BTEC Inc.

Hub Lines 4 and 5 RTO Destruction Efficiency Emissions Test Report

Prepared for:

Michigan Automotive Compressor, Inc.

2400 North Dearing Road
Jackson, Michigan

Project No. 13-4352.00
May 27, 2014

BT Environmental Consulting, Inc.
4949 Fernlee Avenue
Royal Oak, Michigan 48073
(248) 548-8070

EXECUTIVE SUMMARY

BT Environmental Consulting, Inc. (BTEC) was retained by Michigan Automotive Compressor, Inc. (MACI) to conduct a volatile organic compound (VOC) destruction efficiency (DE) emissions test program at the MACI facility in Jackson, Michigan. The purpose of the test program was to evaluate the performance of the Hub Lines 4 and 5 regenerative thermal oxidizer (RTO) for comparison to Permit No. 117-11B limitations. The emissions test program was conducted on April 15, 2014.

Sampling for VOC emissions followed USEPA Method 25A and triplicate 60-minute test runs. The results of the emission test program are summarized by Table E-I.

Table E-I
VOC Emission Rate Summary

Parameter	Value
Average RTO Inlet VOC Emission Rate	2.1 lbs/hr
Average RTO Outlet VOC Emission Rate	0.02 lbs/hr
Average RTO VOC Destruction Efficiency	99.0%

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1. Introduction

BT Environmental Consulting, Inc. (BTEC) was retained by Michigan Automotive Compressor, Inc. (MACI) to conduct a volatile organic compound (VOC) destruction efficiency (DE) emissions test program at the MACI facility in Jackson, Michigan. The purpose of the test program was to evaluate the performance of the Hub Lines 4 and 5 regenerative thermal oxidizer (RTO) for comparison to Permit No. 117-11B limitations. The emissions test program was conducted on April 15, 2014.

Sampling for VOC emissions followed USEPA Method 25A and utilized triplicate 60-minute test runs.

AQD 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

Sampling and analysis for the emission test program was conducted on April 15, 2014 at the MACI facility in Jackson, Michigan. The test program included evaluation of exhaust gas florwates and VOC concentrations at the inlet and outlet of the new Hub Line RTO.

1.b Purpose of Testing

The purpose of the test program was to evaluate the performance of the Hub Lines 4 and 5 regenerative thermal oxidizer (RTO) for comparison to Permit No. 117-11B limitations.

1.c Source Description

The emission units are designated "EUHubLine-04" and "EUHubLine-05" by AQD Permit to Install (PTI) No. 170-11B. EUHubLine-04 and EUHubLine-05 are hub spray adhesive and rubber vulcanization processes with volatile organic compound (VOC) emissions captured by permanent total enclosures and controlled by a single regenerative thermal oxidizer (RTO). EUHubLine-04, EUHubLine-05, and the associated RTO are new process equipment installations.

The basic hub line process sequence is as follows:

Stage 1: The exterior of the inner hub and interior of the hub plate is spray coated with Chemlok 205HC primer and conveyed through a drying oven. This process is exhausted through a manifolded duct to the new RTO.

Stage 2: The inner hub and hub plate is spray coated with Chemlok 6125 adhesive and conveyed through a drying oven. This process is exhausted through a manifolded duct to the RTO.

Stage 3: The two hub pieces are staged together on a jig, preheated and injected with rubber. There is no external exhaust from this booth.

Stage 4: The sub-assembly is loaded into the rubber spray coat booth and sprayed with rubber coating. This process exhausts to the RTO.

Stage 5: The rubber spray-coated parts are transported by conveyor to the 2nd vulcanizer where the rubber is processed through a curing oven. This process is exhausted to the RTO.

Coatings are thinned and equipment cleaned using either xylene or n-butyl acetate. Equipment cleaning is performed manually by wiping the applicators with solvent, however, this operation is performed infrequently.

1.d Test Program Contact

Mr. Donald McCulla
Michigan Automotive Compressor, Inc.
2400 North Dearing Road
Jackson, Michigan 48755
(586) 201-6056

Mr. Randal J. Tysar
BT Environmental Consulting, Inc.
4949 Fernlee Avenue
Royal Oak, Michigan 48073
(248) 548-8070

1.e Test Personnel

Names and affiliations for personnel who were present during the testing program are summarized by Table 1.

2. Summary of Results

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

2.a Operating Data

Operating data is included in Appendix D.

2.b Applicable Permit

Permit to Install No. 170-11B.

2.c Results

The overall results of the emission test program are summarized by Tables 2a and 2b (see Section 5.a).

2.d Emission Regulation Comparison

Permit No. 170-11B limits outlet VOC emissions to not more than 0.6 lbs/hr and requires a minimum VOC destruction efficiency of 95%. The average measured outlet VOC emission rate was 0.02 lbs/hr and the average VOC destruction efficiency was 99.0%.

3. Source Description

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

3.a Process Description

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3.b Raw and Finished Materials

Raw materials for the hub line process include metal parts as well as primer, adhesive, and rubber coatings. During the emissions test program, the Hub Line 4 process operated at a production rate of 281 parts per hour and the Hub Line 5 process operated at a production rate of 312 parts per hour. The primer application rate for each process line was approximately 1.72 pounds per hour, the adhesive application rate for each process line was approximately 1.72 pounds per hour, and the rubber coating application rate for each process line was approximately 0.34 pounds per hour.

3.c Process Capacity

Each Hub Line has the capacity to produce 405 parts per hour.

3.d Process Instrumentation

The relevant control device for this emissions test program is a RTO abatement system. The primary operating parameter relevant to operation of the RTO is operating temperature. The RTO operating temperature is required to be maintained at a minimum of 1,550°F as a 3-hour rolling average.

4. Sampling and Analytical Procedures

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

4.a Sampling Train and Field Procedures

Sampling train types used for the emissions test program can be separated into three categories as follows:

(1) Measurement of exhaust gas VOC concentration as propane,
(2) Measurement of exhaust gas VOC concentration as propane with simultaneous measurement of methane concentration for the purpose of subtracting methane from the total VOC measurement, and
(3) Measurement of exhaust gas flowrates.

Measurement of VOC Concentration

The VOC concentration of the exhaust gas at the RTO inlet was measured using a VIG Model 20 total hydrocarbon gas analyzer (or equivalent). A sample of the gas stream will be drawn through a stainless-steel probe with an in-line glass fiber filter to remove any particulate, and a heated Teflon® sample line before it enters the analyzer. Exhaust gas hydrocarbon concentration data will be recorded at 4-second intervals on an IBM PC equipped with data acquisition software.

Measurement of VOC Concentration Minus Methane

The VOC concentration of the exhaust gas and the methane concentration of the exhaust gas at the RTO outlet was simultaneously measured by a J.U.M. Model 109A hydrocarbon and methane gas analyzer (or equivalent). A sample of the gas stream was drawn through a stainless-steel probe with an in-line glass fiber filter to remove any particulate, and a heated Teflon® sample line before it enters the analyzer. The Model 109A utilizes two flame ionization detectors (FIDs) to report average total hydrocarbons concentration (as propane) and average methane concentration (as methane). Upon entry, the analyzer splits the gas stream. One FID ionizes all of the hydrocarbons in the gas stream sample into carbon, which is then detected as a concentration of total hydrocarbons. Using an analog signal, specifically voltage, the concentration of total hydrocarbons is then sent to the PC where recordings are taken at 4-second intervals to produce an average based on the overall duration of the test. This average is then used to determine the average VOC concentration reported as the calibration gas, propane, in equivalent units.

The second FID reports methane only. The sample enters a chamber containing a catalyst that destroys all of the hydrocarbons present in the gas stream other than methane. As with the total hydrocarbons sample, methane gas concentration data is recorded by the PC. The methane concentration (reported as methane) can then be converted to methane (reported as propane) by dividing the measured methane concentration by the analyzer's response factor. An emission rate, on a mass flowrate (lb/hr) basis can then be determined for the non-methane THC present at the outlet of each system.

Measurement of Exhaust Gas Flowrate

Exhaust gas flowrates at both sampling locations were measured using an "S-type" pitot tube and thermocouple assembly along with a manometer to measure exhaust gas velocity pressure and temperature. Exhaust gas molecular weight was determined using a set of Fyrite® combustion gas analyzers with a squeeze bulb. Exhaust gas moisture content was

measured using a single time at the inlet and outlet sampling locations utilizing the procedures of Method 4.

For analyzer calibrations, calibration gases were mixed to desired concentrations using an Environics Series 4040 Computerized Gas Dilution System. The Series 4040 consists of a single chassis with four mass flow controllers. The mass flow controllers are factory-calibrated using a primary flow standard traceable to the United States National Institute of Standards and Technology (NIST). Each flow controller utilizes an 11 point calibration table with linear interpolation, to increase accuracy and reduce flow controller nonlinearity. A field quality assurance check of the system will be performed pursuant to Method 205 by setting the diluted concentration to a value identical to a Protocol 1 calibration gas and then verifying that the analyzer response is the same with the diluted gas as with the Protocol 1 gas.

A schematic drawing of the VOC emissions sampling train is provided as Figure 3.

Sampling and analysis procedures followed the requirements codified at Title 40, Part 60, Appendix A of the Code of Federal Regulations (40 CFR 60, Appendix A):

Method 1	"Sample and Velocity Traverses for Stationary Sources" was used to locate the sampling locations and the velocity traverse points.
Method 2	"Determination of Stack Gas Velocity and Volumetric Flowrate" was used to measure exhaust gas velocity.
Method 3	"Gas Analysis for the Determination of Dry Molecular Weight (Fyrite Analysis)" was used to determine exhaust gas molecular weight.
Method 4	"Determination of Moisture Content in Stack Gases (Wet Bulb/Dry Bulb Method)" was used to determine exhaust gas moisture content.
Method 25A	"Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer" was used to measure exhaust gas VOC concentration.

4.b Recovery and Analytical Procedures

Recovery and analytical procedures were described in Section 4.a.

4.c Sampling Ports

Sampling ports are located at the RTO inlet and outlet sampling locations as illustrated by Figures 1 and 2.

4.d Traverse Points

Traverse points are located at the RTO inlet and outlet sampling locations as illustrated by Figures 1 and 2.

5. Test Results and Discussion

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

5.a Results Tabulation

The results of the emissions test program are summarized by Table 2.

5.b Discussion of Results

The results of the emissions test program are summarized by Table 2.

5.c Sampling Procedure Variations

The test program did not include any sampling procedure variations.

5.d Process or Control Device Upsets

No upset conditions occurred during testing.

5.e Control Device Maintenance

No maintenance was performed during the test program.

5.f Audit Sample Analyses

No audit samples were collected as part of the test program.

5.g Calibration Sheets

Relevant equipment calibration documents are provided as Appendix B.

5.h Sample Calculations

Sample calculations are provided in Appendix C.

5.i Field Data Sheets

Field documents relevant to the emissions test program are presented in Appendix A.

5.j Laboratory Data

No laboratory results are presented in this test program.

TABLES

Table 1
Test Personnel

Name and Title	Affiliation	Telephone
Mr. Randal Tysar Senior Project Manager	BTEC 4949 Fernlee Avenue Royal Oak, MI 48073	(269) 342-1100
Mr. Donald McCulla Environmental Specialist	Michigan Automotive Compressor, Inc. Safety, Hygiene, and Environment 2400 North Dearing Road Parma, MI 49269	(586) 201-6056
Mr. Matthew Young Project Manager	BTEC 4949 Fernlee Avenue Royal Oak, MI 48073	(248) 548-8070
Mr. Kenny Felder Environmental Technician	BTEC 4949 Fernlee Avenue Royal Oak, MI 48073	(248) 548-8070

Table 2
Hub Lines 4 and 5 RTO VOC Destruction Efficiency Testing
Michigan Automotive Compressor, Inc.
Parma, MI

Parameter	Run 1	Run 2	Run 3	Average
Sampling Time	4/15/2014	4/15/2014	4/15/2014	
Inlet Flowrate (scfm)	8,152	8,134	8,220	8,169
Outlet Flowrate (scfm)	8,916	8,716	8,885	8,839
Inlet THC Concentration (ppmv propane)	42.5	36.0	44.5	41.0
Inlet 1 VOC Concentration (ppmv, corrected as per USEPA 7E)	40.1	32.4	40.0	37.5
Inlet THC Mass Flowrate (lb/hr)	2.2	1.8	2.3	2.1
Outlet THC Concentration (ppmv propane)	0.23	0.46	0.88	0.52
Outlet THC Concentration (ppmv, corrected as per USEPA 7E)	0.23	0.47	0.59	0.43
Outlet CH4 Concentration (ppmv methane)	0.38	0.44	0.76	0.53
Outlet CH4 Concentration (ppmv, corrected as per USEPA 7E)	0.2	0.3	0.2	0.23
Outlet THC Concentration (- methane)	0.15	0.35	0.49	0.33
Outlet THC Mass Emission Rate (lb/hr)	0.01	0.02	0.03	0.02
THC Destruction Efficiency (%)	99.6	98.9	98.7	99.0

Inlet 1 VOC Correction			
Co	1.83	3.23	4.27
Cma	49.8	49.8	49.8
Cm	52.30	53.74	54.36

Outlet VOC Correction			
Co	0.01	0.02	0.33
Cma	14.9	14.9	14.9
Cm	14.60	14.21	14.29

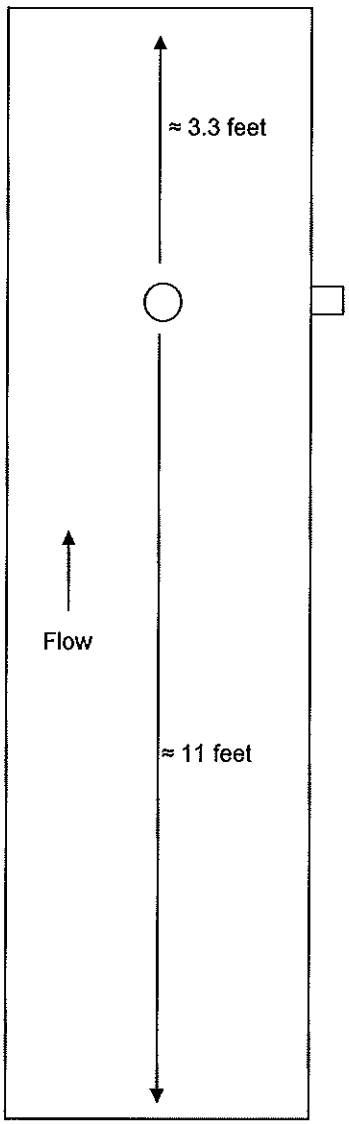
Outlet CH4 Correction			
Co	0.21	0.17	0.53
Cma	14.9	14.9	14.9
Cm	14.83	14.65	14.70

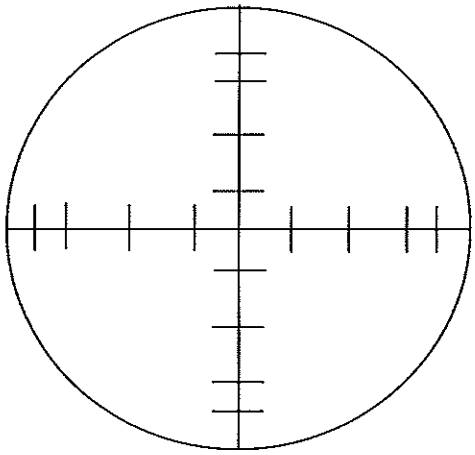
scfm: standard cubic feet per minute
ppmv: parts per million on a volume to volume basis
lb/hr: pounds per hour
THC: total hydrocarbons
MW: molecular weight
24.14: molar volume of air at standard conditions (70°F, 29.92" Hg)
35.31: ft^3 per m^3
453600: mg per lb
Equations
lb/hr = ppmv * MW/24.14 * 1/35.31 * 1/453,600 * scfm* 60

FIGURES

BTEC Inc.

diameter = 29.5 inches





Not to Scale

Points	Distance "
1	0.9
2	3.1
3	5.7
4	9.5
5	20.0
6	23.8
7	26.4
8	28.6

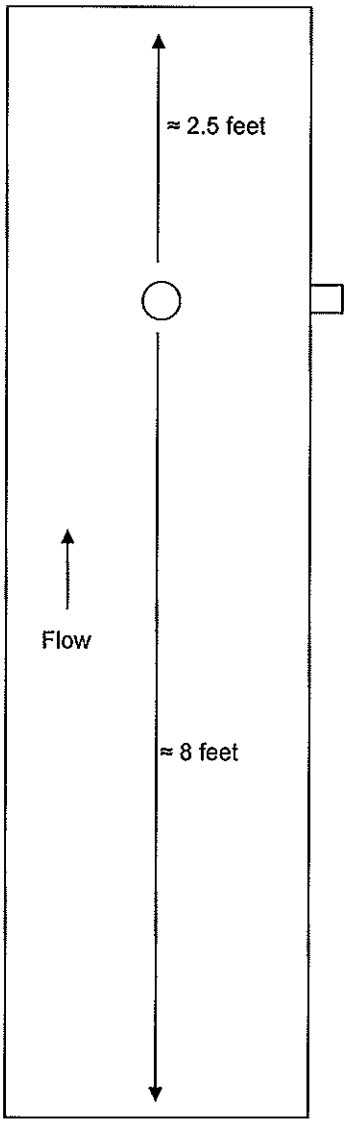
Figure 1

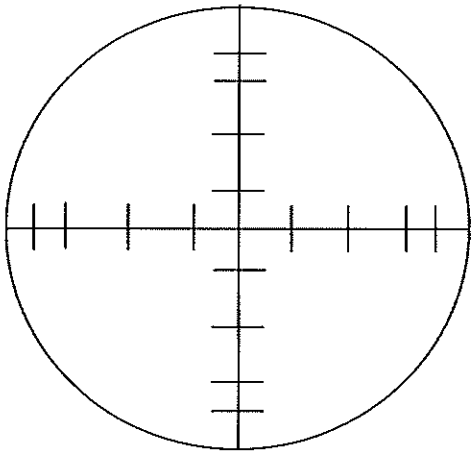
Site:	**Sampling Date:**
RTO Inlet	**April 15, 2014**
Michigan Automotive Compressor	
Jackson, Michigan	

BT Environmental Consulting, Inc.
4949 Fernlee Avenue
Royal Oak, Michigan 48073

BTEC Inc.

diameter = 33.5 inches





Not to Scale

Points	Distance "
1	1.1
2	3.5
3	6.5
4	10.8
5	22.7
6	27.0
7	30.0
8	32.4

Figure 2

Site:	**Sampling Date:**
RTO Outlet	**April 15, 2014**
Michigan Automotive Compressor	
Jackson, Michigan	

BT Environmental Consulting, Inc.
4949 Fernlee Avenue
Royal Oak, Michigan 48073

BTEC Inc.

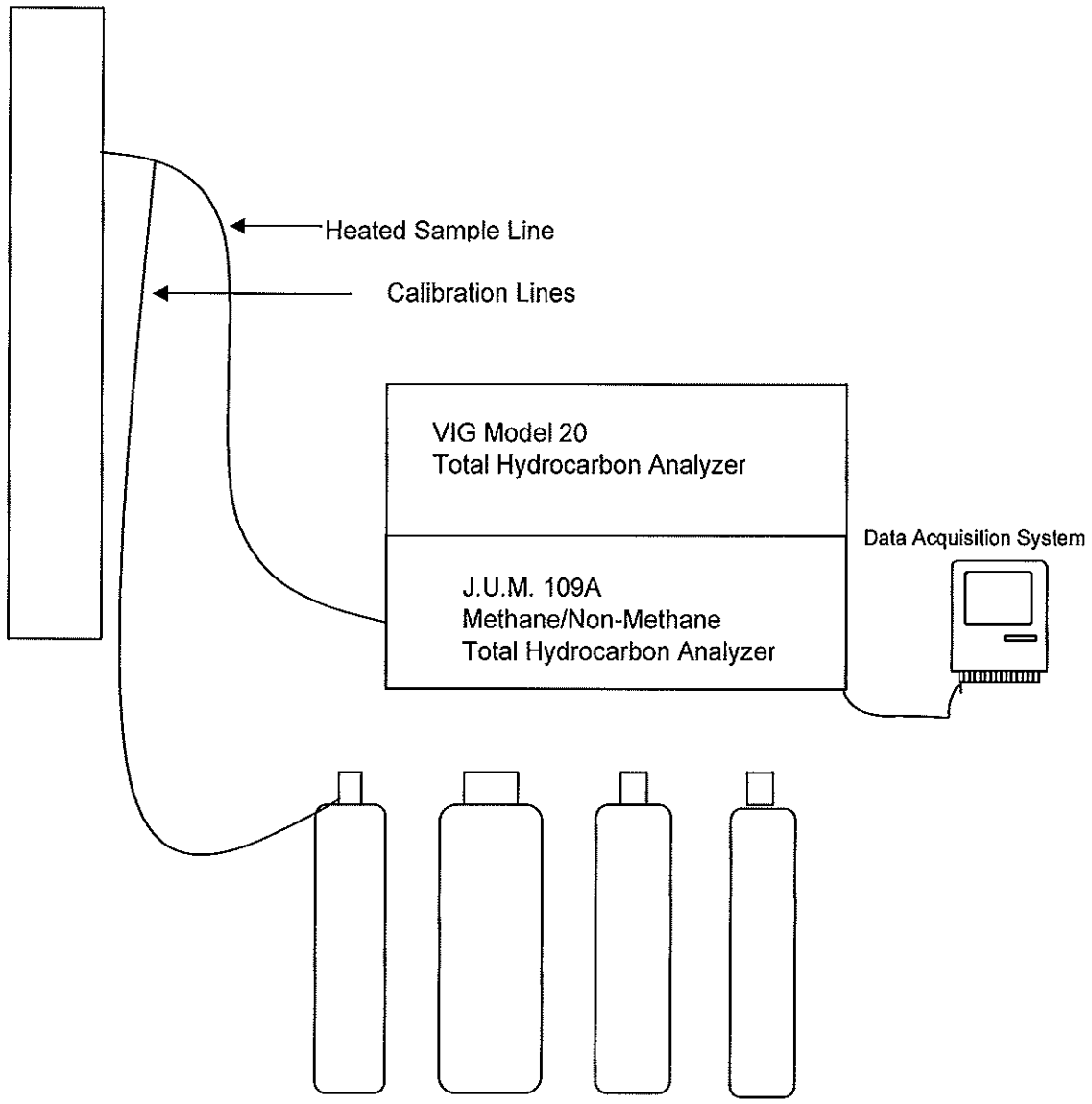


Figure 3

Site: **USEPA Method 25A** **Michigan Automotive Compressor** **Jackson, Michigan**	**Sampling Date:** **April 15, 2014**
	BT Environmental Consulting, Inc. **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**