SOURCE TEST REPORT
2019 NOx, CO, PM AND VOC DE AND RE TESTING
FORD MOTOR COMPANY
MICHIGAN ASSEMBLY PLANT
WAYNE, MICHIGAN

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STAC

ACCREDITED
TO ASTM D7036 ONLY
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MONTROSE
AIR QUALITY SERVICES

EXECUTIVE SUMMARY

Montrose Air Quality Services (MAQS) was retained by Ford Motor Company (Ford) to evaluate the volatile organic compounds (VOC) Removal Efficiency (RE) of the Carbon Wheels Systems No. 1 & 2 and Destruction Efficiency (DE) of the four Regenerative Thermal Oxidizers (RTOs) associated with the carbon wheel systems and ovens at the Michigan Assembly Plant located in Wayne, Michigan. MAQS also sampled for NOx and CO at the outlet of the Topcoat RTO. Lastly, particulate matter (PM) sampling was conducted on five sources. The emissions test program was conducted from July 9th, 2019 to July 18th, 2019. The purpose of this report is to document the results of the test program.

Testing consisted of triplicate 60-minute test runs for VOC, NOx, and CO. Triplicate 180-mintue test runs were conducted for PM. The results of the emission test program are summarized by Table I.

Table I
Overall Results Summary
Test Dates: July 9-18, 2019

Source	Test Dates	Destruction Efficiency (%)		Removal Efficiency (%)	Temperature (°F)
Ecoat RTO	July 9, 2019	98.1			1,502
3-Wet Oven RTO	July 15, 2019	96.6			1,448
Carbon Wheel System 1 RTO	July 10, 2019	96.3			1,424
Carbon Wheel System 2 RTO	July 11, 2019	97.8			1,438
Carbon Wheel System 1	July 10, 2019			97.5	260
Carbon Wheel System 2	July 12, 2019			82.7	264
Source	**Test Dates**	**PM (lb/dscf)**	**PM (lb/vehicle)**	**NOx (lb/hr)**	**CO (lb/hr)**
3-Wet Oven RTO	July 15-17, 2019	$1.65*10^{-7}$		1.1	0.3
Non-Painting Spraybooth Zone	July 10-11, 2019	$3.46*10^{-8}$			
Sealer Oven	July 17-18, 2019		0.003		
ECoat Scuff Booth	July 10-11, 2019		0.006		
Uncontrolled Prime Robots	July 11-12, 2019	$7.02*10^{-9}$			

Table II
Compliance Emissions Test Program Summary

System/Stack ID	Exhaust Gas Parameters to be Evaluated	Test Methods
Carbon Wheel System #1	Carbon Wheel RE & RTO DE	1, 2, 3, 4, and 25A
Carbon Wheel System #2	Carbon Wheel RE & RTO DE	1, 2, 3, 4, and 25A
3-Wet Oven RTO	RTO DE, NO_x, CO, & PM Emission Rates	1, 2, 3, 4, 7E, 10, 5/202, and 25A
Ecoat RTO	RTO DE	1, 2, 3, 4, and 25A
Sealer Oven	PM Emission Rate	1, 2, 3, 4, and 5/202
Ecoat Scuff Booth	PM Emission Rate	1, 2, 3, 4, and 17
Uncontrolled Prime Robots	PM Emission Rate	1, 2, 3, 4, and 17
Non-painting spraybooth zone	PM Emission Rate	1, 2, 3, 4, and 17

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1. Introduction

Montrose Air Quality Services (MAQS) was retained by Ford Motor Company (Ford) to evaluate the volatile organic compounds (VOC) Removal Efficiency (RE) of the Carbon Wheels Systems No. 1 & 2 and Destruction Efficiency (DE) of the four Regenerative Thermal Oxidizers (RTOs) associated with the carbon wheel systems and ovens at the Michigan Assembly Plant located in Wayne, Michigan. MAQS also sampled for NOx and CO at the outlet of the Topcoat RTO. Lastly, particulate matter (PM) sampling was conducted on five sources. The emissions test program was conducted from July 9th, 2019 to July 18th, 2019. The purpose of this report is to document the results of the test program.

1.a Identification, Location, and Dates of Test

System/Stack ID	Exhaust Gas Parameters to be Evaluated	Date
Carbon Wheel System #1	Carbon Wheel RE & RTO DE	July 10, 2019
Carbon Wheel System #2	Carbon Wheel RE & RTO DE	July 11-12, 2019
3-Wet Oven RTO	RTO DE, NO_x, CO, & PM Emission Rates	July 15-17, 2019
Ecoat RTO	RTO DE	July 9, 2019
Sealer Oven	PM Emission Rate	July 17-18, 2019
Ecoat Scuff Booth	PM Emission Rate	July 10-11, 2019
Uncontrolled Prime Robots	PM Emission Rate	July 11-12, 2019
Non-painting spraybooth zone	PM Emission Rate	July 10-11, 2019

1.b Purpose of Testing

The purpose of the emissions test program was to verify VOC RE, DE, NOx, CO, and PM to demonstrate overall control efficiency to comply with the requirements of Michigan Department of Environmental Quality Air Quality Division Permit No. MI-ROP-A8650-2016 for the Michigan Assembly Plant.

1.c Source Description

The sources tested control VOC emissions from the ECoat and 3-Wet painting operations process. The system consists of two carbon concentration wheel systems and four RTOs.

1.d Testing Personnel

Names and affiliations for personnel involved in the emissions test program are summarized by Table 1.

Table 1
Test Personnel

Name and Title	Affiliation	Telephone
Mr. Steve Smith Client Project Manager	MAQS 4949 Fernlee Ave. Royal Oak, MI	(248) 548-8072
Mr. Matt Young Client Project Manager	MAQS 4949 Fernlee Ave. Royal Oak, MI	(248) 548-8070
Mr. Mason Sakshaug Field Project Manager	MAQS 4949 Fernlee Ave. Royal Oak, MI	(248) 548-8070
Mr. Mike Nummer Environmental Technician	MAQS 4949 Fernlee Ave. Royal Oak, MI	(248) 548-8070
Mr. Dave Trahan Environmental Technician	MAQS 4949 Fernlee Ave. Royal Oak, MI	(248) 548-8070
Mr. Dave Koponen Environmental Technician	MAQS 4949 Fernlee Ave. Royal Oak, MI	(248) 548-8070
Mr. Ben Durham Environmental Technician	MAQS 4949 Fernlee Ave. Royal Oak, MI	(248) 548-8070
Ms. Susan Hicks Principal Environmental Engineer	Ford Motor Company Fairlane Plaza North 290 Town Center Drive, Suite 800 Dearborn, Michigan 48126	(313)594-3185
Mr. Mark Dziadosz MDEQ Air Quality Division	Michigan Department of Environmental Quality SE Michigan District 27700 Donald Ct Warren, MI 48092	(586)753-3745

2. Summary of Results

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

2.a Operating Data

Process operating data for this emissions test program is provided in Appendix D.

2.b Applicable Permit

The applicable permit for this emissions test program is Permit No. MI-ROP-A8650-2016.

2.c Results

The results of the emissions test program are summarized by Table 2. Detailed data for each test run can be found in Tables 3-14.

Table 2
Overall Results Summary
Test Dates: July 9-18, 2019

Source	Test Dates	Destruction Efficiency (%)	Removal Efficiency (%)	Temperature (°F)
Ecoat RTO	July 9, 2019	98.1		1,502
3-Wet Oven RTO	July 15, 2019	96.6		1,448
Carbon Wheel System 1 RTO	July 10, 2019	96.3		1,424
Carbon Wheel System 2 RTO	July 11, 2019	97.8		1,438
Carbon Wheel System 1	July 10, 2019		97.5	260
Carbon Wheel System 2	July 12, 2019		82.7	264

Source	Test Dates	PM (lb/dscf)	PM (lb/vehicle)	NOx (lb/hr)	CO (lb/hr)
3-Wet Oven RTO	July 15-17, 2019	$1.65*10^{-7}$		1.1	0.3
Non-Painting Spraybooth Zone	July 10-11, 2019	$3.46*10^{-8}$			
Sealer Oven	July 17-18, 2019		0.003		
ECoat Scuff Booth	July 10-11, 2019		0.006		
Uncontrolled Prime Robots	July 11-12, 2019	$7.02*10^{-9}$			

2.d Emission Regulation Comparison

NA

3. Source Description

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

3.a Process Flow Diagram

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

3.b Process Description

Michigan Assembly is an automotive assembly plant located in Wayne, Michigan. Vehicle body panels are stamped and assembled on site from sheet metal components. The bodies are cleaned, treated, and prepared for painting in the phosphate system. Drawing compounds, mill oils, and dirt are removed from the vehicle bodies utilizing both high pressure spray and immersion cleaning/rinsing techniques. Vehicle bodies then are dip coated in electro deposition corrosion primer paint for protection. The electro primer (E-coat) is heat-cured to the vehicle body in a high-temperature bake oven. After completing the E-coat operation, vehicle bodies are conveyed to the sealer area for application of various sealants to body seams and joints. Vehicle bodies are then conveyed to an oven to cure the sealers.

After the sealer oven, the vehicles are routed to the 3-Wet paint system. The 3-Wet system consists of dual spray booths and oven; the bodies receive a solvent borne surface primer, basecoat and clearcoat that is applied to interior and exterior surface areas. All three materials are applied using robotic bell applicators. The surfaces are then dried in the oven. After exiting the 3-Wet oven, the vehicles are routed to inspection and blackout/cavity wax booth.

3.c Raw and Finished Materials

NA.

3.d Process Capacity

NA.

3.e Process Instrumentation

The rotary concentrator desorb temperature was recorded every 15-minutes during each test run. The regenerative thermal oxidizer temperature was recorded every 15-minutes during the test run. Process data was collected by Ford personnel and can be found in Appendix D.

4. Sampling and Analytical Procedures

Sections 4.a through 4.d provide a summary of the sampling and analytical procedures used to verify emission rates and removal efficiency.

4.a Sampling Train and Field Procedures

USEPA Methods 1-4

Stack gas velocity traverses were conducted in accordance with the procedures outlined in Methods 1 and 2. An S-type pitot tube with a thermocouple assembly, calibrated in accordance with Method 2, Section 4.1.1, was used to measure exhaust gas velocity pressures (using a manometer) and temperatures at each traverse location. The S-type pitot tube dimensions were within specified limits, therefore, a baseline pitot tube coefficient of 0.84 (dimensionless) was assigned.

A cyclonic flow check was 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. Both sampling locations were evaluated for cyclonic flow and deemed acceptable for flowrate measurement.

Exhaust gas molecular weight was determined according to Method 3. The equipment used for the Method 3 evaluation consisted of a one-way squeeze bulb with connecting tubing and a set of Fyrite® combustion gas analyzers. CO_2 and O_2 content was analyzed using the Fyrite® procedure.

Exhaust gas moisture content was evaluated using Method 4 with triplicate test runs conducted at the outlet. Exhaust gas was extracted and passed through (i) two impingers, each with 100 ml deionized water, (ii) an empty impinger, and (iii) an impinger filled with silica gel. Exhaust gas moisture content was then determined volumetrically (liquid impingers) and gravimetrically (silica gel impinger). A schematic drawing of the Method 4 sampling train is provided as Figure 19.

USEPA Method 25A

VOC concentrations were measured at the inlet and outlet of the carbon concentrators according to USEPA Method 25A, "Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer." The samples were collected through a probe and heated sample line, and into the analyzers, in accordance with Method 25A procedures. BTEC used a VIG THC hydrocarbon analyzer to determine the VOC concentration at the inlet. A J.U.M. Model 109A methane/non-methane hydrocarbon analyzer was used at the outlet to determine the methane/non-methane concentrations.

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 will be ionized into carbon. The carbon concentration is then determined by the detector in parts per million (ppm). This concentration is sent 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).

The J.U.M. Model 109A utilizes two FIDs to determine the average ppm for THC (as propane), as well as the average ppm for methane (as methane). Upon entry, the gas stream is split by the analyzer. 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 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 ppm 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 ppm as propane, is divided by the Methane analyzer's response to the methane calibration gas, in ppm as methane.

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 schematic drawing of the continuous emission system is provided as Figure 20.

USEPA Method 7E

The NOx content of the gas stream was measured using a Teledyne NOx gas analyzer. The gas stream was drawn through a stainless-steel probe with a heated in-line filter to remove any particulate, a heated Teflon® sample line, through a refrigerated Teflon® sample conditioner to remove the moisture from the sample before it entered the NOx analyzer. Data was recorded on a PC equipped with data acquisition software. Recorded NOx concentrations were averaged and reported for the duration of each 60-minute test (as drift corrected per Method 7E). A drawing of the sampling train used for the testing program is presented as Figure 23.

In accordance with Method 7E, a 3-point (zero, mid, and high) bias check and calibration check was performed on the NOx analyzer prior to initiating the test program. Following each test run, a 2-point (zero and high) calibration drift check was performed. The NOx analyzer was operated at the 0-100 ppm range.

USEPA Method 10

The CO content of the exhaust gas was evaluated according to procedures outlined in 40 CFR 60, Appendix A, Method 10. The CO content of the gas stream was measured using a Teledyne CO gas analyzer. The gas stream was drawn through a stainless-steel probe with a heated in-line filter to remove any particulate, a heated Teflon® sample line, through a refrigerated sample conditioner with a peristaltic pump to remove the moisture from the sample before it entered the analyzer. Data was recorded on a PC equipped with Labview® II data acquisition software. Recorded CO concentrations were averaged and reported for the duration of each 60-minute test (as drift corrected per Method 7E). The analyzer was calibrated for a range of 0 to 100 ppm.

In accordance with Method 10, a 3-point (zero, mid, and high) calibration check was performed on the CO analyzer. Calibration drift checks were performed at the completion of each run.

Method 5/202

40 CFR 60, Appendix A, Method 5, *"Determination of Particulate Emissions from Stationary Sources"* and 40 CFR 60, Appendix A, Method 202, *"Dry Impinger Method for Determining Condensable Particulate Emissions from Stationary Sources"* was used to measure PM concentrations and calculate PM emission rates (see Figure 21 for a schematic of the sampling train). Triplicate 180-minute test runs were conducted for each source.

MAQS' Nutech® Model 2010 modular isokinetic stack sampling system consisted of (1) a stainless-steel nozzle, (2) a steel probe, (3) a heated filter holder, (4) a vertical condenser, (5) an empty pot bellied impinger, (6) an empty modified Greenburg-Smith (GS) impinger, (7) unheated filter holder with a teflon filter, (8) a second modified GS impinger with 100 ml of deionized water, and a third modified GS impinger containing approximately 300 g of silica gel desiccant, (9) a length of sample line, and (10) a Nutech® control case equipped with a pump, dry gas meter, and calibrated orifice.

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. The impinger train was then purged with nitrogen for one hour at a flow rate of 14 liters per minute. The CPM filter was recovered and placed in a petri dish. The back half of the filter housing, the condenser, the pot bellied impinger, the moisture drop out impinger, and the front half of the CPM filter housing and all connecting glassware were triple rinsed with deionized water which was collected in a pre-cleaned sample container. The same glassware was then rinsed with acetone which was collected in a pre-cleaned sample container labeled as the organic fraction. The glassware was then double rinsed with hexane which was added to the same organic fraction sample bottle.

MAQS 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, DI water, hexane, and filter were collected. MAQS personnel carried all samples to MAQS' laboratory (for filter and acetone gravimetric analysis) in Royal Oak, Michigan. DI water and organic samples were hand delivered to Enthalpy for analysis.

USEPA 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 22 for a schematic of the sampling train). Triplicate 180-minute test runs were conducted on each source.

MAQS' Nutech® Model 2010 modular isokinetic stack sampling system consisted of (1) a stainless-steel nozzle, (2) an in stack stainless-steel filter housing, (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 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.

MAQS 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. MAQS personnel carried all samples to MAQS' laboratory (for filter and acetone gravimetric analysis) in Royal Oak, Michigan.

4.b Recovery and Analytical Procedures

All recoveries were performed according to the correct USEPA Method.

4.c Sampling Ports

The inlet and outlet sampling locations satisfy the minimum criteria for Method 1.

4.d Traverse Points

Stack traverse point diagrams are appended as Figures 1-18.

5. Test Results and Discussion

The hot water generator was not sampled as it provides "on-demand" hot water. The facility was hot due to the outside temperature so the bath temperatures did not drop requiring the hot water. The unit did not run long enough to provide an accurate sample for the necessary run time. The team discussed this with Mr. Steve Weiss of EGLE and it was determined that the testing would be rescheduled during "colder" temperatures.

During run 2 on the sealer oven unit, a plastic cap connection melted and clogged the CPM filter. The second run was voided and an additional run was conducted. Results for

run 2 are included in the report, but only runs 1, 3, and 4 are used for emission rate determination.

5.a Results Tabulation

The results of the emission test program are summarized by Table 2 (see section 2c). Detailed data for each test run can be found in Tables 3-14.

5.b Sampling Procedure Variations

The emissions test program did not include sampling procedure variations.

5.c Process or Control Device Upsets

No upset conditions occurred during testing.

5.d Control Device Maintenance

There has been no major maintenance performed during the past three months.

5.e Retest

This test program was not a re-test.

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 are presented as well as raw analyzer test data (provided electronically on CD) are provided in Appendix A.

5.j Laboratory Data

The laboratory data can be found in Appendix E

REVIEW AND CERTIFICATION

All work, calculations, and other activities and tasks performed and presented in this document were carried out by me or under my direction and supervision. I hereby certify that, to the best of my knowledge, Montrose operated in conformance with the requirements of the Montrose Quality Management System and ASTM D7036-04 during this test project.

Signature: _____ Date: 9-11-19

Name: Steve Smith Title: Client Project Manager

I have reviewed, technically and editorially, details calculations, results, conclusions, and other appropriate written materials contained herein. I hereby certify that, to the best of my knowledge, the presented material is authentic, accurate, and conforms to the requirements of the Montrose Quality Management System and ASTM D7036-04.

Signature: _____ Date: 9-11-19

Name: Randal Tysar Title: District Manager

Tables

Table 3
Ecoat RTO VOC Destruction Efficiency Summary
Ford MAP
Wayne, MI

Parameter	Run 1	Run 2	Run 3	Average
Sampling Date	7/9/2019	7/9/2019	7/9/2019	
Sampling Time	8:43-9:43	10:15-11:15	12:40-13:40	
Tank Inlet Flowrate (scfm)	13,243	13,221	12,694	13,053
Oven Inlet Flowrate (scfm)	14,013	13,976	13,945	13,978
Outlet Flowrate (scfm)	31,447	31,858	31,505	31,604
Tank Inlet VOC Concentration (ppmv propane)	15.5	15.4	17.1	16.0
Tank Inlet VOC Concentration (ppmv, corrected as per USEPA 7E)	15.4	15.4	17.2	16.0
Tank Inlet VOC Mass Flowrate (standard lb/hr)	1.4	1.4	1.5	1.4
Oven Inlet VOC Concentration (ppmv propane)	120.3	126.8	100.6	115.9
Oven Inlet VOC Concentration (ppmv, corrected as per USEPA 7E)	114.9	112.2	82.5	103.2
Oven Inlet VOC Mass Flowrate (standard lb/hr)	11.0	10.7	7.9	9.9
Outlet VOC Concentration (ppmv propane)	1.3	1.1	0.8	1.0
Outlet VOC Concentration (ppmv, corrected as per USEPA 7E)	1.0	1.0	0.9	1.0
Outlet VOC Mass Emission Rate (standard lb/hr)	0.2	0.2	0.2	0.2
VOC Destruction Efficiency (%)	**98.2**	**98.2**	**98.0**	**98.1**

Tank Inlet 1 VOC Correction			
Co	0.69	0.91	0.94
Cma	50	50	50
Cm	48.77	48.21	47.92

Oven Inlet 2 VOC Correction			
Co	6.13	15.48	19.09
Cma	500	500	500
Cm	503.00	511.38	512.56

Outlet VOC Correction			
Co	0.25	0.05	-0.08
Cma	50	50	50
Cm	49.85	49.80	48.99

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
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

Table 4
3-Wet Oven RTO (Topcoat) VOC Destruction Efficiency Summary
Ford MAP
Wayne, Michigan

Parameter	Run 1	Run 2	Run 3	Average
Sampling Date	7/15/2019	7/15/2019	7/15/2019	
Sampling Time	11:25-12:25	12:45-13:45	14:05-15:05	
Inlet Flowrate (scfm)	22,371	20,608	20,401	21,127
Outlet Flowrate (scfm)	22,096	21,627	21,872	21,865
Inlet VOC Concentration (ppmv propane)	136.8	106.2	168.4	137.1
Inlet VOC Concentration (ppmv, corrected as per USEPA 7E)	134.7	101.9	166.4	134.3
Inlet VOC Mass Flowrate (lb/hr)	20.6	14.4	23.2	19.4
Outlet VOC Concentration (ppmv propane)	4.7	3.4	5.2	4.5
Outlet VOC Concentration (ppmv, corrected as per USEPA 7E)	4.6	3.3	5.3	4.4
Outlet CH4 Concentration (ppmv methane)	0.6	0.7	0.7	0.6
Outlet CH4 Concentration (ppmv, corrected as per USEPA 7E)	-0.1	0.0	0.1	0.0
Outlet VOC Concentration (- methane)	4.6	3.4	5.2	4.4
Outlet VOC Mass Emission Rate (lb/hr)	0.7	0.5	0.8	0.7
VOC Destruction Efficiency (%)	**96.6**	**96.5**	**96.6**	**96.6**

Inlet VOC Correction			
Co	4.93	7.91	8.23
Cma	500	500	500
Cm	494.38	490.31	489.58

Outlet VOC Correction			
Co	0.19	0.19	0.15
Cma	50	50	50
Cm	49.61	48.73	48.22

Outlet CH4 Correction			
Co	0.67	0.70	0.57
Cma	50	50	50
Cm	49.73	48.78	48.65

RF= 2.33

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

Table 5
Carbon Wheel System 1 RTO VOC Destruction Efficiency Summary
Ford MAP
Wayne, Michigan

Parameter	Run 1	Run 2	Run 3	Average
Sampling Date	7/10/2019	7/10/2019	7/10/2019	
Sampling Time	14:20-15:20	15:35-16:35	16:48-17:48	
Inlet Flowrate (scfm)	8,566	8,627	8,314	8,502
Outlet Flowrate (scfm)	10,494	10,489	10,631	10,538
Inlet VOC Concentration (ppmv propane)	110.3	112.0	120.0	114.1
Inlet VOC Concentration (ppmv, corrected as per USEPA 7E)	109.4	109.6	117.7	112.3
Inlet VOC Mass Flowrate (lb/hr)	6.4	6.5	6.7	6.5
Outlet VOC Concentration (ppmv propane)	3.3	3.2	3.4	3.3
Outlet VOC Concentration (ppmv, corrected as per USEPA 7E)	3.3	3.2	3.5	3.4
Outlet CH4 Concentration (ppmv methane)	0.9	0.9	1.2	1.0
Outlet CH4 Concentration (ppmv, corrected as per USEPA 7E)	0.2	0.0	0.0	0.1
Outlet VOC Concentration (- methane)	3.2	3.2	3.5	3.3
Outlet VOC Mass Emission Rate (lb/hr)	0.2	0.2	0.3	0.2
VOC Destruction Efficiency (%)	**96.4**	**96.4**	**96.2**	**96.3**

Inlet VOC Correction			
Co	1.27	3.09	3.21
Cma	500	500	500
Cm	499.68	499.93	498.97

Outlet VOC Correction			
Co	0.09	0.01	0.00
Cma	50	50	50
Cm	48.78	48.90	48.65

Outlet CH4 Correction			
Co	0.71	0.80	0.80
Cma	50	50	50
Cm	49.63	49.43	49.22

RF= 2.3

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

Table 6
Carbon Wheel System 1 VOC Removal Efficiency Summary
Ford MAP
Wayne, MI

Parameter	Run 1	Run 2	Run 3	Average
Sampling Date	7/10/2019	7/10/2019	7/10/2019	
Sampling Time	7:50-8:50	9:10-10:10	12:15-13:00 13:15-13:30	
Basecoat Flowrate (scfm)	18,682	17,294	17,539	17,838
Clearcoat Flowrate (scfm)	8,871	8,364	8,649	8,628
Outlet Flowrate (scfm)	11,577	12,436	12,540	12,184
Basecoat VOC Concentration (ppmv propane)	78.8	65.6	59.1	67.8
Basecoat VOC Concentration (ppmv, corrected as per USEPA 7E)	78.0	64.6	59.1	67.3
Basecoat VOC Mass Flowrate (standard lb/hr)	10.0	7.6	7.1	8.2
Clearcoat VOC Concentration (ppmv propane)	126.5	95.9	97.2	106.5
Clearcoat VOC Concentration (ppmv, corrected as per USEPA 7E)	124.8	92.3	93.8	103.6
Clearcoat VOC Mass Flowrate (standard lb/hr)	7.6	5.3	5.6	6.1
Outlet VOC Concentration (ppmv propane)	6.1	6.1	6.8	6.3
Outlet VOC Concentration (ppmv, corrected as per USEPA 7E)	6.0	6.2	6.9	6.4
Outlet CH4 Concentration (ppmv methane)	5.4	5.1	5.1	5.2
Outlet CH4 Concentration (ppmv, corrected as per USEPA 7E)	5.2	4.9	4.7	4.9
Outlet VOC Concentration (- methane)	3.8	4.0	4.7	4.2
Outlet VOC Mass Emission Rate (standard lb/hr)	0.3	0.3	0.4	0.3
VOC Removal Efficiency (%)	**98.3**	**97.3**	**96.8**	**97.5**

Basecoat VOC Correction			
Co	0.72	1.11	0.23
Cma	500	500	500
Cm	501.05	499.86	498.31

Clearcoat VOC Correction			
Co	3.25	5.16	5.02
Cma	500	500	500
Cm	497.06	496.76	496.21

Outlet VOC Correction			
Co	0.14	0.05	0.15
Cma	50	50	50
Cm	49.39	49.09	48.47

Outlet CH4 Correction			
Co	0.31	0.32	0.53
Cma	50	50	50
Cm	49.63	49.73	49.73

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
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

RF=2.3

Equations
lb/hr = ppmv * MW/24.14 * 1/35.31 * 1/453,600 * scfm* 60

Table 7
Carbon Wheel System 2 RTO VOC Destruction Efficiency Summary
Ford MAP
Wayne, Michigan

Parameter	Run 1	Run 2	Run 3	Average
Sampling Date	7/11/2019	7/11/2019	7/11/2019	
Sampling Time	7:37-8:36	8:52-9:52	10:10-11:10	
Inlet Flowrate (scfm)	14,650	14,704	14,802	14,719
Outlet Flowrate (scfm)	17,623	17,852	18,021	17,832
Inlet VOC Concentration (ppmv propane)	441.4	497.3	367.6	435.4
Inlet VOC Concentration (ppmv, corrected as per USEPA 7E)	437.0	494.0	371.6	434.2
Inlet VOC Mass Flowrate (lb/hr)	43.8	49.7	37.6	43.7
Outlet VOC Concentration (ppmv propane)	8.2	9.2	8.9	8.8
Outlet VOC Concentration (ppmv, corrected as per USEPA 7E)	8.0	8.8	8.4	8.4
Outlet CH4 Concentration (ppmv methane)	1.5	1.5	1.5	1.5
Outlet CH4 Concentration (ppmv, corrected as per USEPA 7E)	1.1	1.0	1.0	1.1
Outlet VOC Concentration (- methane)	7.5	8.3	8.0	7.9
Outlet VOC Mass Emission Rate (lb/hr)	0.9	1.0	1.0	1.0
VOC Destruction Efficiency (%)	**97.9**	**98.0**	**97.4**	**97.8**

Inlet VOC Correction			
Co	3.67	7.04	6.78
Cma	500	500	500
Cm	504.52	503.17	492.33

Outlet VOC Correction			
Co	0.43	0.67	0.76
Cma	50	50	50
Cm	49.26	49.16	49.33

Outlet CH4 Correction			
Co	0.40	0.49	0.59
Cma	50	50	50
Cm	49.28	48.93	48.62

RF= 2.26

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

Table 8
Carbon Wheel System 2 VOC Removal Efficiency Summary
Ford MAP
Wayne, MI

Parameter	Run 1	Run 2	Run 3	Average
Sampling Date	7/12/2019	7/12/2019	7/12/2019	
Sampling Time	7:55-8:20 8:25-9:00	9:19-9:32 10:30-11:00 11:10-11:28	13:15-14:15	
Basecoat 1 Flowrate (scfm)	61,565	62,325	64,891	**62,927**
Basecoat 2 Flowrate (scfm)	53,953	52,787	55,305	**54,015**
Primecoat Flowrate (scfm)	18,313	18,868	18,460	**18,547**
Clearcoat Flowrate (scfm)	48,186	48,564	48,646	**48,465**
Combined Outlet Flowrate (scfm)	171,151	172,370	169,246	**170,922**
RTO Outlet (scfm)	17,333	19,992	19,019	**18,781**
Basecoat 1 VOC Concentration (ppmv propane)	64.3	56.0	91.1	**70.5**
Basecoat 1 VOC Concentration (ppmv, corrected as per USEPA 7E)	64.6	56.3	91.8	**70.9**
Basecoat 1 VOC Mass Flowrate (standard lb/hr)	27.2	24.0	40.8	**30.7**
Basecoat 2 VOC Concentration (ppmv propane)	50.4	47.1	49.4	**49.0**
Basecoat 2 VOC Concentration (ppmv, corrected as per USEPA 7E)	50.1	47.3	49.8	**49.1**
Basecoat 2 VOC Mass Flowrate (standard lb/hr)	18.5	17.1	18.9	**18.2**
Primecoat VOC Concentration (ppmv propane)	112.2	82.0	88.0	**94.0**
Primecoat VOC Concentration (ppmv, corrected as per USEPA 7E)	110.0	81.1	87.9	**93.0**
Primecoat VOC Mass Flowrate (standard lb/hr)	13.8	10.5	11.1	**11.8**
Clearcoat VOC Concentration (ppmv propane)	62.4	53.9	46.6	**54.3**
Clearcoat VOC Concentration (ppmv, corrected as per USEPA 7E)	64.2	56.9	51.5	**57.6**
Clearcoat VOC Mass Flowrate (standard lb/hr)	21.2	18.9	17.1	**19.1**
Combined Inlets Mass Flowrate (standard lb/hr)	**80.7**	**70.5**	**87.9**	**79.7**
Combined Outlet VOC Concentration (ppmv propane)	13.8	13.6	13.6	**13.7**
Combined Outlet VOC Concentration (ppmv, corrected as per USEPA 7E)	13.6	13.2	13.2	**13.4**
Combined Outlet CH4 Concentration (ppmv methane)	3.0	2.9	2.9	**2.9**
Combined Outlet CH4 Concentration (ppmv, corrected as per USEPA 7E)	2.2	2.2	2.1	**2.1**
Combined Outlet (-methane)	12.7	12.2	12.3	**12.4**
Combined Outlet Mass Flowrate (standard lb/hr)	14.8	14.4	14.3	**14.5**
RTO Outlet VOC Concentration (ppmv propane)	7.6	7.1	7.2	**7.3**
RTO Outlet VOC Concentration (ppmv, corrected as per USEPA 7E)	7.3	6.7	6.8	**7.0**
RTO CH4 Concentration (ppmv methane)	1.2	1.1	1.1	**1.1**
RTO Outlet CH4 Concentration (ppmv, corrected as per USEPA 7E)	0.9	0.7	0.8	**0.8**
RTO Outlet (-methane)	6.9	6.4	6.5	**6.6**
RTO Outlet Mass Flowrate (standard lb/hr)	0.8	0.9	0.8	**0.8**
CC Clean Air Exhaust Mass Flowrate (lb/hr)	**14.0**	**13.6**	**13.4**	**13.7**
VOC Removal Efficiency %	**82.6**	**80.8**	**84.7**	**82.7**

Basecoat 1 VOC Correction			
Co	-0.19	0.42	-0.03
Cma	250	250	250
Cm	249.45	247.23	248.09
Basecoat 2 VOC Correction			
Co	0.41	-0.41	-0.35
Cma	250	250	250
Cm	249.58	250.55	249.42
Primecoat VOC Correction			
Co	3.09	2.70	3.23
Cma	250	250	250
Cm	250.90	246.92	244.21
Clearcoat VOC Correction			
Co	-1.60	-3.85	-5.32
Cma	250	250	250
Cm	247.49	249.49	246.65

Combined Outlet VOC Correction			
Co	0.50	0.82	0.80
Cma	50	50	50
Cm	49.42	49.25	49.14
Combined Outlet CH4 Correction			
Co	0.82	0.81	0.93
Cma	50	50	50
Cm	49.67	49.13	49.04
RTO Outlet VOC Correction			
Co	0.44	0.66	0.68
Cma	50	50	50
Cm	49.21	48.40	48.21
RTO Outlet CH4 Correction			
Co	0.36	0.37	0.31
Cma	50	50	50
Cm	49.38	48.90	48.84

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
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

RF Combo Out = 2.28
RF RTO Out = 2.28

Table 9
3-Wet Oven RTO NOx and CO Emission Rates
Ford MAP
Wayne, Michigan
049AS-601431
Sampling Dates: 7/15/2019

Parameter	Run 1	Run 2	Run 3	Average
Test Run Date	7/15/2019	7/15/2019	7/15/2019	
Test Run Time	11:25-12:25	12:45-13:15	14:05-15:05	
Outlet Flowrate (dscfm)	21,680	21,221	21,460	**21,454**
Outlet NOx Concentration (ppmv, corrected as per USEPA 7E)	6.9	5.4	8.7	**7.0**
NOx Emission Rate (lb/hr) (corrected as per USEPA 7E)	**1.1**	**0.8**	**1.3**	**1.1**
Outlet CO Concentration (ppmv, corrected as per USEPA 7E)	2.7	2.7	2.7	**2.7**
CO Emission Rate (lb/hr) (corrected as per USEPA 7E)	**0.3**	**0.3**	**0.2**	**0.3**

scfm = standard cubic feet per minute
dscfm = dry standard cubic feet per minute
ppmv = parts per million on a volume-to-volume basis
lb/hr = pounds per hour
MW = molecular weight (CO = 28.01, NOx = 46.01, SO_2 = 64.05, C_3H_8 = 44.10, carbon = 12.01)
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

Co= Average of initial and final zero gases
Cma=Actual concentration of the calibration gas
Cm= Average of initial and final calibration gases
$C_c=KC_{meas}$
where Cc = Concentration as Carbon (ppmv), K= Carbon equivalent correction factor (3 for Propane)
and C_{meas} = concentration as measured (as propane)
[1]emission rate calculated on dry basis
[2]emission rate calculated on wet basis

Equations
lb/hr = ppmv * MW/24.14 * 1/35.31 * 1/453,600 * ***scfm*** * 60 *for* VOC
lb/hr = ppmv * MW/24.14 * 1/35.31 * 1/453,600 * ***dcfm*** * 60
$Conc_{@15\%O2}$ = Conc * (20.9 -15)/(20.9 - $\%O_2$)

Table 10
Particulate Matter Emission Rates

Company	**Ford MAP**			
Source Designation	**3-Wet Oven RTO Outlet**			
Test Date	**7/15/2019**	**7/15/2019**	**7/15/2019**	
Meter/Nozzle Information	Run 1	Run 2	Run 3	Average
Meter Temperature Tm (F)	84.8	70.0	68.3	74.3
Meter Pressure - Pm (in. Hg)	29.5	29.4	29.3	29.4
Measured Sample Volume (Vm)	121.4	118.7	124.7	121.6
Sample Volume (Vm-Std ft3)	114.0	114.2	119.9	116.0
Sample Volume (Vm-Std m3)	3.23	3.23	3.39	3.28
Condensate Volume (Vw-std)	2.188	3.880	4.314	3.461
Gas Density (Ps(std) lbs/ft3) (wet)	0.0740	0.0736	0.0736	0.0737
Gas Density (Ps(std) lbs/ft3) (dry)	0.0745	0.0745	0.0745	0.0745
Total weight of sampled gas (m g lbs) (wet)	8.60	8.69	9.14	8.81
Total weight of sampled gas (m g lbs) (dry)	8.49	8.51	8.93	8.65
Nozzle Size - An (sq. ft.)	0.000619	0.000619	0.000619	0.000619
Isokinetic Variation - I	99.6	101.4	99.9	100.3
Stack Data				
Average Stack Temperature - Ts (F)	313.3	312.0	309.7	311.7
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	28.6	28.5	28.5	28.5
Stack Gas Specific Gravity (Gs)	0.989	0.983	0.983	0.985
Percent Moisture (Bws)	1.88	3.29	3.47	2.88
Water Vapor Volume (fraction)	0.0188	0.0329	0.0347	0.0288
Pressure - Ps ("Hg)	29.4	29.3	29.1	29.3
Average Stack Velocity -Vs (ft/sec)	26.0	26.0	27.8	26.6
Area of Stack (ft2)	19.0	19.0	19.0	19.0
Exhaust Gas Flowrate				
Flowrate ft^3(Actual)	29,632	29,627	31,677	30,312
Flowrate ft^3 (Standard Wet)	19,848	19,815	21,164	20,275
Flowrate ft^3 (Standard Dry)	19,474	19,164	20,428	19,689
Flowrate m^3 (standard dry)	551	543	578	558
Total Particulate Weights (mg)				
Total Nozzle/Probe/Filter	3.7	2.5	1.3	2.5
Organic Condensible Particulate	1.3	1.5	1.0	1.3
Inorganic Condensible Particulate	7.6	8.1	5.0	6.9
Condensible Blank Correction	2.0	2.0	2.0	2.0
Total Condensible Particulate	6.9	7.6	4.0	6.1
Total Filterable and Condensible Particulate	10.6	10.1	5.3	8.6
Filterable Particulate Concentration				
lb/1000 lb (wet)	0.001	0.001	0.000	0.001
lb/1000 lb (dry)	0.001	0.001	0.000	0.001
mg/dscm (dry)	1.1	0.8	0.4	0.8
gr/dscf	0.0005	0.0003	0.0002	0.0003
Filterable Particulate Emission Rate				
lb/ hr	0.08	0.06	0.03	0.06
Condensible Particulate Concentration				
lb/1000 lb (wet)	0.002	0.002	0.001	0.002
lb/1000 lb (dry)	0.002	0.002	0.001	0.002
mg/dscm (dry)	2.1	2.3	1.2	1.9
gr/dscf	0.0009	0.0010	0.0005	0.0008
Condensible Particulate Emission Rate				
lb/ hr	0.16	0.17	0.09	0.14
Total Particulate Concentration				
lb/1000 lb (wet)	0.003	0.003	0.001	0.002
lb/1000 lb (dry)	0.003	0.003	0.001	0.002
mg/dscm (dry)	3.3	3.1	1.6	2.6
gr/dscf	0.0014	0.0014	0.0007	0.0012
lb/dscf	2.04E-07	1.94E-07	9.73E-08	1.65E-07
Total Particulate Emission Rate				
lb/ hr	0.24	0.22	0.12	0.19

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Table 11
Particulate Matter Emission Rates

Company	**Ford MAP**			
Source Designation	**Non-Painting Spray Booth Zone**			
Test Date	**7/10/2019**	**7/10/2019**	**7/11/2019**	
Meter/Nozzle Information	Run 1	Run 2	Run 3	Average
Meter Temperature Tm (F)	89.8	93.1	83.3	88.7
Meter Pressure - Pm (in. Hg)	29.4	29.3	29.2	29.3
Measured Sample Volume (Vm)	141.3	139.4	140.4	140.3
Sample Volume (Vm-Std ft3)	135.2	132.6	135.3	134.4
Sample Volume (Vm-Std m3)	3.83	3.75	3.83	3.80
Condensate Volume (Vw-std)	4.196	4.149	4.244	4.196
Gas Density (Ps(std) lbs/ft3) (wet)	0.0737	0.0737	0.0737	0.0737
Gas Density (Ps(std) lbs/ft3) (dry)	0.0745	0.0745	0.0745	0.0745
Total weight of sampled gas (m g lbs) (wet)	10.27	10.07	10.28	10.21
Total weight of sampled gas (m g lbs) (dry)	10.08	9.88	10.08	10.01
Nozzle Size - An (sq. ft.)	0.000488	0.000488	0.000488	0.000488
Isokinetic Variation - I	101.1	100.3	100.2	100.5
Stack Data				
Average Stack Temperature - Ts (F)	76.4	78.7	78.1	77.7
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	28.5	28.5	28.5	28.5
Stack Gas Specific Gravity (Gs)	0.984	0.984	0.984	0.984
Percent Moisture (Bws)	3.01	3.03	3.04	3.03
Water Vapor Volume (fraction)	0.0301	0.0303	0.0304	0.0303
Pressure - Ps ("Hg)	29.2	29.2	29.1	29.2
Average Stack Velocity -Vs (ft/sec)	27.2	27.0	27.7	27.3
Area of Stack (ft2)	43.7	43.7	43.7	43.7
Exhaust Gas Flowrate				
Flowrate ft^3(Actual)	71,381	70,836	72,632	71,616
Flowrate ft^3 (Standard Wet)	68,642	67,823	69,260	68,575
Flowrate ft^3 (Standard Dry)	66,576	65,764	67,154	66,498
Flowrate m^3 (standard dry)	1,885	1,862	1,902	1,883
Total Particulate Weights (mg)				
Nozzle/Probe/Filter	0.8	3.4	2.1	2.1
Total Particulate Concentration				
lb/1000 lb (wet)	0.000	0.001	0.000	0.000
lb/1000 lb (dry)	0.000	0.001	0.000	0.000
mg/dscm (dry)	0.2	0.9	0.5	0.6
gr/dscf	0.0001	0.0004	0.0002	0.0002
lb/dscf	1.30E-08	5.65E-08	3.42E-08	3.46E-08
Total Particulate Emission Rate				
lb/ hr	0.1	0.2	0.1	0.14

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Table 12
Particulate Matter Emission Rates

Company	**Ford**				
Source Designation	**Sealer Oven**				
Test Date	**7/17/2019**	**7/17/2019**	**7/18/2019**	**7/18/2019**	
Meter/Nozzle Information	P-1	P-2	P-3	P-4	Average
Meter Temperature Tm (F)	86.9	94.3	84.1	95.5	88.82
Meter Pressure - Pm (in. Hg)	29.2	29.2	29.3	29.3	29.28
Measured Sample Volume (Vm)	125.2	122.0	123.3	126.0	124.8
Sample Volume (Vm-Std ft3)	119.9	115.2	119.0	119.2	119.4
Sample Volume (Vm-Std m3)	3.40	3.26	3.37	3.38	3.38
Condensate Volume (Vw-std)	3.480	2.985	2.782	3.456	3.24
Gas Density (Ps(std) lbs/ft3) (wet)	0.0737	0.0738	0.0739	0.0737	0.0738
Gas Density (Ps(std) lbs/ft3) (dry)	0.0745	0.0745	0.0745	0.0745	0.0745
Total weight of sampled gas (m g lbs) (wet)	9.10	8.73	9.00	9.04	9.05
Total weight of sampled gas (m g lbs) (dry)	8.94	8.59	8.87	8.88	8.90
Nozzle Size - An (sq. ft.)	0.000319	0.000319	0.000319	0.000319	0.000319
Isokinetic Variation - I	103.8	101.0	101.4	103.6	102.9
Stack Data					
Average Stack Temperature - Ts (F)	97.8	100.2	95.1	100.4	97.8
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	28.5	28.6	28.6	28.5	28.5
Stack Gas Specific Gravity (Gs)	0.985	0.986	0.987	0.985	0.986
Percent Moisture (Bws)	2.82	2.52	2.28	2.82	2.64
Water Vapor Volume (fraction)	0.0282	0.0252	0.0228	0.0282	0.0264
Pressure - Ps ("Hg)	29.1	29.1	29.2	29.2	29.2
Average Stack Velocity -Vs (ft/sec)	37.4	37.0	37.6	37.4	37.5
Area of Stack (ft2)	12.3	12.3	12.3	12.3	12.3
Exhaust Gas Flowrate					
Flowrate ft^3(Actual)	27,633	27,329	27,717	27,569	27,640
Flowrate ft^3 (Standard Wet)	25,440	25,050	25,710	25,330	25,493
Flowrate ft^3 (Standard Dry)	24,722	24,418	25,123	24,616	24,821
Flowrate m^3 (standard dry)	700	691	711	697	703
Total Particulate Weights (mg)					
Total Nozzle/Probe/Filter*	0.5	0.5	0.5	0.5	0.5
Organic Condensible Particulate	0.5	4.4	0.7	0.6	0.6
Inorganic Condensible Particulate	5.0	4.7	3.8	4.0	4.2
Condensible Blank Correction	2.0	2.0	2.0	2.0	2.0
Total Condensible Particulate	3.5	7.0	2.5	2.6	2.9
Total Filterable and Condensible Particulate	4.0	7.5	3.0	3.1	3.4
Filterable Particulate Concentration					
lb/1000 lb (wet)	0.0001	0.0001	0.0001	0.0001	0.0001
lb/1000 lb (dry)	0.0001	0.0001	0.0001	0.0001	0.0001
mg/dscm (dry)	0.1	0.2	0.1	0.1	0.1
gr/dscf	0.0001	0.0001	0.0001	0.0001	0.0001
Filterable Particulate Emission Rate					
lb/ hr	0.01	0.01	0.01	0.01	0.01
Condensible Particulate Concentration					
lb/1000 lb (wet)	0.001	0.002	0.001	0.001	0.001
lb/1000 lb (dry)	0.001	0.002	0.001	0.001	0.001
mg/dscm (dry)	1.0	2.2	0.7	0.8	0.8
gr/dscf	0.0004	0.0009	0.0003	0.0003	0.0004
Condensible Particulate Emission Rate					
lb/ hr	0.10	0.20	0.07	0.07	0.08
Total Particulate Concentration					
lb/1000 lb (wet)	0.001	0.002	0.001	0.001	0.001
lb/1000 lb (dry)	0.001	0.002	0.001	0.001	0.001
mg/dscm (dry)	1.2	2.3	0.9	0.9	1.0
gr/dscf	0.0005	0.0010	0.0004	0.0004	0.0004
Total Particulate Emission Rate					
lb/ hr	0.11	0.21	0.08	0.08	0.09
lb/vehicle	0.004	0.008	0.003	0.003	0.003

* - Filterable Particualte matter results were less than the detection limit specified by USEPA Method 5. Results are listed as the detection limit

Table 13
Particulate Matter Emission Rates

Company	**Ford MAP**			
Source Designation	**Scuff Booth**			
Test Date	**7/10/2019**	**7/10/2019**	**7/11/2019**	
Meter/Nozzle Information	Run 1	Run 2	Run 3	Average
Meter Temperature Tm (F)	97.8	102.9	87.3	96.0
Meter Pressure - Pm (in. Hg)	29.3	29.3	29.2	29.3
Measured Sample Volume (Vm)	126.6	127.9	124.8	126.4
Sample Volume (Vm-Std ft3)	119.9	120.1	119.9	120.0
Sample Volume (Vm-Std m3)	3.40	3.40	3.39	3.40
Condensate Volume (Vw-std)	2.640	3.112	2.640	2.798
Gas Density (Ps(std) lbs/ft3) (wet)	0.0739	0.0738	0.0739	0.0739
Gas Density (Ps(std) lbs/ft3) (dry)	0.0745	0.0745	0.0745	0.0745
Total weight of sampled gas (m g lbs) (wet)	9.06	9.10	9.06	9.07
Total weight of sampled gas (m g lbs) (dry)	8.94	8.95	8.94	8.94
Nozzle Size - An (sq. ft.)	0.000250	0.000250	0.000250	0.000250
Isokinetic Variation - I	100.9	101.0	100.6	100.8
Stack Data				
Average Stack Temperature - Ts (F)	75.8	78.5	81.9	78.7
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)	0.988	0.986	0.988	0.987
Percent Moisture (Bws)	2.15	2.53	2.15	2.28
Water Vapor Volume (fraction)	0.0215	0.0253	0.0215	0.0228
Pressure - Ps ("Hg)	29.2	29.2	29.0	29.1
Average Stack Velocity -Vs (ft/sec)	46.8	47.3	47.7	47.3
Area of Stack (ft2)	12.6	12.6	12.6	12.6
Exhaust Gas Flowrate				
Flowrate ft^3(Actual)	35,304	35,621	35,981	35,635
Flowrate ft^3 (Standard Wet)	33,936	34,074	34,025	34,012
Flowrate ft^3 (Standard Dry)	33,205	33,214	33,292	33,237
Flowrate m^3 (standard dry)	940	941	943	941
Total Particulate Weights (mg)				
Nozzle/Probe/Filter	2.9	3.7	2.2	2.9
Total Particulate Concentration				
lb/1000 lb (wet)	0.001	0.001	0.001	0.001
lb/1000 lb (dry)	0.001	0.001	0.001	0.001
mg/dscm (dry)	0.9	1.1	0.6	0.9
gr/dscf	0.0004	0.0005	0.0003	0.0004
Total Particulate Emission Rate				
lb/ hr	0.1	0.1	0.1	0.11
lb/vehicle	0.006	0.010	0.003	0.006

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Table 14
Particulate Matter Emission Rates

Company	**Ford MAP**			
Source Designation	**Prime Uncontrolled Robot**			
Test Date	**7/11/2019**	**7/12/2019**	**7/12/2019**	
Meter/Nozzle Information	Run 1	Run 2	Run 3	Average
Meter Temperature Tm (F)	85.9	74.8	87.5	82.7
Meter Pressure - Pm (in. Hg)	29.3	29.4	29.4	29.3
Measured Sample Volume (Vm)	183.8	182.3	185.1	183.7
Sample Volume (Vm-Std ft3)	176.9	179.4	178.1	178.1
Sample Volume (Vm-Std m3)	5.01	5.08	5.04	5.04
Condensate Volume (Vw-std)	4.904	4.998	4.715	4.872
Gas Density (Ps(std) lbs/ft3) (wet)	0.0738	0.0738	0.0738	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)	13.41	13.61	13.49	13.50
Total weight of sampled gas (m g lbs) (dry)	13.18	13.37	13.27	13.28
Nozzle Size - An (sq. ft.)	0.000431	0.000431	0.000431	0.000431
Isokinetic Variation - I	100.5	100.2	100.1	100.3
Stack Data				
Average Stack Temperature - Ts (F)	77.9	73.0	73.2	74.7
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	28.5	28.5	28.6	28.5
Stack Gas Specific Gravity (Gs)	0.986	0.986	0.986	0.986
Percent Moisture (Bws)	2.70	2.71	2.58	2.66
Water Vapor Volume (fraction)	0.0270	0.0271	0.0258	0.0266
Pressure - Ps ("Hg)	29.0	29.1	29.1	29.1
Average Stack Velocity -Vs (ft/sec)	40.8	41.0	40.7	40.9
Area of Stack (ft2)	18.3	18.3	18.3	18.3
Exhaust Gas Flowrate				
Flowrate ft^3(Actual)	44,893	45,141	44,819	44,951
Flowrate ft^3 (Standard Wet)	42,783	43,534	43,205	43,174
Flowrate ft^3 (Standard Dry)	41,629	42,354	42,090	42,024
Flowrate m^3 (standard dry)	1,179	1,199	1,192	1,190
Total Particulate Weights (mg)				
Nozzle/Probe/Filter*	0.7	0.5	0.5	0.6
Total Particulate Concentration				
lb/1000 lb (wet)	0.000	0.000	0.000	0.000
lb/1000 lb (dry)	0.000	0.000	0.000	0.000
mg/dscm (dry)	0.1	0.1	0.1	0.1
gr/dscf	0.0001	0.0000	0.0000	0.0000
lb/dscf	8.73E-09	6.14E-09	6.19E-09	7.02E-09
Total Particulate Emission Rate				
lb/ hr	0.022	0.016	0.016	0.018

* - Filterable particulate matter results for runs 2 and 3 were below the detection limit specified by USEPA Method 17. Results are listed as the detection limit.

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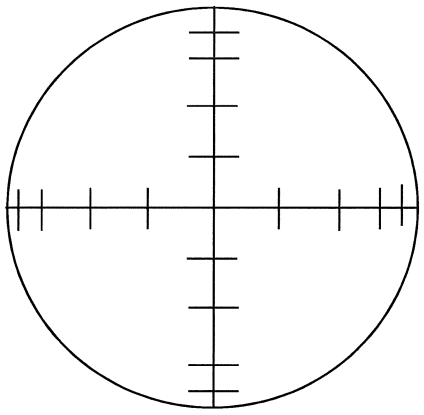
Figures

MONTROSE
AIR QUALITY SERVICES

diameter = 33.5 inches

Points	Distance "
1	1.07
2	3.52
3	6.50
4	10.82
5	22.68
6	27.00
7	29.98
8	32.43



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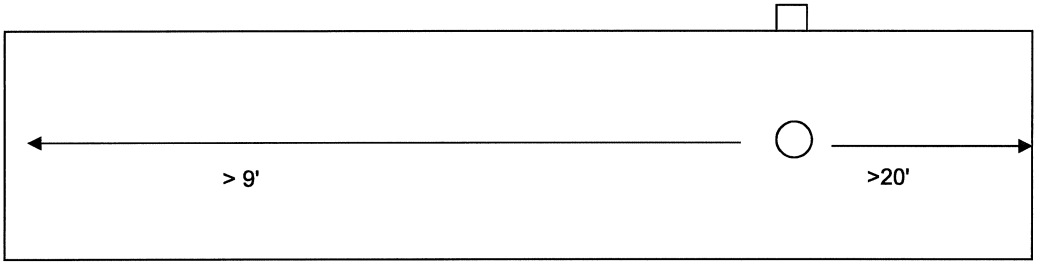


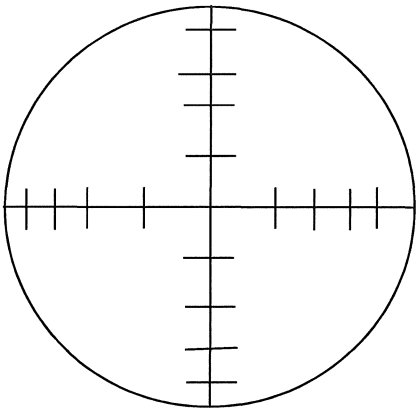
Figure No. 1

Site:	Sampling Date:	
Ecoat RTO Inlet Tank **Ford MAP** **Wayne, MI**	**July 9, 2019**	**Montrose Air Quality Services** **4949 Fernlee Ave** **Royal Oak, MI**

MONTROSE
AIR QUALITY SERVICES

diameter = 49.75 inches

Points	Distance "
1	1.59
2	5.22
3	9.65
4	16.07
5	33.68
6	40.10
7	44.53
8	48.16



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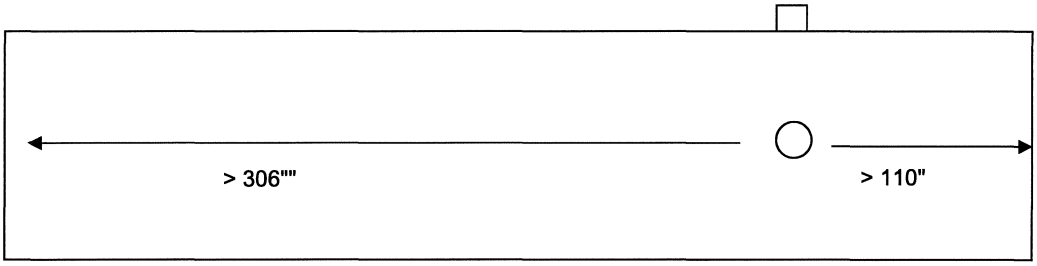
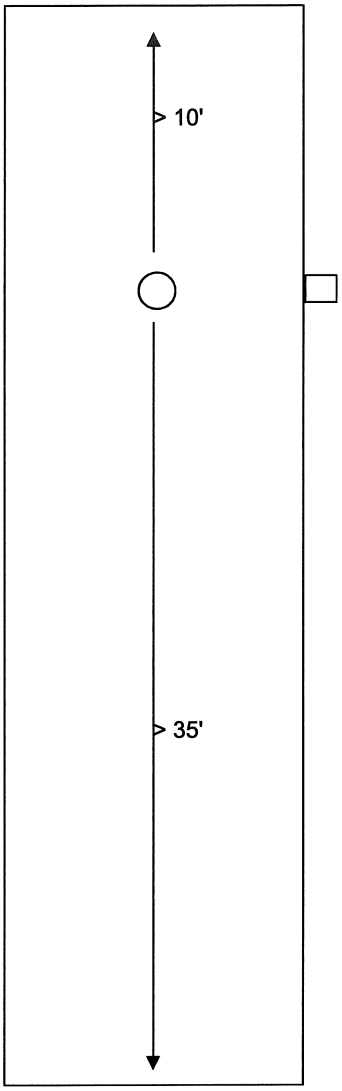


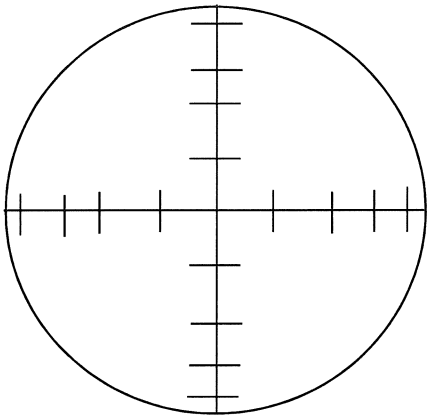
Figure No. 2

Site:	Sampling Date:	
Ecoat RTO Inlet Oven Ford MAP Wayne, MI	July 9, 2019	Montrose Air Quality Services 4949 Fernlee Ave Royal Oak, MI

MONTROSE
AIR QUALITY SERVICES

diameter = 48.25 inches





Not to Scale

Points	Distance "
1	1.54
2	5.07
3	9.36
4	15.58
5	32.67
6	38.89
7	43.18
8	46.71

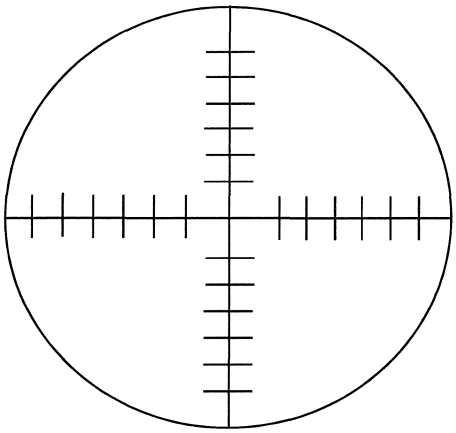
Figure No. 3

Site:	Sampling Date:	
Ecoat RTO Outlet	July 9, 2019	**Montrose Air Quality Services**
Ford MAP		4949 Fernlee Ave
Wayne, MI		Royal Oak, Michigan

MONTROSE
AIR QUALITY SERVICES

diameter = 55.5 inches

Points	Distance "
1	1.78
2	5.83
3	10.77
4	17.93
5	37.57
6	44.73
7	49.67
8	53.72



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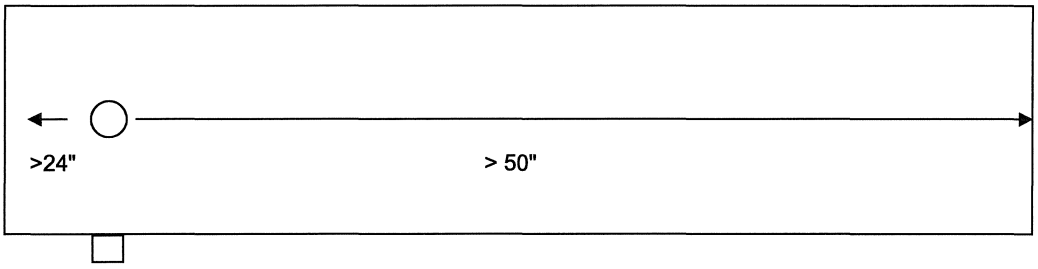
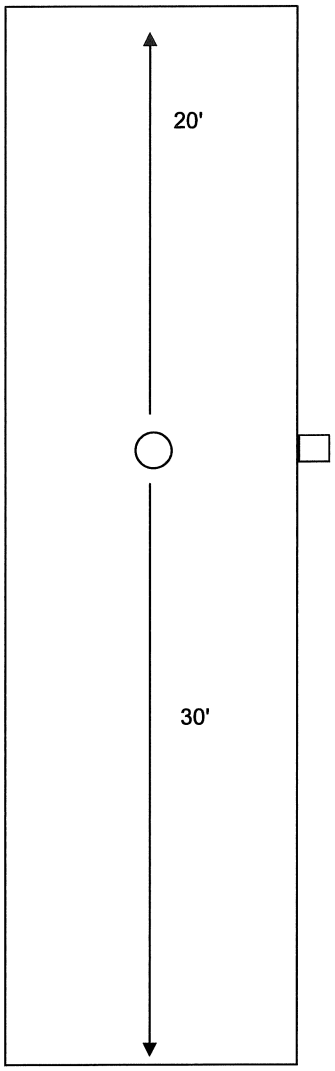


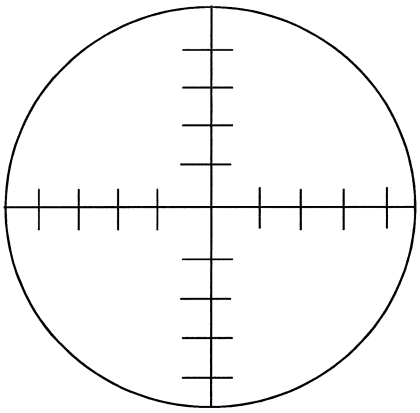
Figure No. 4

Site: **3-Wet Oven RTO Inlet** **Ford MAP** **Wayne, MI**	**Sampling Date:** **July 15, 2019**	**Montrose Air Quality Services** **4949 Fernlee Ave** **Royal Oak, MI**

MONTROSE
AIR QUALITY SERVICES

diameter = 59 inches





Not to Scale

Points	Distance "
1	1.2
2	4.0
3	7.0
4	10.4
5	14.8
6	21.0
7	38.0
8	44.3
9	48.6
10	52.0
11	55.0
12	57.8

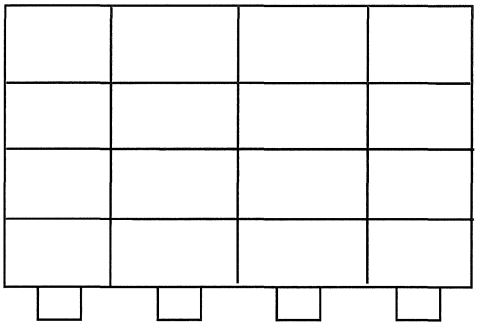
Figure No. 5

Site: **3-Wet Oven RTO Outlet** **Ford MAP** **Wayne, MI**	**Sampling Date:** **July 15-17, 2019**	**Montrose Air Quality Services** **4949 Fernlee Ave** **Royal Oak, MI**

MONTROSE
AIR QUALITY SERVICES

Stack Dimensions: 48" X 48"

Points	Distance "
1	6
2	18
3	30
4	42



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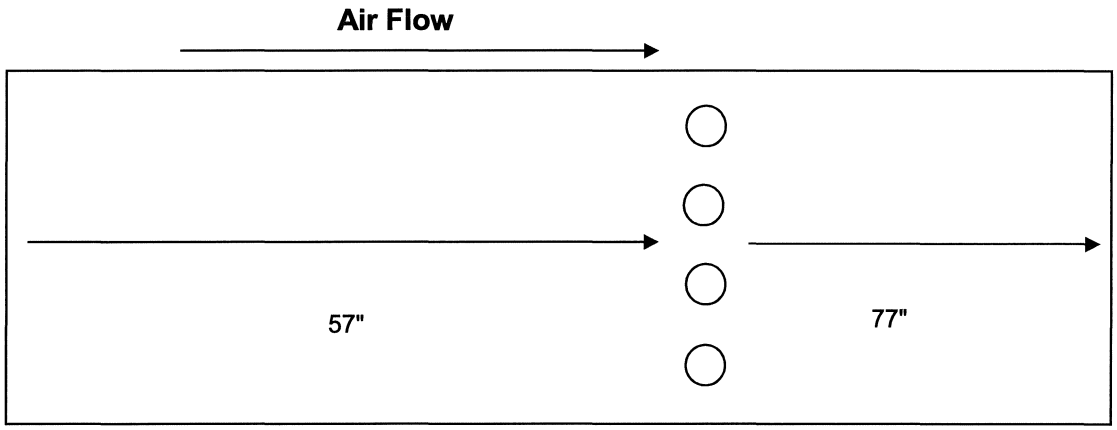
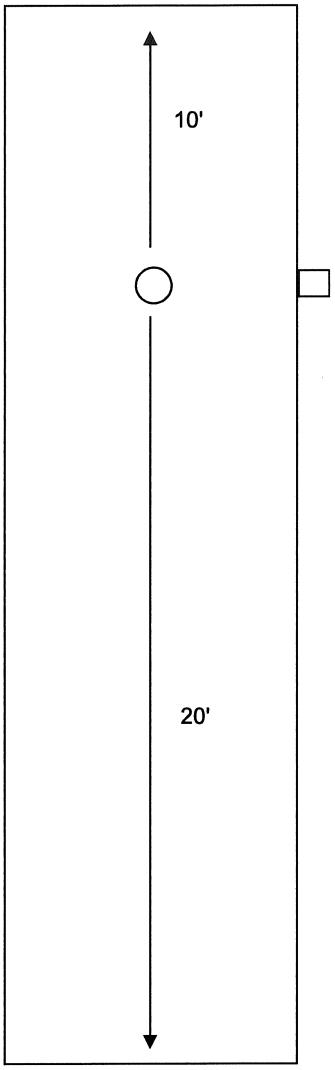


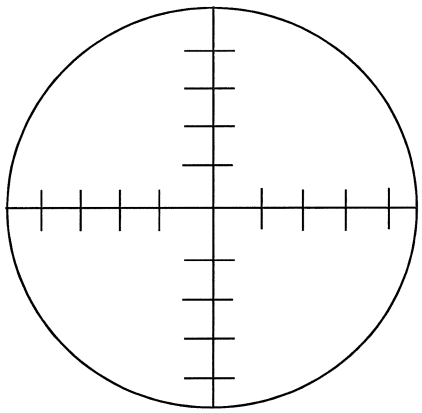
Figure No. 6

Site: **Carbon Wheel System 1 RTO Inlet** **Ford MAP** **Wayne, MI**	**Sampling Date:** **July 10, 2019**	**Montrose Air Quality Services** **4949 Fernlee Ave** **Royal Oak, MI**

MONTROSE
AIR QUALITY SERVICES

diameter = 47.25 inches





Not to Scale

Points	Distance "
1	1.51
2	4.96
3	9.17
4	15.26
5	31.99
6	38.08
7	42.29
8	45.74

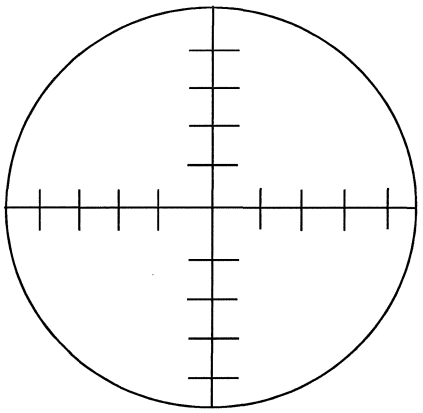
Figure No. 7

Site:	Sampling Date:	
Carbon Wheel System 1 RTO Outlet **Ford MAP** **Wayne, MI**	**July 10, 2019**	**Montrose Air Quality Services** **4949 Fernlee Ave** **Royal Oak, MI**

MONTROSE
AIR QUALITY SERVICES

diameter = 46 inches

Points	Distance "
1	1.47
2	4.83
3	8.92
4	14.86
5	31.14
6	37.08
7	41.17
8	44.53



Not to Scale

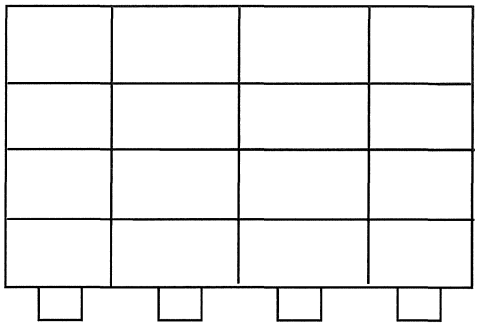
Figure No. 8

Site:	Sampling Date:	
Carbon Wheel System 2 RTO Inlet **Ford MAP** **Wayne, MI**	**July 11, 2019**	**Montrose Air Quality Services** **4949 Fernlee Ave** **Royal Oak, MI**

MONTROSE
AIR QUALITY SERVICES

Stack Dimensions: 48" X 66"

Points	Distance "
1	6
2	18
3	30
4	42



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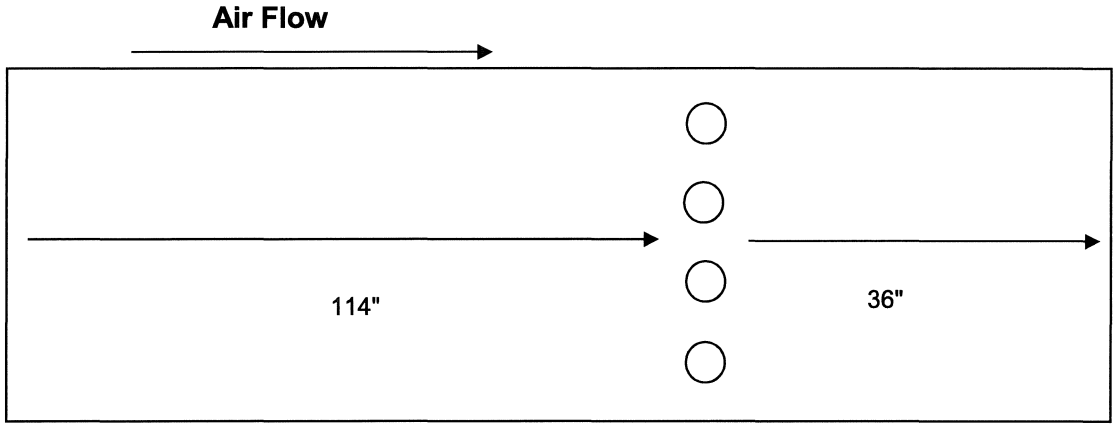


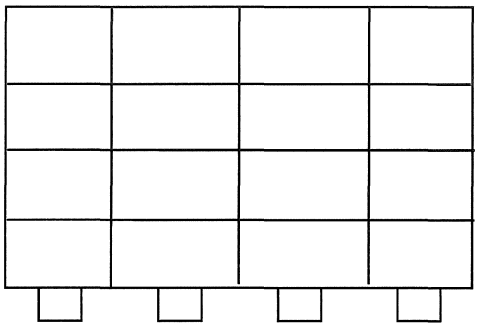
Figure No. 9

Site: **Carbon Wheel System 2 RTO Outlet** **Ford MAP** **Wayne, MI**	**Sampling Date:** **July 11, 2019**	**Montrose Air Quality Services** **4949 Fernlee Ave** **Royal Oak, MI**

MONTROSE
AIR QUALITY SERVICES

Stack Dimensions: 60" X 70"

Points	Distance "
1	7.5
2	22.5
3	37.5
4	52.5



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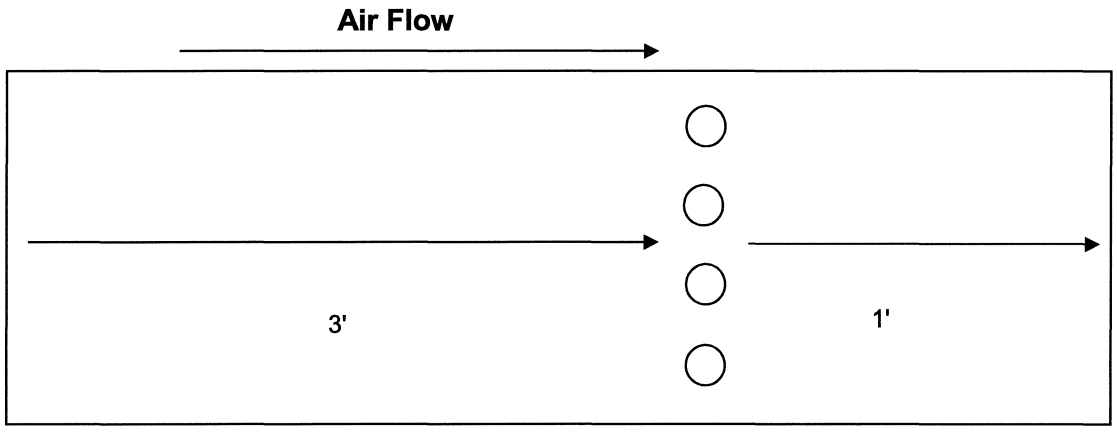


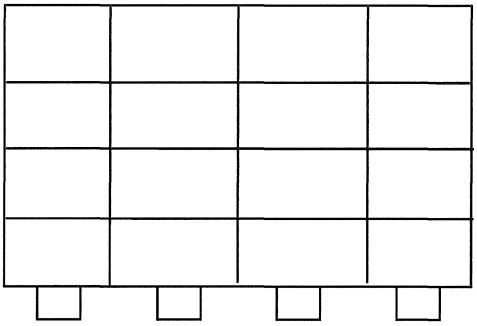
Figure No. 10

Site: **Carbon Wheel System 2 Inlet Basecoat 1** **Ford MAP** **Wayne, MI**	**Sampling Date:** **July 12, 2019**	**Montrose Air Quality Services** **4949 Fernlee Ave** **Royal Oak, MI**

MONTROSE
AIR QUALITY SERVICES

Stack Dimensions: 48" X 60"

Points	Distance "
1	6
2	18
3	30
4	42



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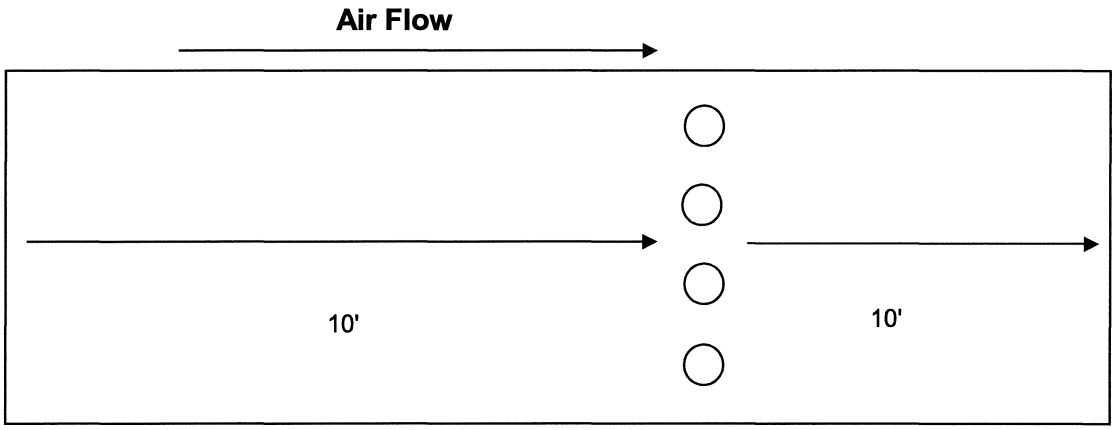


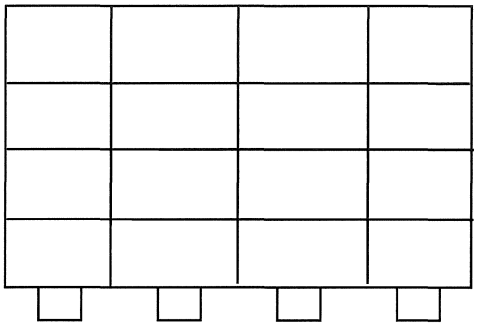
Figure No. 11

Site: **Carbon Wheel System 2 Inlet Basecoat 2** **Ford MAP** **Wayne, MI**	**Sampling Date:** **July 12, 2019**	**Montrose Air Quality Services** **4949 Fernlee Ave** **Royal Oak, MI**

MONTROSE
AIR QUALITY SERVICES

Stack Dimensions: 60" X 50"

Points	Distance "
1	6.3
2	18.8
3	31.3
4	43.8



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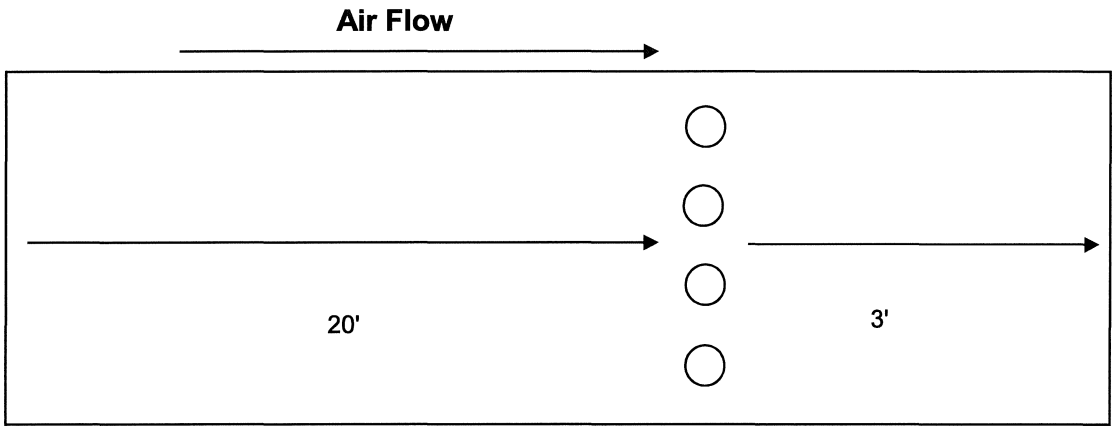


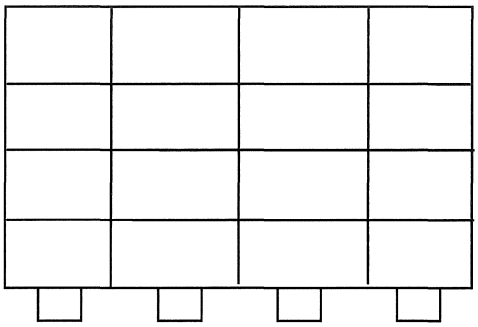
Figure No. 12

Site: **Carbon Wheel System 2 Inlet Clearcoat** **Ford MAP** **Wayne, MI**	**Sampling Date:** **July 12, 2019**	**Montrose Air Quality Services** **4949 Fernlee Ave** **Royal Oak, MI**

MONTROSE
AIR QUALITY SERVICES

Stack Dimensions: 60" X 36"

Points	Distance "
1	4.5
2	13.5
3	22.5
4	31.5



Not to Scale

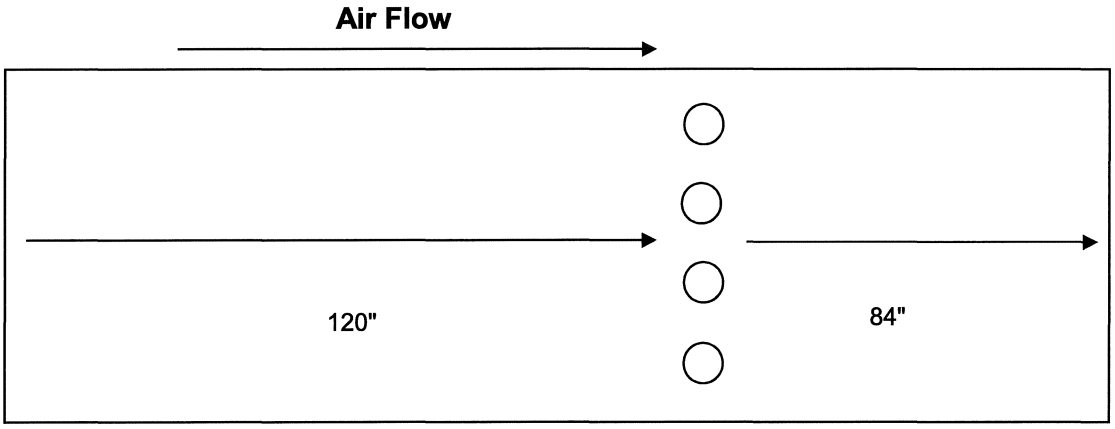
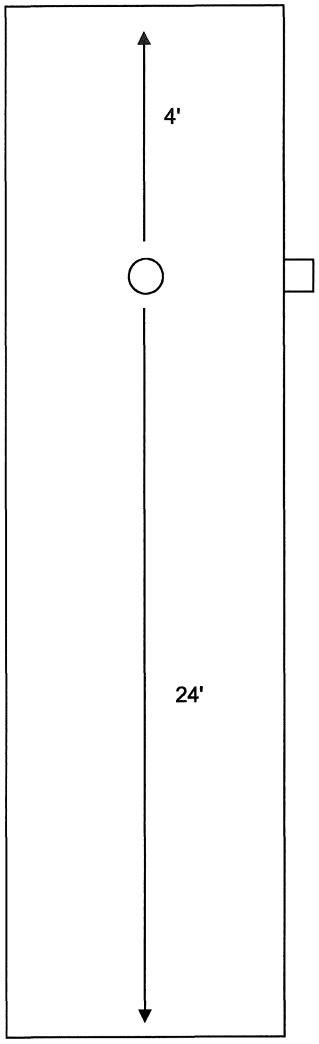


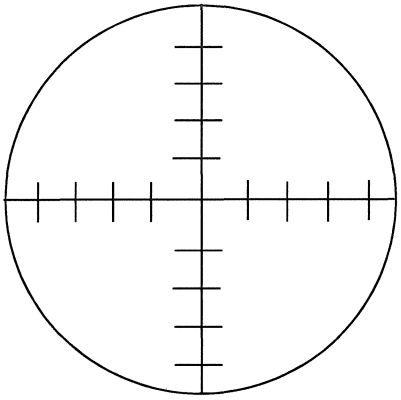
Figure No. 13

Site: **Carbon Wheel System 2 Inlet Primecoat** **Ford MAP** **Wayne, MI**	**Sampling Date:** **July 12, 2019**	**Montrose Air Quality Services** **4949 Fernlee Ave** **Royal Oak, MI**

MONTROSE
AIR QUALITY SERVICES

diameter = 120 inches





Not to Scale

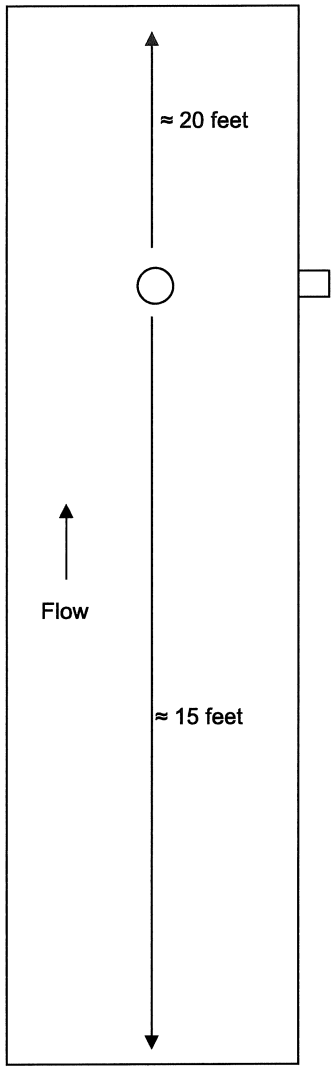
Points	Distance "
1	3.84
2	12.60
3	23.28
4	38.76
5	81.24
6	96.72
7	107.40
8	116.16

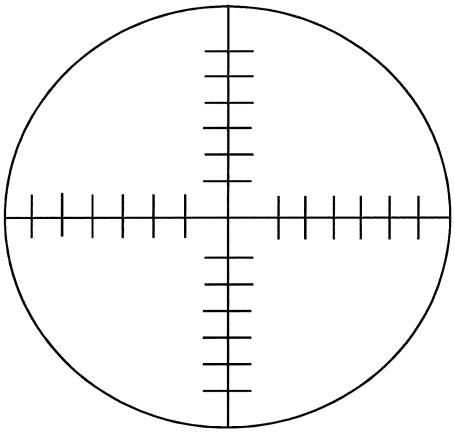
Figure No. 14

Site:	Sampling Date:	
System 2 RTO & Carbon Wheel Outlet Ford MAP Wayne, MI	July 12, 2019	Montrose Air Quality Services 4949 Fernlee Ave Royal Oak, MI

MONTROSE
AIR QUALITY SERVICES

diameter = 89.5 inches





Not to Scale

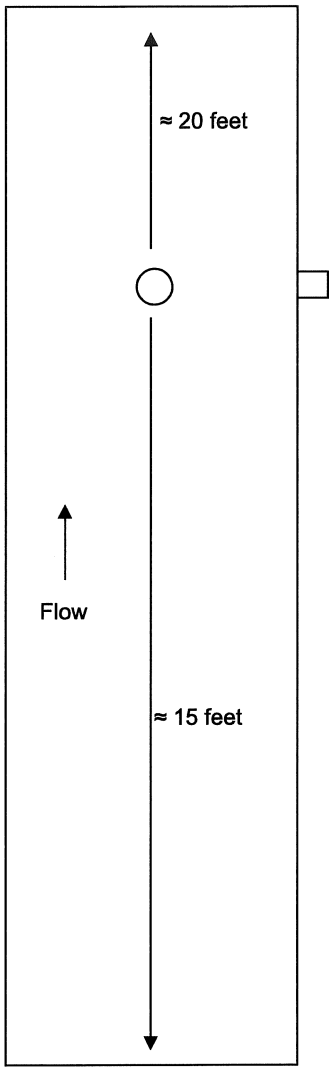
Points	Distance "
1	1.9
2	6.0
3	10.6
4	15.8
5	22.4
6	31.9
7	57.6
8	67.1
9	73.7
10	78.9
11	83.5
12	87.6

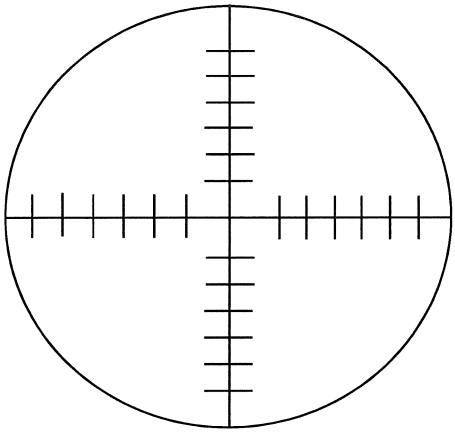
Figure No. 15

Site: **Non Painting Spray Booth** **Ford MAP** **Wayne, Michigan**	**Sampling Date:** **July 10-11, 2019**	**Montrose Air Quality Services** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**

MONTROSE
AIR QUALITY SERVICES

diameter = 47.5 inches





Not to Scale

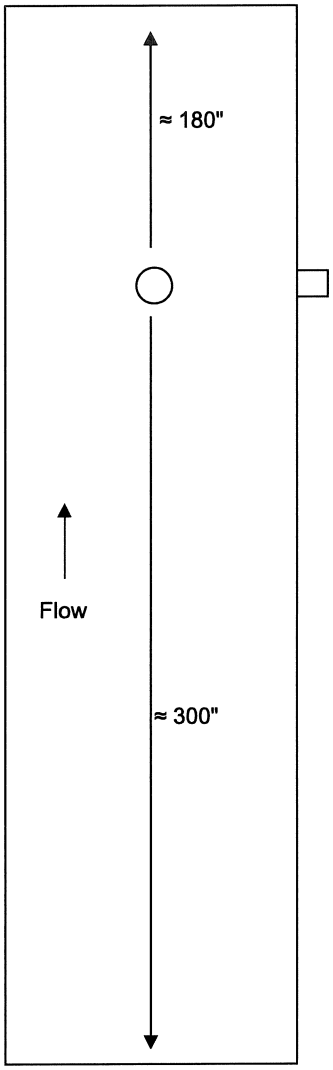
Points	Distance "
1	1.0
2	3.2
3	5.6
4	8.4
5	11.9
6	16.9
7	30.6
8	35.6
9	39.1
10	41.9
11	44.3
12	46.5

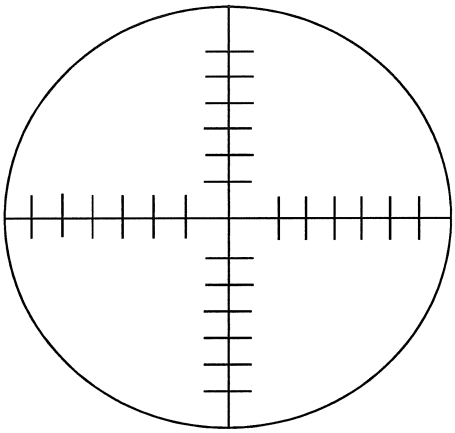
Figure No. 16

Site: **Sealer Oven** **Ford MAP** **Wayne, Michigan**	**Sampling Date:** **July 17-18, 2019**	**Montrose Air Quality Services** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**

MONTROSE
AIR QUALITY SERVICES

diameter = 48 inches





Not to Scale

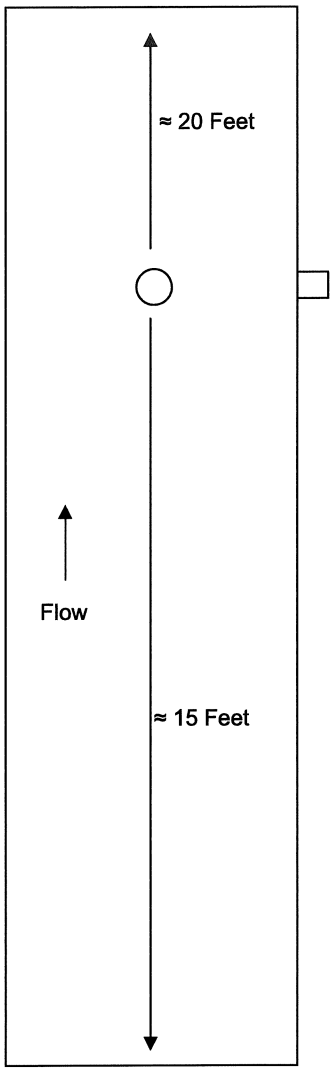
Points	Distance "
1	1.0
2	3.2
3	5.7
4	8.5
5	12.0
6	17.1
7	30.9
8	36.0
9	39.5
10	42.3
11	44.8
12	47.0

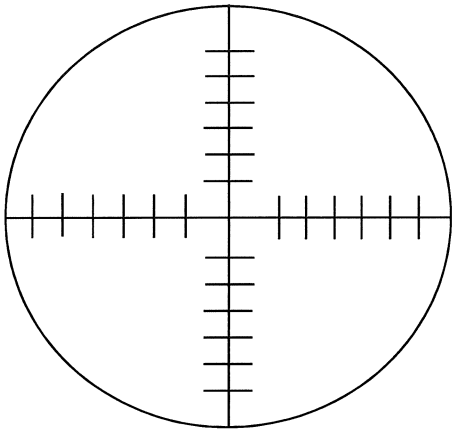
Figure No. 17

Site: **Scuff Booth** **Ford MAP** **Wayne, Michigan**	**Sampling Date:** **July 10-11, 2019**	**Montrose Air Quality Services** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**

MONTROSE
AIR QUALITY SERVICES

diameter = 58 inches





Not to Scale

Points	Distance "
1	1.2
2	3.9
3	6.8
4	10.3
5	14.5
6	20.6
7	37.4
8	43.5
9	47.7
10	51.2
11	54.1
12	56.8

Figure No. 18

Site: **Uncontrolled Prime Robots** **Ford MAP** **Wayne, Michigan**	**Sampling Date:** **July 11-12, 2019**	**Montrose Air Quality Services** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**

MONTROSE
AIR QUALITY SERVICES

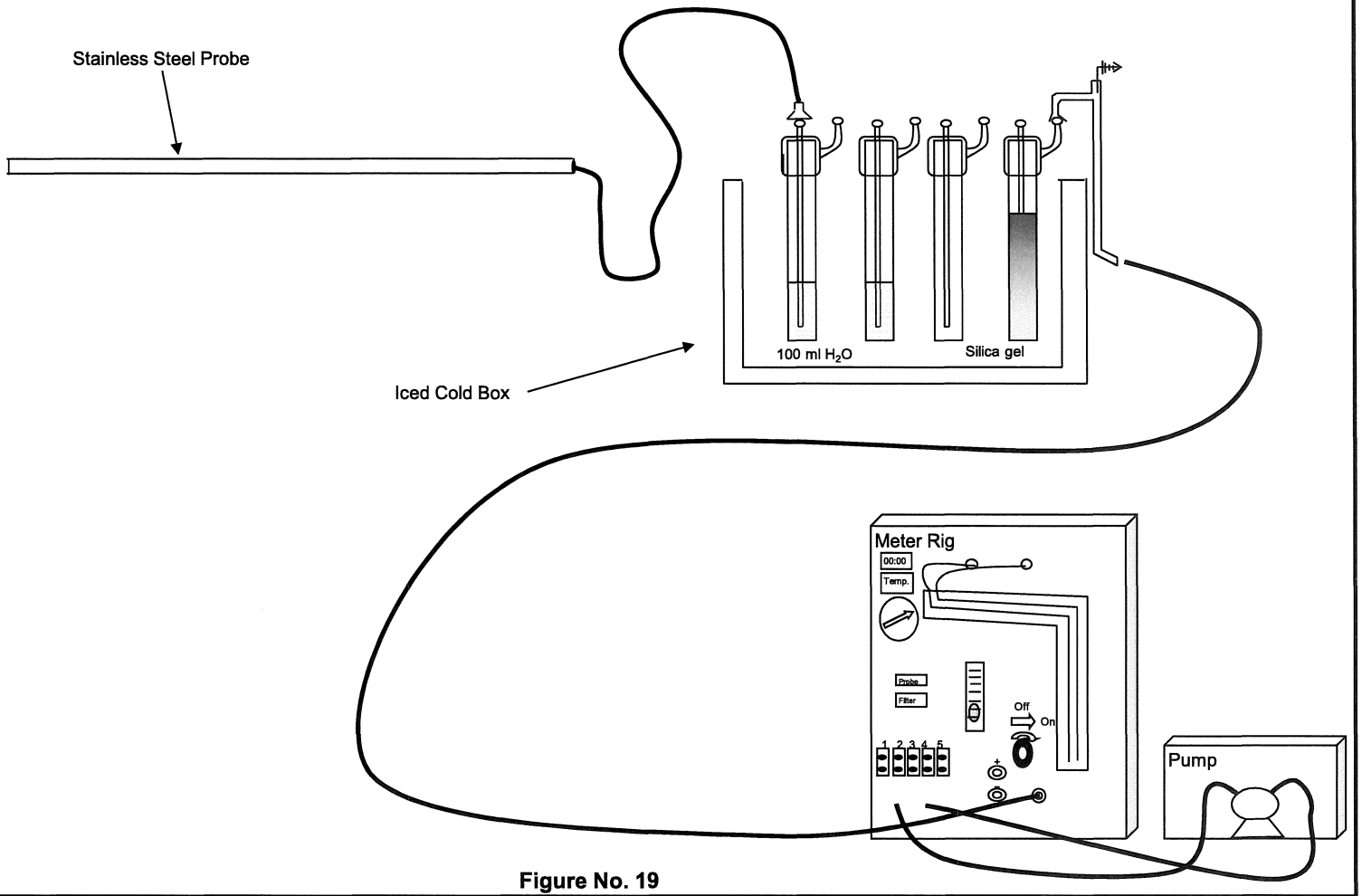


Figure No. 19

Site: **USEPA Method 4** **Ford Motor Company** **Wayne, Michigan**	**Sampling Date:** **July 9-July 18, 2019**	**Montrose Air Quality Services** **4949 Fernlee Ave** **Royal Oak, MI**

MONTROSE
AIR QUALITY SERVICES

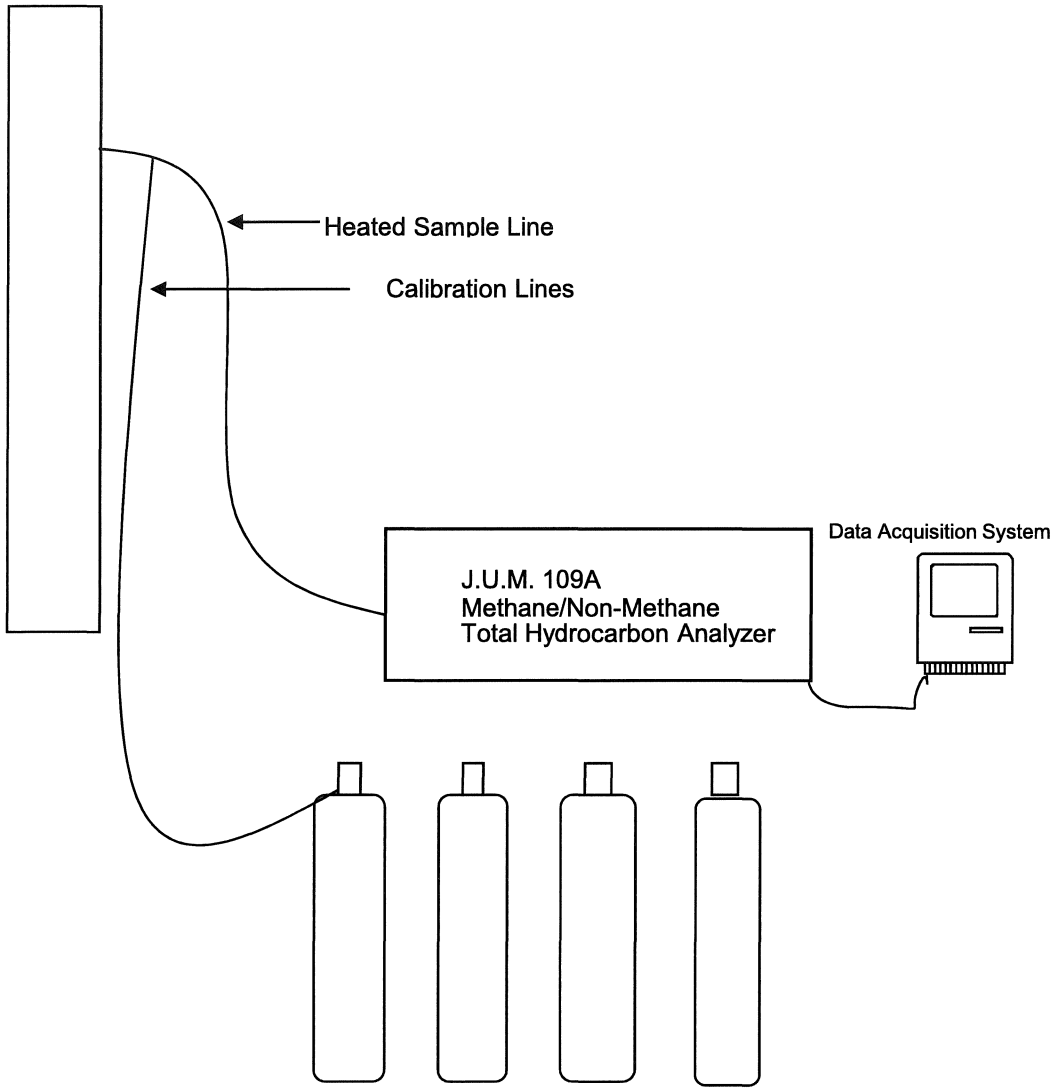


Figure No. 20

Site: **USEPA Method 25A** **Ford Motor Company** **Wayne, Michigan**	**Sampling Date:** **July 9-18, 2019**	**Montrose Air Quality Services** **4949 Fernlee Ave** **Royal Oak, MI**

MONTROSE
AIR QUALITY SERVICES

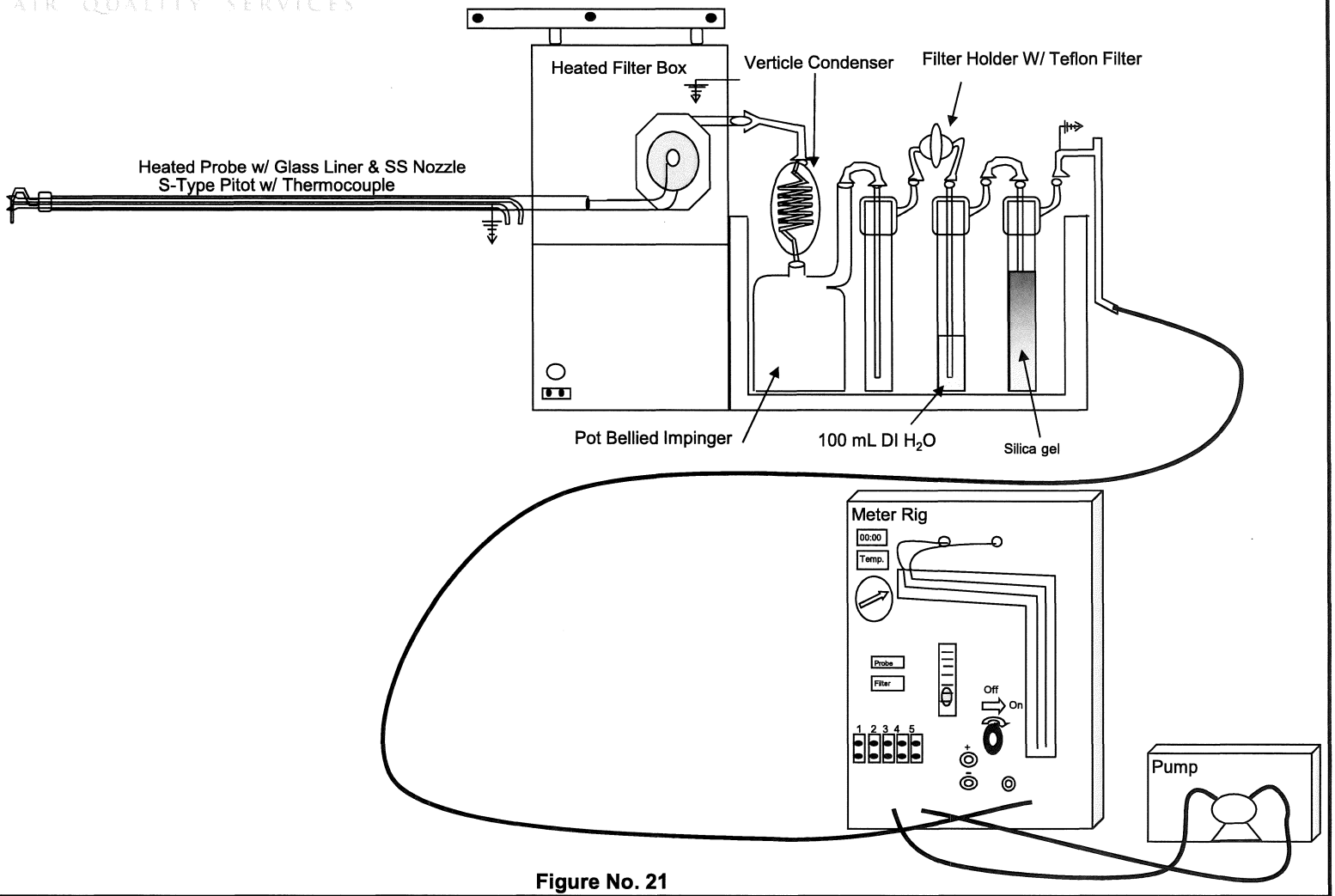


Figure No. 21

Site: **USEPA Method 5/202** **Ford MAP** **Wayne, Michigan**	**Sampling Date:** **July 9-18, 2019**	**Montrose Air Quality Services** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**

MONTROSE
AIR QUALITY SERVICES

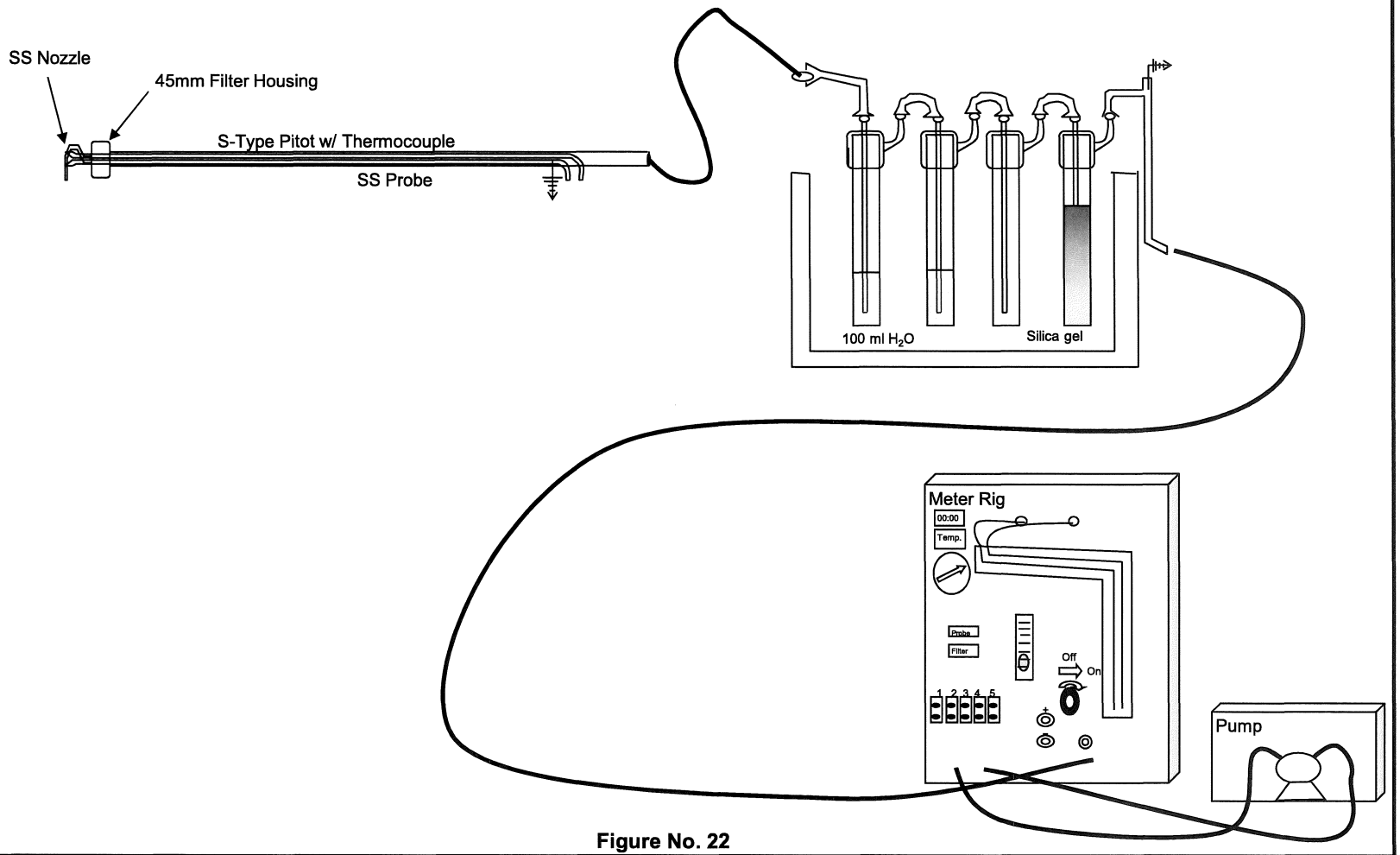


Figure No. 22

Site: **USEPA Method 17** **Ford MAP** **Wayne, Michigan**	**Sampling Date:** **July 9-18, 2019**	**Montrose Air Quality Services** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**

MONTROSE
AIR QUALITY SERVICES

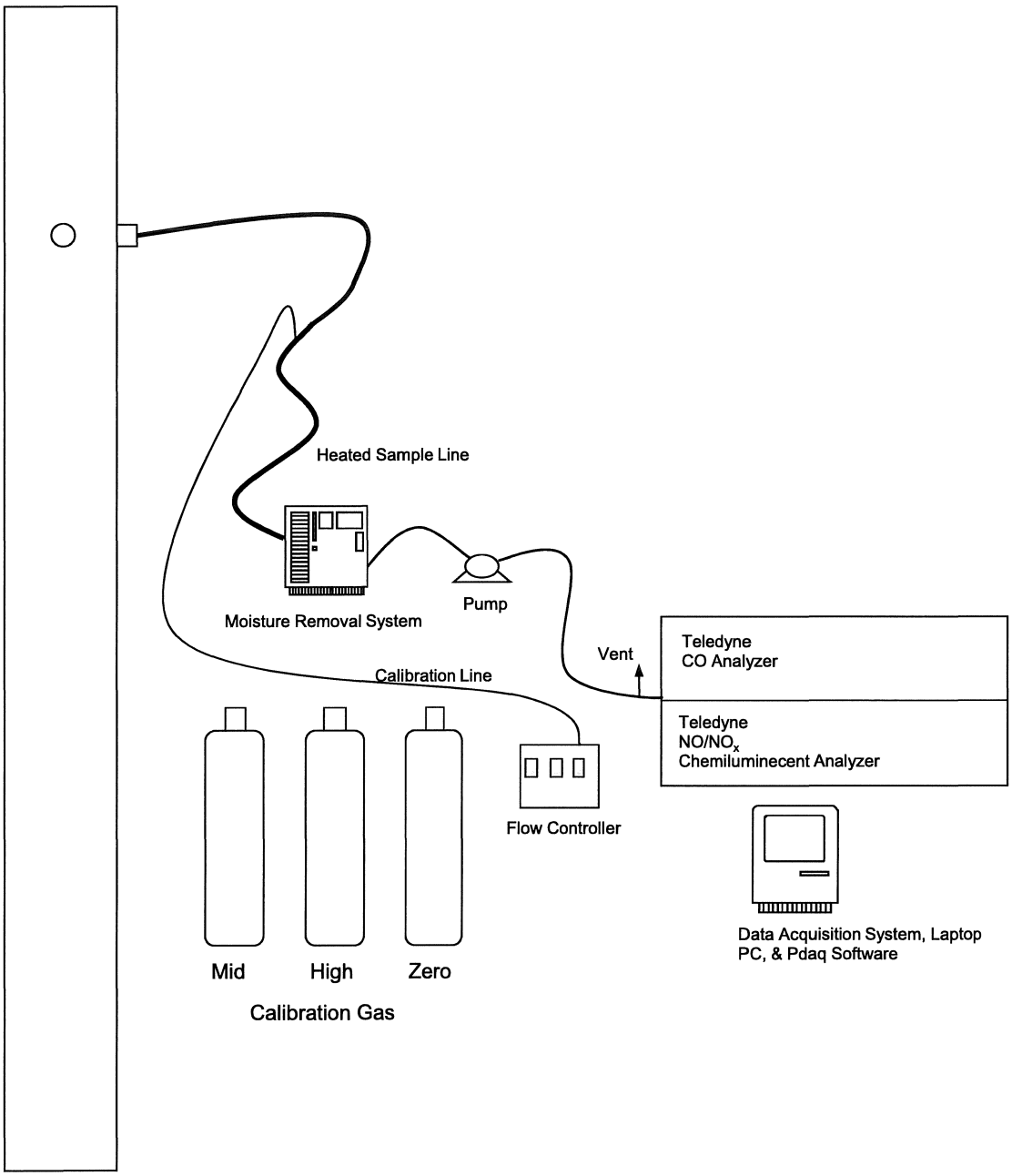


Figure No. 23

Site: **USEPA Method 7E and 10** **Ford MAP** **Wayne, Michigan**	**Sampling Date:** **July 9-18, 2019**	**Montrose Air Quality Services** **4949 Fernlee Avenue** **Royal Oak, MI 48073**