BTEC Inc.

RTO VOC Destruction Efficiency Test Report

Prepared for:

Universal Coating, Inc.

Flint, Michigan

Universal Coating, Inc.
5204 Energy Drive
Flint, Michigan 48505

Project No. 16-4813.00
March 29, 2017

BT Environmental Consulting, Inc.
4949 Fernlee Avenue
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EXECUTIVE SUMMARY

BT Environmental Consulting, Inc. (BTEC) was retained by Universal Coating, Inc. (UCI) to evaluate volatile organic compounds (VOC) Destruction Efficiency (DE) emissions testing during a single mobilization at the UCI facility located in Flint, Michigan. The emissions test program was conducted on January 31, 2017.

Testing consisted of triplicate 60-minute test runs conducted simultaneously at the inlet and outlet of the RTO. The emissions test program was required by MDEQ Air Quality Division. The results of the emission test program are summarized by Table I.

Table I
RTO Overall Emission Summary
Test Date: January 31, 2017

Pollutant	Average DE	Average VOC Emission Rate (lb/hr)
VOC	99.4%	0.5

1. Introduction

BT Environmental Consulting, Inc. (BTEC) was retained by Universal Coatings, Inc. (UCI) to evaluate volatile organic compounds (VOC) destruction efficiency (RE) emissions testing during a single mobilization at the UCI facility located in Flint, Michigan. The emissions test program was conducted on January 31, 2017. The purpose of this report is to document the results of the test program.

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 January 31, 2017 at the UCI facility located in Flint, Michigan. The test program included evaluation of VOC DE from the RTO. The test program also included verification of the exhaust gas flow monitors for Booths 2 and 7. The testing was required by 40 CFR 63, Subparts MMMM and PPPP.

1.b Purpose of Testing

The emissions test program was required by MDEQ Air Quality Permit to Install No. 96-03D and 40 CFR 63, Subparts MMMM and PPPP.

1.c Source Description

The unit being tested is an RTO that controls emissions from four (4) automatic miscellaneous metal parts spray booths (EU-CE1, EU-CE2, EU-CE3, EU-CE4) listed in Permit to Install (PTI) No. 96-03D. The RTO has been installed to replace the catalytic oxidizer.

EU-CE2 - Two (2) automatic miscellaneous metal parts spray booths (T1 and T2) with two IR ovens connected by a chain-on-edge conveyor system and controlled by a RTO. EU-CE2 is referred to as Line 2 by UCI.

EU-CE1 - Two (2) automatic miscellaneous metal parts spray booths (T3 and T4) with two IR ovens connected by a chain-on-edge conveyor system and controlled by a RTO. EU-CE1 is referred to as Line 1 by UCI.

EU-CE3 - One (1) manual/automatic miscellaneous metal parts spray booth with associated electric oven connected by a chain-on-edge conveyor system and controlled by a RTO. EU-CE3 is referred to as Line 3 by UCI.

EU-CE4 - Two (2) automatic miscellaneous metal parts spray booths (T5 and T6) with two IR ovens connected by a chain-on-edge conveyor system and controlled by a RTO. EU-CE4 is referred to as Line 4 by UCI.

1.d Test Program Contacts

The contact for the source and test report is:

Mr. Julie Taylor
Director of Quality – Risk Manager
Universal Coating, Inc.
5204 Energy Drive
Flint, Michigan 48505
(810) 785-7555

Ms. Rhiana Dornbos, P.E.
Project Engineer
NTH Consultants, Ltd.
1010 Front Street NW
Grand Rapids, Michigan 49504
(517) 702-2953
(406) 599-9177

Mr. Randal J. Tysar
Senior Environmental Engineer
BT Environmental Consulting, Inc.
4949 Fernlee Avenue
Royal Oak, Michigan 48073
(313) 449-2361

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

Table 1
Test Personnel

Name and Title	Affiliation	Telephone
Ms. Julie Taylor Director of Quality – Risk Manager	Universal Coating, Inc. 5204 Energy Drive Flint, Michigan 48505	(810) 785-7555
Ms. Rhiana Dornbos Senior Staff Engineer	NTH Consultants, Ltd. 1010 Front Avenue, NW Grand Rapids, MI 49504	(517) 702-2953
Mr. Randal Tysar Senior Environmental Engineer	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Matt Young Project Manager	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Mike Nummer Environmental Technician	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Shane Rabideau Environmental Technician	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Robert Byrnes Environmental Engineering Supervisor	MDEQ Air Quality Division Lansing District	(517) 284-6632
Mr. Tom Maza Environmental Quality Analyst	MDEQ Air Quality Division Detroit Office	(313) 456-4709

2. Summary of Results

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

2.a Operating Data

Process operating is summarized in Appendix E.

2.b Applicable Permit

The surface coating processes are included in Permit to Install No. 96-03D.

2.c Results

The overall results of the emission test program are summarized by Table 2 (see Section 5.a). The overall DE was 99.4%.

3. Source Description

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

3.a Process Description

The process is described in Section 1.c.

3.b Process Flow Diagram

Due to the simplicity of the RTO, a process flow diagram is not necessary.

3.c Raw and Finished Materials

UCI utilizes various coating and solvents in their spray booth coating processes (See Appendix E for Production data).

3.d Process Capacity

The RTO is rated for a maximum capacity of 30,000 standard cubic feet per minute (scfm). Testing was conducted at the maximum routine operating rate for the seven miscellaneous metal parts spray booths, the roll coater line, and the tumble spray lines.

3.e Process Instrumentation

The RTO combustion chamber operating bed temperature, RTO exhaust flow rate, and the operating rate of each spindle coating line (i.e., UCI Lines 1-4), roll coater, and tumble spray lines routed to the RTO was collected during the test period. In addition, the exhaust flowrate from each of the seven spray coating enclosures is continuously monitored and recorded. This data is provided in Appendix E.

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

Measurement of exhaust gas velocity, molecular weight, and moisture content was conducted using the following reference test methods codified at Title 40, Part 60, Appendix A of the Code of Federal Regulations (40 CFR 60, Appendix A):

- Method 1 - *"Location Sample and Velocity Traverses for Stationary Sources"*
- Method 2 - *"Determination of Stack Gas Velocity and Volumetric Flowrate"*
- Method 3 - *"Determination of Molecular Weight of Dry Stack Gas"(Fyrite)*
- Method 4 - *"Determination of Moisture Content in Stack Gases"*

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 were used to measure exhaust gas velocity pressures (using a manometer) and temperatures during testing. The s-type pitot tube dimensions were within specified limits, therefore, a baseline pitot tube coefficient of 0.84 (dimensionless) was assigned.

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 average of the absolute values of the flow angles was less than 20 degrees at each sampling location.

Molecular weight determinations were evaluated according to USEPA Method 3, "Gas Analysis for the Determination of Dry Molecular Weight." The equipment used for this evaluation consisted of a one-way squeeze bulb with connecting tubing and a set of Fyrite® combustion gas analyzers. Carbon dioxide and oxygen content were analyzed using the Fyrite® procedure.

Exhaust gas moisture content was evaluated using Method 4. Wet bulb/dry bulb was used during this testing for moisture at the RTO inlet and a single moisture train run was used at the RTO outlet.

Measurement of exhaust gas VOC and methane concentrations was conducted using the following reference test method codified at 40 CFR 60, Appendix A:

- Method 25A- *"Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer"*

Volatile Organic compound (VOC) concentrations were measured according to 40 CFR 60, Appendix A, Method 25A. 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 to prevent the condensation of any moisture from the sample before it enters the analyzer. Data was recorded at 4-second intervals on a PC equipped with IOtech® data acquisition software. BTEC used a JUM Model 109A Methane/Non-Methane THC hydrocarbon analyzer at the outlet and a VIG Model 20 hydrocarbon analyzer at the inlet to determine the VOC and methane concentrations.

The JUM Model 109A analyzer utilizes two flame ionization detectors (FIDs) in order to report the average ppmv for total hydrocarbons (THC), as propane, as well as the average ppmv for methane (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 THC is then sent to the data acquisition system (DAS), 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 ppmv for THC 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 THC sample, the methane gas concentration is sent to the DAS and recorded. 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.

The analyzer's response factor is obtained by introducing a methane calibration gas to the calibrated J.U.M. 109A. The response of the analyzer's THC FID to the methane calibration gas, in ppmv as propane, is divided by the Methane analyzer's response to the methane calibration gas, in ppmv as methane.

The VIG THC hydrocarbon analyzer channels a fraction of the gas sample through a capillary tube that directs the sample to the flame ionization detector (FID), where the hydrocarbons present in the sample are ionized into carbon. The carbon concentration is then determined by the detector in parts per million (ppm). This concentration is transmitted to the data acquisition system (DAS) at 4-second intervals in the form of an analog signal, specifically voltage, to produce data that can be averaged over the duration of the testing program. This data is then used to determine the average ppm for total hydrocarbons (THC) using the equivalent units of propane (calibration gas).

In accordance with Method 25A, a 4-point (zero, low, mid, and high) calibration check was performed on the THC analyzer. Calibration drift checks were performed at the completion of each run.

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 State's 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 drawing of the Method 25A sampling train used for the testing program is presented as Figure 1. Protocol 1 gas certification sheets for the calibration gases used for this testing program are presented in Appendix B.

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 State's 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 check of the gas dilution system was conducted using Method 205.

Prior to the DE test, utilizing USEPA Method 204 UCI/Schreiner Mechanical reconfirmed that the capture efficiency (CE) still remains at 100% as previously verified. A list of all natural draft openings (NDO) is included in Appendix E.

4.b Recovery and Analytical Procedures

This test program did not include laboratory samples, consequently, sample recovery and analysis is not applicable to this test program.

4.c Sampling Ports

A diagram of the inlet and exhaust stacks showing sampling ports in relation to upstream and downstream disturbances are included as Figures 2 and 3.

4.d Traverse Points

Diagrams of the stacks indicating traverse point locations and stack dimensions are included as Figure 2 and 3.

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 2. Detailed results for the emissions test program are summarized by Table 3.

Table 2
RTO Overall Emission Summary
Test Date: January 31, 2017

Pollutant	Average DE	Average VOC Emission Rate (lb/hr)
VOC	99.4%	0.5

5.b Discussion of Results

The RTO VOC DE averaged 99.4% and had an average VOC emission rate of 0.5 lb/hr.

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 upset conditions occurred during testing.

5.e Control Device Maintenance

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

5.f Re-Test

The emissions test program was not a re-test.

5.g Audit Sample Analyses

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

5.h Calibration Sheets

Relevant equipment calibration documents are provided in Appendix B.

5.i Sample Calculations

Sample calculations are provided in Appendix C.

5.j Field Data Sheets

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

5.k Laboratory Data

There are no laboratory results for this test program. Raw CEM data is provided electronically in Appendix D.

Table 3
RTO Destruction Efficiency Summary
Universal Coating, Inc.
Flint, MI

Parameter	Run 1	Run 2	Run 3	Average
Sampling Date	1/31/2017	1/31/2017	1/31/2017	
Sampling Time	9:30 - 10:30	10:46 - 11:46	12:04 - 13:04	
Inlet Flowrate (scfm)	19,764	18,237	19,783	19,261
Outlet Flowrate (scfm)	18,944	21,404	20,483	20,277
Inlet VOC Concentration (ppmv propane)	426.8	636.2	698.6	587.2
Inlet VOC Concentration (ppmv, corrected as per USEPA 7E)	424.4	632.9	692.8	583.4
Inlet VOC Mass Flowrate (lb/hr)	57.6	79.2	94.1	77.0
Outlet VOC Concentration (ppmv propane)	5.6	5.9	6.7	6.1
Outlet VOC Concentration (ppmv, corrected as per USEPA 7E)	5.5	5.8	6.5	5.9
Outlet CH4 Concentration (ppmv methane)	6.4	5.0	6.0	5.8
Outlet CH4 Concentration (ppmv, corrected as per USEPA 7E)	6.2	4.8	5.6	5.5
Outlet VOC Concentration (ppmv, - methane)	2.6	3.5	3.9	3.4
Outlet VOC Mass Emission Rate (lb/hr)	0.3	0.5	0.6	0.5
VOC Destruction Efficiency (%)	**99.4**	**99.3**	**99.4**	**99.4**

Inlet VOC Correction			
Co	1.21	2.41	3.22
Cma	497	497	497
Cm	499.60	500.10	502.06

Outlet VOC Correction			
Co	0.20	0.31	0.14
Cma	29.9	29.9	29.9
Cm	29.43	29.37	30.16

Outlet CH4 Correction			
Co	0.11	0.17	0.35
Cma	29.9	29.9	29.9
Cm	30.32	30.42	30.73

scfm: standard cubic feet per minute
ppmv: parts per million on a volume to volume basis
lb/hr: pounds per hour
VOC: volatile organic compound
MW = molecular weight (C_3H_8 = 44.10)
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

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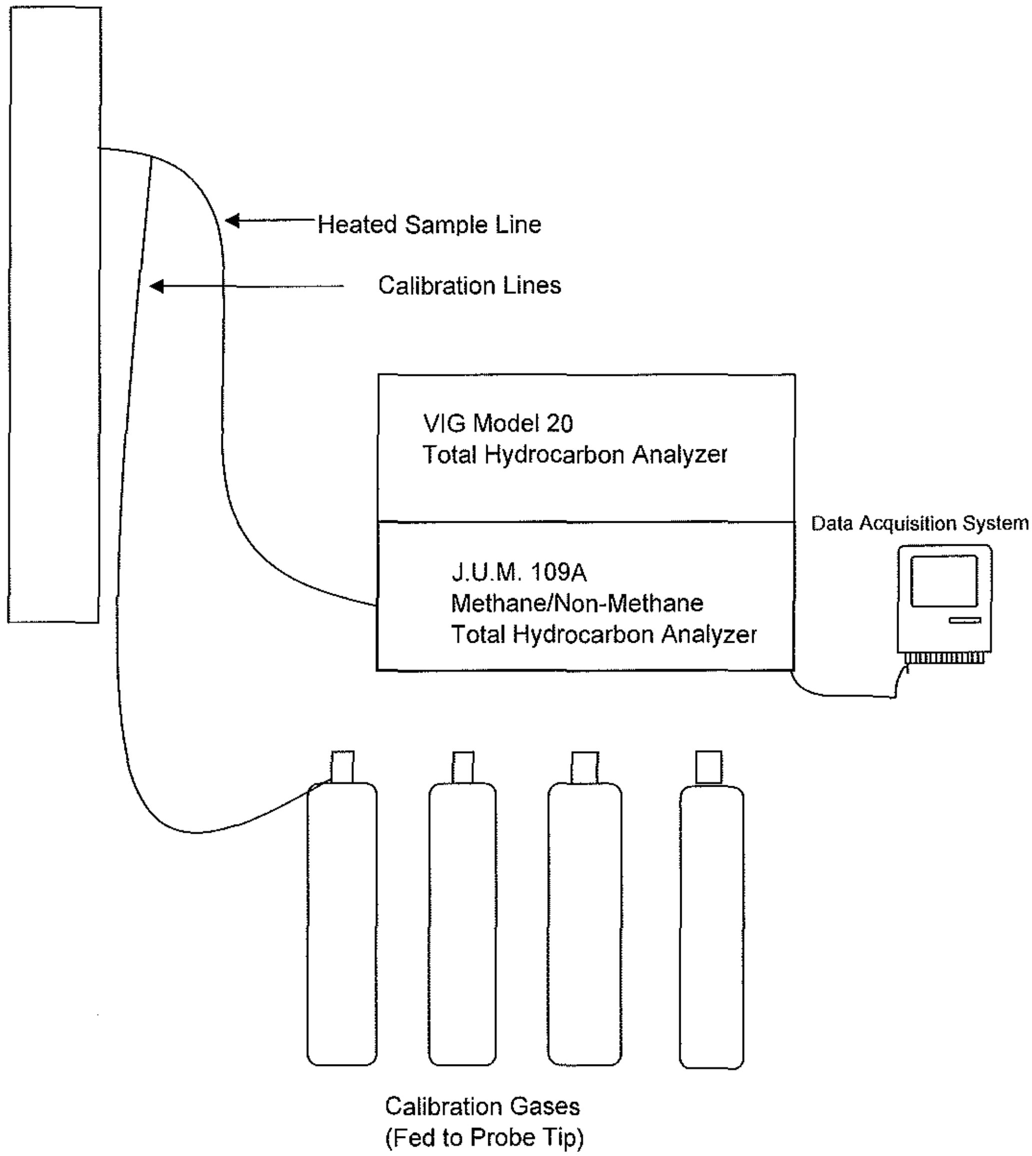


Figure No. 1

Site: **Sampling Date:** **USEPA Method 25A January 31, 2017** **Universal Coatings, Inc.** **Flint, Michigan**	**BT Environmental Consulting, Inc.** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**

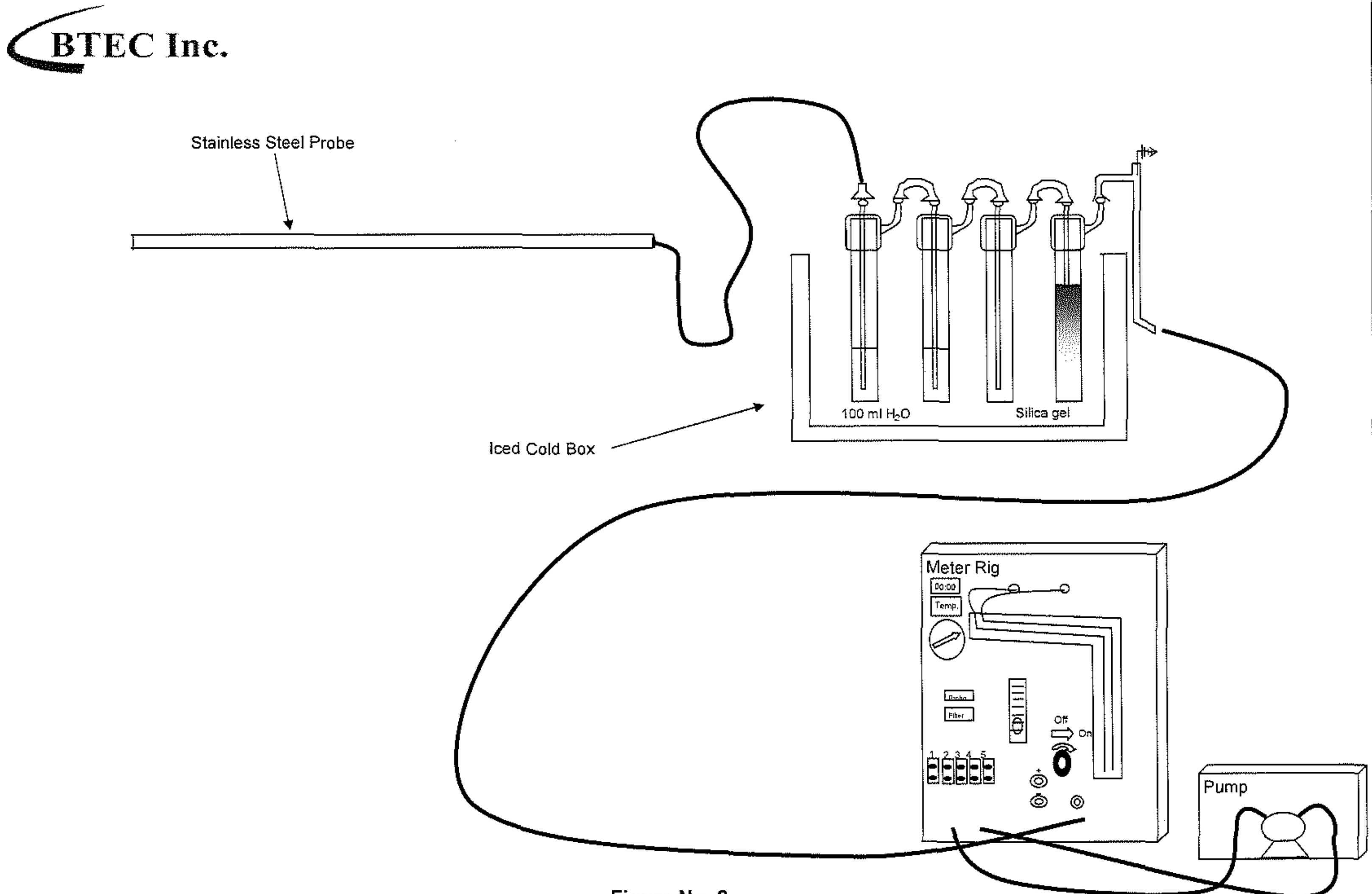


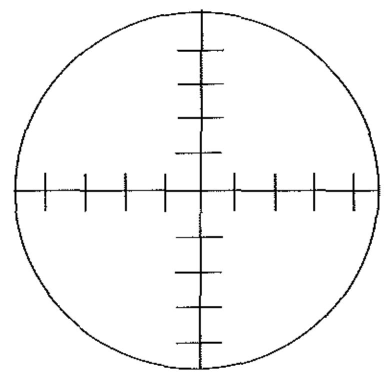
Figure No. 2

Site:	Sampling Date:	
USEPA Method 4 Universal Coatings, Inc. Flint, Michigan	January 31, 2017	<u>BT Environmental Consulting, Inc.</u> 4949 Fernlee Avenue Royal Oak, Michigan 48073

BTEC Inc.

diameter = 47.5 inches

Points	Distance "
1	1.5
2	5.0
3	9.2
4	15.3
5	32.2
6	38.3
7	42.5
8	46.0



Not to Scale

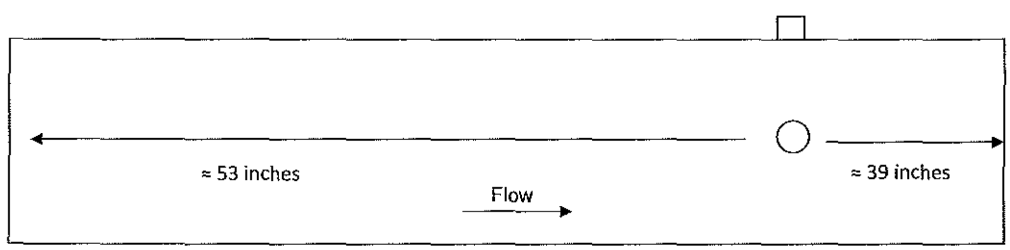


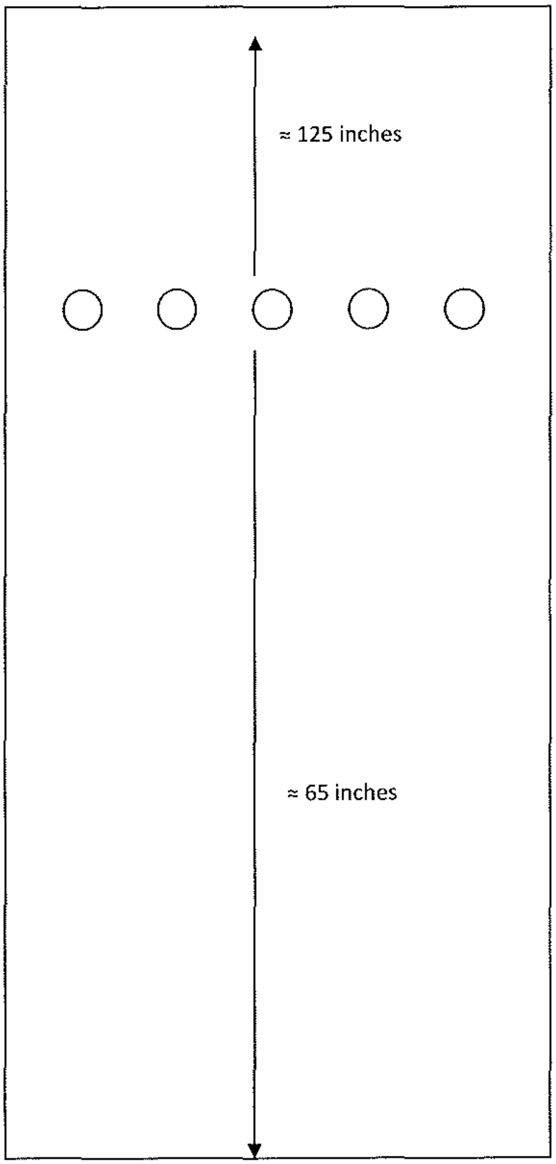
Figure No. 3

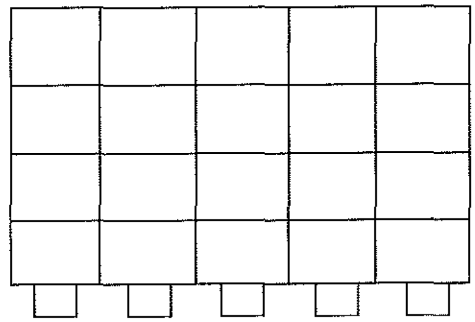
Site:	Sampling Date:	
RTO Inlet Universal Coating, Inc. Flint, Michigan	January 31, 2017	BT Environmental Consulting, Inc. 4949 Fernlee Avenue Royal Oak, Michigan 48073

BTEC Inc.

Stack Dimensions:

Depth:	30	inches
Width:	52.75	inches





Not to Scale

Points	Distance "
1	3.8
2	11.3
3	18.8
4	26.3

Figure No. 4

Site: **RTO Outlet** **Universal Coatings, Inc.** **Flint, Michigan**	**Sampling Date:** **January 31, 2017**	**BT Environmental Consulting, Inc.** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**