials

The raw materials used in the Mold Line 6 processes include molten aluminum, sand, and resin. See section 3.a.

3.d Process Capacity

Mold Line 6 has a current target production rate of 180 molds/hr.

3.e Process Instrumentation

Process instrumentation relevant to the emissions test program includes monitoring the water flow and pressure drop associated with the wet scrubbers

4. Sampling and Analytical Procedures

Sections 4.a through 4.d provide a summary of the sampling and analytical procedures used during the testing.

4.a Sampling Train and Field Procedures

Sampling and analytical methodologies for the emissions test program can be separated into two categories as follows:

(1) Measurement of exhaust gas velocity, molecular weight, and moisture content;
(2) Measurement of exhaust gas filterable PM concentration;

Sampling and analytical methodologies by category are summarized below.

Exhaust Gas Velocity, Molecular Weight, and Moisture Content

Stack gas velocity traverses were conducted in accordance with the procedures outlined in Method 1 and Method 2. S-type pitot tubes with thermocouple assemblies, calibrated in accordance with Method 2, Section 4.1.1, were used to measure exhaust gas velocity pressures (using a manometer) and temperatures during testing. The S-type pitot tube dimensions outlined in Sections 2-6 through 2-8 were within specified limits, therefore, a baseline pitot tube coefficient of 0.84 (dimensionless) was assigned. A diagram of the sample points is provided in Figure 1.

Cyclonic flow checks were performed at each sampling location. The existence of cyclonic flow is determined by measuring the flow angle at each sample point. The flow angle is the angle between the direction of flow and the axis of the stack. If the average of the absolute values of the flow angles is greater than 20 degrees, cyclonic flow exists. The null angle was determined to be less than 20 degrees at each sampling point.

The Molecular Weight of the gas stream was evaluated according to procedures outlined in Title 40, Part 60, Appendix A, Method 3A. The O_2/CO_2 content of the gas stream was measured using a Fyrite combustion analyzer.

Exhaust gas was extracted as part of the sampling train. Exhaust gas moisture content was then determined gravimetrically.

Filterable Particulate Matter – Method 17

40 CFR 60, Appendix A, Method 17, *"Determination of Particulate Emissions from Stationary Sources"* was used to measure PM concentrations and calculate PM emission rates (see Figure 2 for a schematic of the sampling train). Triplicate 60-minute test runs were conducted on each source.

BTEC's Nutech® Model 2010 modular isokinetic stack sampling system (USEPA Method 17) consisted of (1) a stainless-steel nozzle, (2) an in stack stainless-steel filter housing with a pre weighed 47-mm diameter filter, (3) a steel probe, (4) a set of four Greenburg-Smith (GS) impingers with the first modified and second standard GS impingers each containing 100 ml of deionized water, and with a third dry modified GS impinger and a fourth modified GS impinger containing approximately 300 g of silica gel desiccant, (5) a length of sample line, and (6) a Nutech® control case equipped with a pump, dry gas meter, and calibrated orifice. A schematic drawing of the Method 17 particulate sample train is provided as Figure 2.

A sampling train leak test was conducted before and after each test run. After completion of the final leak test for each test run, the filter was recovered, and the nozzle and the front half of the filter holder assembly were brushed and triple rinsed with acetone. The acetone rinses were collected in a pre-cleaned sample container.

BTEC labeled each container with the test number, test location, and test date, and marked the level of liquid on the outside of the container. In addition, blank samples of the acetone and filter were collected. BTEC personnel carried all samples to BTEC's laboratory (for filter and acetone gravimetric analysis) in Royal Oak, Michigan.

4.b Recovery and Analytical Procedures

Descriptions of the recovery procedures are provided in section 4.a for each sampling method.

4.c Sampling Ports

A diagram of the stack showing sampling ports are included as Figure 1.

4.d Traverse Points

A diagram of the stack showing sampling ports are included as Figure 1.

5. Test Results and Discussion

Sections 5.a through 5.k provide a summary of the test results.

5.a Results Tabulation

The overall results of the emissions test program are summarized by Table 1. Emission limits are summarized by Table 3. Detailed results for the emissions test program are summarized by Table 4.

5.b Discussion of Results

The average results of the particulate matter emissions of EU-6ML-DC-67 are below the corresponding limits.

Table 1
Overall Results Summary
Sampling Dates: June 25, 2014

Source	Pollutant*	Average Test Result	Emission Limit
EU-6ML-DC-67	PM	0.93 lbs/hr	2.1 lbs/hr
		0.004 lb/1000 exhaust gas, dry	0.01 lb/1000 exhaust gas, dry

*PM is representative of PM10.

5.c Sampling Procedure Variations

There were no sampling variations used during the emission compliance test program.

5.d Process or Control Device Upsets

No process or control device upsets occurred during the emissions test program.

5.e Control Device Maintenance

There was no control equipment maintenance performed during the emissions test program.

5.f Audit Sample Analyses

Audit samples were not analyzed as part of this emissions test program.

5.g Calibration Sheets

Calibration documents are provided as Appendix B.

5.h Sample Calculations

Sample calculations are provided as Appendix C.

5.i Field Data Sheets

Field data sheets are provided in Appendix D.

5.j Laboratory Data

Laboratory analysis is provided in Appendix E.

Tables

Table 1
Overall Results Summary
Sampling Dates: June 25, 2014

Source	Pollutant*	Average Test Result	Emission Limit
EU-6ML-DC-67	PM	0.93 lbs/hr	2.1 lbs/hr
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Table 3
MI-ROP-B1991-2009a Emission Limitations

Emission Unit	Pollutant	Permit Limit
EU-6ML-DC-67	PM_{10}	0.01 lb / 1,000 lb of exhaust gas, dry
		2.1 lb / hr

Table 4
EU-6ML-DC-67 Particulate Matter Emission Rates

Company	**GM SMCO**			
Source Designation	**DC 67**			
Test Date	**6/25/2014**	**6/25/2014**	**6/25/2014**	
Meter/Nozzle Information	P-1	P-2	P-3	Average
Meter Temperature Tm (F)	69.2	76.5	76.0	73.9
Meter Pressure - Pm (in. Hg)	29.5	29.4	29.4	29.4
Measured Sample Volume (Vm)	38.8	38.0	36.6	37.8
Sample Volume (Vm-Std ft3)	38.2	37.0	35.6	36.9
Sample Volume (Vm-Std m3)	1.08	1.05	1.01	1.05
Condensate Volume (Vw-std)	0.943	0.990	0.849	0.927
Gas Density (Ps(std) lbs/ft3) (wet)	0.0739	0.0738	0.0739	0.0738
Gas Density (Ps(std) lbs/ft3) (dry)	0.0745	0.0745	0.0745	0.0745
Total weight of sampled gas (m g lbs) (wet)	2.89	2.80	2.69	2.80
Total weight of sampled gas (m g lbs) (dry)	2.85	2.76	2.65	2.75
Nozzle Size - An (sq. ft.)	0.000173	0.000173	0.000173	0.000173
Isokinetic Variation - I	100.0	100.1	99.7	99.9
Stack Data				
Average Stack Temperature - Ts (F)	70.5	74.6	76.0	73.7
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	28.6	28.6	28.6	28.6
Stack Gas Specific Gravity (Gs)	0.987	0.986	0.987	0.987
Percent Moisture (Bws)	2.41	2.61	2.33	2.45
Water Vapor Volume (fraction)	0.0241	0.0261	0.0233	0.0245
Pressure - Ps ("Hg)	28.3	28.3	28.3	28.3
Average Stack Velocity -Vs (ft/sec)	66.9	65.3	63.1	65.1
Area of Stack (ft2)	13.1	13.1	13.1	13.1
Exhaust Gas Flowrate				
Flowrate ft^3(Actual)	52,537	51,266	49,569	51,124
Flowrate ft^3 (Standard Wet)	49,438	47,870	46,167	47,825
Flowrate ft^3 (Standard Dry)	48,248	46,622	45,092	46,654
Flowrate m^3 (standard dry)	1,366	1,320	1,277	1,321
Total Particulate Weights (mg)*				
Nozzle/Probe/Filter	7.0	4.6	5.1	5.6
Total Particulate Concentration*				
lb/1000 lb (wet)	0.005	0.004	0.004	0.004
lb/1000 lb (dry)	0.005	0.004	0.004	0.004
mg/dscm (dry)	6.5	4.4	5.1	5.3
gr/dscf	0.0028	0.0019	0.0022	0.0023
Total Particulate Emission Rate*				
lb/ hr	1.17	0.77	0.86	0.93

*PM is representative of PM10.

Figures

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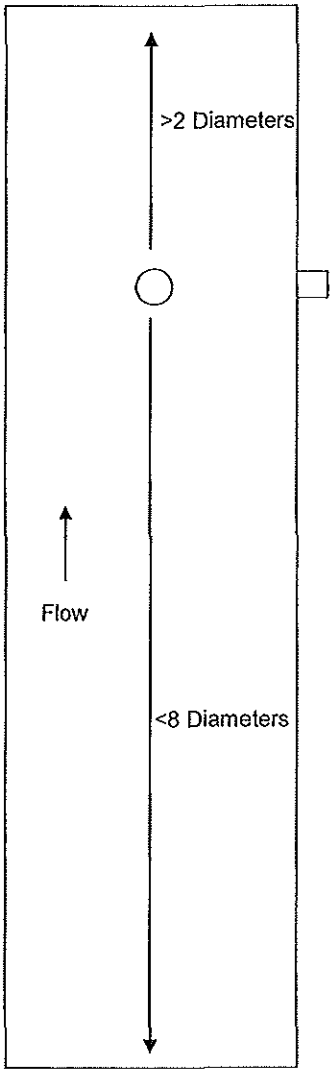
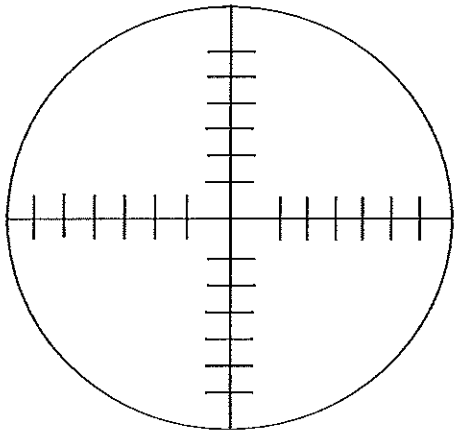
diameter = 49 inches





Not to Scale

Points	Distance "
1	1.0
2	3.3
3	5.8
4	8.7
5	12.3
6	17.4
7	31.6
8	36.8
9	40.3
10	43.2
11	45.7
12	48.0

Figure No. 1

Site: **EU-6ML-DC-67** **GM SMCO** **Saginaw, MI**	**Sampling Date:** **June 25, 2014**	**BT Environmental Consulting, Inc.** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**

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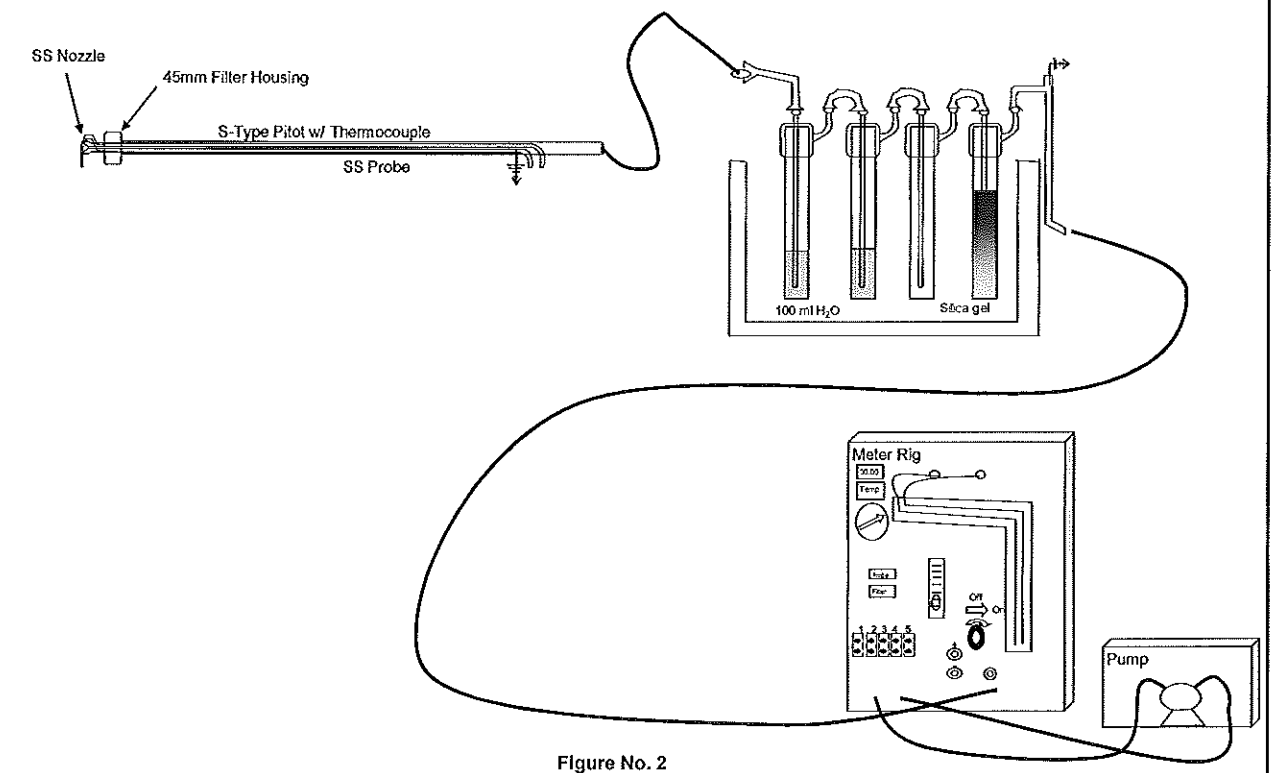

Figure No. 2

Site: USEPA Method 17 GM SMCO Saginaw, MI	Sampling Date: June 25, 2014	BT Environmental Consulting, Inc. 4949 Fernlee Avenue Royal Oak, Michigan 48073