FINAL REPORT

FCA US LLC

DETROIT, MICHIGAN

DETROIT ASSEMBLY COMPLEX – JEFERSON (DACJ) TOPCOAT BOOTH 2 THERMAL OXIDIZER DESTRUCTION EFFICIENCY

RWDI #2410211

October 31, 2024

SUBMITTED TO

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EXECUTIVE SUMMARY

RWDI USA LLC (RWDI) was retained by FCA US LLC (FCA) to complete the emission sampling program at their Detroit Assembly Complex – Jefferson (DACJ) (also referred to as Jefferson North Assembly Plant (JNAP)) located at 2101 Conner Ave., Detroit, Michigan. DACJ operates an automobile assembly plant that produces the Jeep Grand Cherokee and Dodge Durango. Under Title V Renewable Operating Permit (ROP) MI ROP-N2155-2017, this Source Testing Plan covers the required testing for validation of destruction efficiency for EU-TOPCOAT2 (Booth Color 2 Thermal Oxidizer (TO)). The testing program was completed on September 24th, 2024 at the FCA DACJ facility located at 2101 Connor Avenue, Detroit, Michigan 48225.

Testing included measurements of Volatile Organic Compounds (VOC) by United States Environmental Protection Agency (U.S. EPA) Method 25A. The testing was completed to fulfill the requirements within the Michigan Department of Environment, Great Lakes, and Energy (EGLE)-issued ROP MI ROP-N2155-2017 Flexible Group Condition FG-FACILITY V.3. For VOCs, three (3) 60-minute tests were completed concurrently on the EU-TOPCOAT2 Booth TO inlet and outlet.

RWDI also completed flue gas velocity measurements and moisture content measurements at the inlet and outlet of EU-TOPCOAT2 Booth TO using methods outlined by U.S. EPA Methods 1, 2, 3/3A, and 4.

DACJ personnel monitored and recorded the production rate of vehicles processed as well as the TO combustion chamber temperature during each destruction efficiency test on the EU-TOPCOAT2 Booth TO.

Executive Table i: EU-TOPCOAT2 Destruction Efficiency - Testing Summary

Parameter	Concentration & Emission Rate (ppmvd, lb/hr & % Destruction)				
	Test 1	Test 2	Test 3	Average	ROP Limit
VOC Inlet (as propane)	356.5 $ppmv_d$ 22.8 lb/hr	388.1 $ppmv_d$ 24.3 lb/hr	416.1 $ppmv_d$ 26.3 lb/hr	386.9 $ppmv_d$ 24.4 lb/hr	--
VOC Outlet (as propane)	15.25 $ppmv_d$ 1.04 lb/hr	17.57 $ppmv_d$ 1.16 lb/hr	18.85 $ppmv_d$ 1.26 lb/hr	17.22 $ppmv_d$ 1.15 lb/hr	---
Destruction Efficiency	95.4%	95.2%	95.2%	95.3%	95%
Residence Time (seconds)	0.68	0.70	0.70	0.70	0.50
TO Temperature (°F)	1351	1349	1353	1351	--
Vehicles Processed	39	39	48	42	--

Note: VOC – Volatile Organic Compound (Total Hydrocarbons (THC) minus Methane)

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1 INTRODUCTION

RWDI USA LLC (RWDI) was retained by FCA US LLC (FCA) to complete the emission sampling program at their Detroit Assembly Complex – Jefferson (DACJ) (also referred to as Jefferson North Assembly Plant (JNAP)) located at 2101 Conner Ave., Detroit, Michigan. DACJ operates an automobile assembly plant that produces the Jeep Grand Cherokee and Dodge Durango. Under Title V Renewable Operating Permit (ROP) MI ROP-N2155-2017, this Source Testing Plan covers the required testing for validation of destruction efficiency for EU-TOPCOAT2 (Booth Color 2 Thermal Oxidizer (TO)).

1.1 Location and Date of Testing

The testing program was completed on September 24th, 2024 at the FCA Detroit Assembly Complex – Jefferson (DACJ) facility located at 2101 Connor Avenue, Detroit, Michigan 48225.

1.2 Purpose of the Testing

The purpose of testing was to comply with the State of Michigan Department of Environment, Great Lakes, and Energy (EGLE) Renewable Operating Permit MI-ROP-N2155-2017's ("ROP's") obligation to confirm the destruction efficiency of EU-TOPCOAT2 Booth's Thermal Oxidizer.

1.3 Description of the Source

DACJ operates an automobile assembly plant that produces Jeep Grand Cherokee and Dodge Durango models for FCA US LLC. Emission Units and Flexible Group: EU-TOPCOAT2 and FG-FACILITY for EU-TOPCOAT2 Booth's TO are covered under this source testing program. Paint is applied to vehicles automatically in booths. Vehicles proceed through a curing oven. This line consists of three basecoat robot zones, basecoat electrostatic bells, basecoat automatic conventional zone, heated flash zone, two clearcoat robot zones, clearcoat electrostatic bells zone and a cure oven. Emissions from the basecoat bell zone, basecoat automatic conventional zone, heated flash, and clearcoat bell zones are ducted to a filter house, concentrator, and a thermal incinerator. Emissions from the oven are controlled by a separate thermal incinerator.

1.4 Personnel Involved in Testing

Details with respect to the key individuals involved with the stack sampling survey are provided below:

Table 1.4.1: Testing Personnel

Tom Caltrider Corporate Environmental Programs Thomas.Caltrider@stellantis.com	**Detroit Assembly Complex - Jefferson** 2101 Conner Ave. Detroit, MI 48215	(248) 882-7169
Mike Spacil Environmental Specialist Michael.Spacil1@stellantis.com		(313) 956-7462
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Roy Zimmer Field Technician Roy.Zimmer@rwdi.com		

2 SUMMARY OF RESULTS

2.1 Operating Data

Operational data collected during the testing included the following (found in **Appendix A**):

- Topcoat 2 Booth TO combustion chamber temperature; and
- Vehicle counts

2.2 Applicable Permit Number

The facility operates under Renewable Operating Permit MI-ROP-N2155-2017.

2.3 Source Testing Results

Process data is provided in **Appendix A**. The following tables summarize the testing results, and more detailed tables can be found in **Appendix B**.

Table 2.3.1 EU-TOPCOAT2 Destruction Efficiency - Testing Summary

Parameter	Concentration & Emission Rate (ppmvd, lb/hr & % Destruction)				
	Test 1	Test 2	Test 3	Average	ROP Limit
VOC Inlet (as propane)	356.5 $ppmv_d$ 22.8 lb/hr	388.1 $ppmv_d$ 24.3 lb/hr	416.1 $ppmv_d$ 26.3 lb/hr	386.9 $ppmv_d$ 24.4 lb/hr	--
VOC Outlet (as propane)	15.25 $ppmv_d$ 1.04 lb/hr	17.57 $ppmv_d$ 1.16 lb/hr	18.85 $ppmv_d$ 1.26 lb/hr	17.22 $ppmv_d$ 1.15 lb/hr	---
Destruction Efficiency	95.4%	95.2%	95.2%	95.3%	95%
Residence Time (seconds)	0.68	0.70	0.70	0.69	0.50
TO Temperature (°F)	1351	1349	1353	1351	--
Vehicles Processed	39	39	48	42	--

Note: VOC – Volatile Organic Compound (Total Hydrocarbons (THC) minus Methane)

The flow and emissions data for this study are presented in the '**Tables**' section of this report. Detailed information regarding each test run can be found in the corresponding appendix. Field notes are presented in **Appendix C**. All calibration information for the equipment used for the program is included in **Appendix D**. Detailed example calculations for each measured pollutant are provided in **Appendix E**.

2.4 Variations in Testing Procedures

Testing was completed as detailed in the test plan submitted to EGLE.

2.5 Modifications to Testing Program

There were no modifications to the testing program.

2.6 Process Upset Conditions During Testing

There were no upsets in the process during testing.

2.7 Maintenance Performed in Last Three Months

Routine maintenance was completed on the Topcoat 2 Booth TO.

2.8 Re-Test

This is not a Re-Test.

2.9 Audit Samples

This test did not require any audit samples.

2.10 Process Data

Process data can be found in **Appendix A**.

2.11 Field Notes

Field notes can be found in **Appendix C**.

2.12 Calibration Data

Calibration can be found in **Appendix D**.

2.13 Example Calculations

Example calculations can be found in **Appendix E**.

2.14 Source Testing Plan and EGLE Correspondence

Copies of the correspondence received from the Source Testing Plan from EGLE and the Source Testing Plan submitted can be found in **Appendix F**.

2.15 Laboratory Data

There was no laboratory data affiliated with this testing.

3 SOURCE DESCRIPTION

DACJ operates an automobile assembly plant that produces Jeep Grand Cherokee and Dodge Durango models for FCA US LLC. Emission Units and Flexible Group: EU-TOPCOAT2 and FG-FACILITY for EU-TOPCOAT2 Booth TO are covered under this source testing program.

3.1 Process Flow Sheet or Diagram

A process schematic can be provided upon request.

3.2 Type and Quantity of Raw and Finished Materials

Various coating products are used to apply basecoat and clearcoat to automotive vehicles.

3.3 Normal Rated Capacity of Process

Normal operating capacity of Topcoat Booth 2 is approximately 40 vehicles per hour. The booth is rated for a maximum of 45 vehicles per hour.

3.4 Process and Control Equipment Data

Operating conditions during the sampling were monitored by FCA personnel. All equipment was operated under normal operating conditions.

Contact was maintained between the operator and the sampling team. A member of the RWDI sampling team contacted the operator before each test, to ensure that the process was at normal maximum operating conditions.

The following process and control equipment data was collected and is included in **Appendix A**.

- Vehicle production rate for each test; and
- Thermal Oxidizer temperature for each test.

4 POLLUTANTS TO BE MEASURED

Testing consisted of emissions for total hydrocarbons, methane and non-methane organic compounds (NMOC).

5 SAMPLING AND ANALYTICAL PROCEDURES

The following section provides brief descriptions of the sampling methods and discusses any modifications to the reference test methods that were completed with the testing.

5.1 Stack Velocity, Temperature, and Volumetric Flow Rate Determination by U.S. EPA Method 1-4

Flow rates, temperature, and moisture data were collected from each source. The exhaust velocities and flow rates were determined following the US EPA Method 2, "Determination of Stack Gas Velocity and Flow Rate (Type S Pitot Tube)". Velocity measurements were taken with a pre-calibrated S-Type pitot tube and incline manometer. Volumetric flow rates were determined following the equal area method as outlined in US EPA Method 1. Temperature measurements were made simultaneously with the velocity measurements and were conducted using a chromel-alumel type "k" thermocouple in conjunction with a digital temperature indicator.

The dry molecular weight of the stack gas was determined following procedures outlined in US EPA Method 3, "Determination of Molecular Weight of Dry Stack Gas" by Fyrite and US EPA Method 3A, "Determination of Oxygen and Carbon Dioxide Concentrations on Emissions from Stationary Sources (Instrumental Analyzer Procedure). Stack moisture content was determined through direct condensation and according to US EPA Method 4, "Determination of Moisture Content of Stack Gas". Moistures were collected at a single point during each test.

5.2 VOC by U.S. EPA Method 25A

Regular performance checks on the CEMS were carried out by zero and span calibration checks using US EPA Protocol calibration gases. These checks verified the ongoing precision of the monitor over time by introducing pollutant-free (zero) air followed by known calibration gas (span) into the monitor. The response of the monitor to pollutant-free air and the corresponding sensitivity to the span gases are reviewed frequently as an ongoing indication of analyzer performance.

Prior to testing, a 4-point analyzer calibration error check was conducted using US EPA protocol gases. The calibration error check was performed by introducing zero, low, mid, and high-level calibration gases directly into the system through the calibration line on the sample line. The calibration error check was performed to confirm that the analyzer response was within ±5% of the certified calibration gas introduced. At the conclusion of each test run a system-bias check was performed to evaluate the percent drift from pre- and post-test system bias checks. The system bias checks were used to confirm that the analyzer did not drift greater than ±3% throughout a test run.

Zero and upscale calibration checks were conducted both before and after each test run to quantify measurement system calibration drift and sampling system bias. During these checks, the calibration gases were introduced into the sampling system at the probe tip so that the calibration gases were analyzed in the same manner as the flue gas samples.

A gas sample was continuously extracted from the stack and delivered to the analyzer. The probe tip was equipped with a heated filter system for particulate removal. The end of the probe was connected to a heated Teflon sample line, which delivers the sample gas from the stack to the CEM system. The heated sample line is designed to maintain the gas temperature above 250°F in order to prevent condensation of stack gas moisture within the line.

5.3 Gas Dilution by U.S. EPA Method 205

Calibration gas was mixed using an Environics 4040 Gas Dilution System. 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. The calibration is done yearly, and the records are included in **Appendix D** of this report. A multi-point EPA Method 205 check was executed in the field to ensure accurate gas mixtures. The gas dilution system consists of calibrated orifices or mass flow controllers and dilutes a high-level calibration gas to within ±2% of predicted values. The gas divider is capable of diluting gases at set increments and was evaluated for accuracy in the field in accordance with US EPA Method 205 "*Verification of Gas Dilution Systems for Field Instrument Calibrations*". Before testing, the gas divider dilutions were measured to evaluate that the responses are within ±2% of predicted values. In addition, a certified mid-level calibration gas within ±10% of one of the tested dilution gases was introduced into an analyzer to ensure the response of the gas calibration is within ±2% of gas divider dilution concentration.

5.4 Quality Assurance/Quality Control Activities

Applicable quality assurance measures were implemented during the sampling program to ensure the integrity of the results. These measures included detailed documentation of field data, and equipment calibrations for all measured parameters.

Quality control procedures specific to the CEM monitoring equipment included linearity checks to determine the instrument performance and reproducibility checks prior to its use in the field. Regular performance checks on the analyser were also carried out during the testing program by performing zero checks and span calibration checks using primary gas standards. Sample system bias checks were also done. These checks were used to verify the ongoing accuracy of the monitor and sampling system over time. Pollutant-free nitrogen or zero air was introduced to perform the zero checks, followed by a known calibration (span) gas into the monitor. The response of the monitor to pollutant-free air and the corresponding sensitivity to the span gas were recorded regularly during the tests.

Pre and post test leak checks were done on the flow system by pressurizing and plugging the positive and negative side of the pitot separately.

6 NUMBER AND LENGTH OF SAMPLING RUNS

Testing consisted of three (3) 1-hour tests concurrently on the inlet and outlet of the Topcoat 2 Booth Thermal Oxidizer.

7 STACK INFORMATION

This following table summarizes the sampling locations.

Table 7.1: Summary of the Stack Characteristics– Topcoat 2 Booth TO

Source	Parameter	Diameter	Approximate Duct Diameters from Flow Disturbance	Number of Ports	Points per Traverse	Total Points per Test	Average Stack Temperature
TO Inlet	VOC	29.5"	8 downstream and 0.8 upstream	2	8 Flow	1 THC 16 Flow	136°F
TO Outlet	VOC	32.75"	11 downstream and 3.4 upstream	2	8 Flow	1 THC 16 Flow	638°F

8 CONCLUSIONS

Testing was successfully completed on September 24th, 2024. All parameters were tested in accordance with U.S. EPA referenced methodologies and the Test Plan submitted prior to testing.

TABLES

Table 1: Summary of Sampling Parameters and Methodology

Source Location	No. of Tests per Stack	Sampling Parameter	Sampling Method
EU-TOPCOAT2	3	Velocity, Temperature and Flow Rate	U.S. EPA [1] Methods 1-4
	3	Oxygen, Carbon Dioxide	U.S. EPA [1] Method 3 (Inlet) U.S. EPA [1] Method 3A (Outlet) Bag Samples
	3	THC/Methane/NMOC	U.S. EPA [1] Method 25A

Notes:

[1] U.S. EPA - United States Environmental Protection Agency

Table 2: Sampling Summary and Sample Log

Source and Test #	Sampling Date	Start Time	End Time
EU-TOPCOAT2			
Test #1	24-Sep-24	6:25 AM	7:24 AM
Test #2	24-Sep-24	7:48 AM	8:47 AM
Test #3	24-Sep-24	9:15 AM	10:14 AM

Table 3: Sampling Summary - Flow Characteristics - EU-TOPCOAT2 Booth TO

EU-TOPCOAT2 TO Inlet		Test No. 1 Inlet	Test No. 2 Inlet	Test No. 3 Inlet	Average
Testing Date		24-Sep-24	24-Sep-24	24-Sep-24	-
Stack Temperature	°F	139	135	135	136
Moisture	%	1.3%	1.4%	1.4%	1.4%
Velocity	ft/s	38.85	37.90	38.22	38.33
Referenced Flow Rate	CFM	9,299	9,112	9,194	9,202
EU-TOPCOAT2 TO Outlet		**Test No. 1 Outlet**	**Test No. 2 Outlet**	**Test No. 3 Outlet**	**Average**
Testing Date		24-Sep-24	24-Sep-24	24-Sep-24	-
Stack Temperature	°F	628	641	645	638
Moisture	%	5.6%	6.1%	5.4%	5.7%
Velocity	ft/s	62.91	62.20	62.69	62.60
Referenced Flow Rate	CFM	9,905	9,623	9,743	9,757

Notes:

[1] Referenced flow rate expressed as dry at 101.3 kPa, 68 °F, and Actual Oxygen

Table 4 - THC, CH4, NMOC Emissions Summary Table

Source: EU-TOPCOAT2 Booth TO

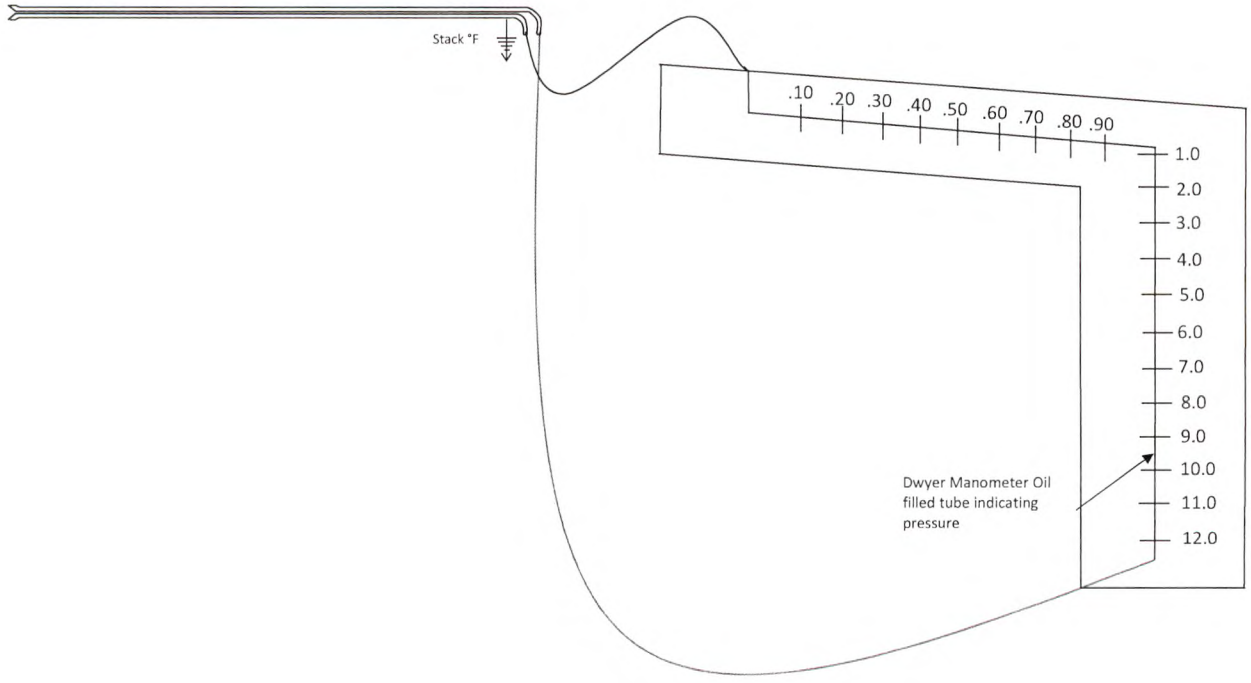
RWDI Project # 2410211

Parameter	Test 1	Test 2	Test 3	Average
Date	24-Sep-24	24-Sep-24	24-Sep-24	--
Start Time:	6:25	7:48	9:15	--
Stop Time:	7:24	8:47	10:14	--
Duration (mins):	60	60	60	--
Average Production Number:	39	39	48	42
Average Temperature for TO (°F):	1351	1349	1353	1351
Inlet THC Concentration (as propane) (ppm_w):	353.9	384.8	411.9	383.5
Inlet THC Concentration (as propane) (ppm_d):	358.5	390.2	417.9	388.9
Inlet THC Concentration (as propane) (lb/hr_d):	22.9	24.4	26.4	24.5
Inlet Methane Correction Factor	2.34	2.44	2.49	2.43
Inlet CH4 Concentration (as methane) (ppmw):	4.59	5.03	4.32	4.65
Inlet CH4 Concentration (as Methane) (ppm_d):	4.65	5.10	4.39	4.71
Inlet CH4 Concentration (as Propane) (ppm_d):	1.99	2.09	1.76	1.94
Inlet CH4 Concentration (as propane) (lb/hr_d):	0.13	0.13	0.11	0.12
Inlet NMOC Concentration (as Propane) (ppm_d):	356.5	388.1	416.1	386.9
Inlet NMOC Concentration (as propane) (lb/hr_d):	22.8	24.3	26.3	24.4
Inlet Flow Rate (dscfm):	9,299	9,112	9,194	9,202
Moisture:	1.30%	1.40%	1.43%	1.4%
Outlet Flow Rate (dscfm):	9,905	9,623	9,743	9,757
Moisture:	5.62%	6.10%	5.35%	5.69%
Outlet THC Concentration (as propane) (ppm_w):	14.41	16.59	17.87	16.29
Outlet THC Concentration (as propane) (ppm_d):	15.27	17.67	18.88	17.27
Outlet THC Concentration (as propane) (lb/hr_d):	1.04	1.17	1.26	1.16
Outlet Methane Correction Factor	2.24	2.17	2.16	2.19
Outlet CH4 Concentration (as methane) (ppm_w):	0.04	0.21	0.07	0.10
Outlet CH4 Concentration (as Methane) (ppm_d):	0.04	0.22	0.07	0.11
Outlet CH4 Concentration (as Propane) (ppm_d):	0.02	0.10	0.03	0.05
Outlet CH4 Concentration (as propane) (lb/hr_d):	0.0012	0.0068	0.0022	0.0034
Outlet NMOC Concentration (as Propane) (ppm_d):	15.25	17.57	18.85	17.22
Outlet NMOC Concentration (as propane) (lb/hr_d):	1.04	1.16	1.26	1.15
Destruction Efficiency (THC) (%):	95.5%	95.2%	95.2%	95.3%
Destruction Efficiency (NMOC) (%):	95.4%	95.2%	95.2%	95.3%
Residence Time (seconds)	0.68	0.70	0.70	0.69

Note: "d" indicated based on dry conditions
"w" indicated based on wet conditions

FIGURES

Figure 1: Schematic of US EPA Method 2 Sampling Train



USEPA Method 2

FCA US, LLC

Detroit Assembly Complex - Jefferson (DACJ)

Topcoat 2 Booth TO

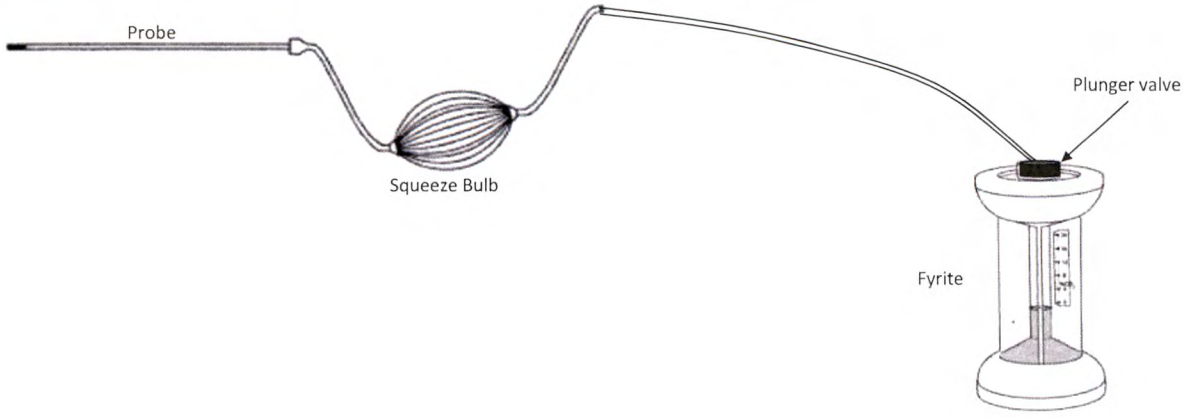
Detroit, MI

Project #2410211

Figure 1

Date: Sept. 24, 2024

Figure No. 2: Schematic of USEPA Method 3 (Fyrite) Sampling Train



USEPA Method 3

FCA US LLC

Detroit Assembly Complex - Jefferson (DACJ)

Topcoat Booth 2 TO

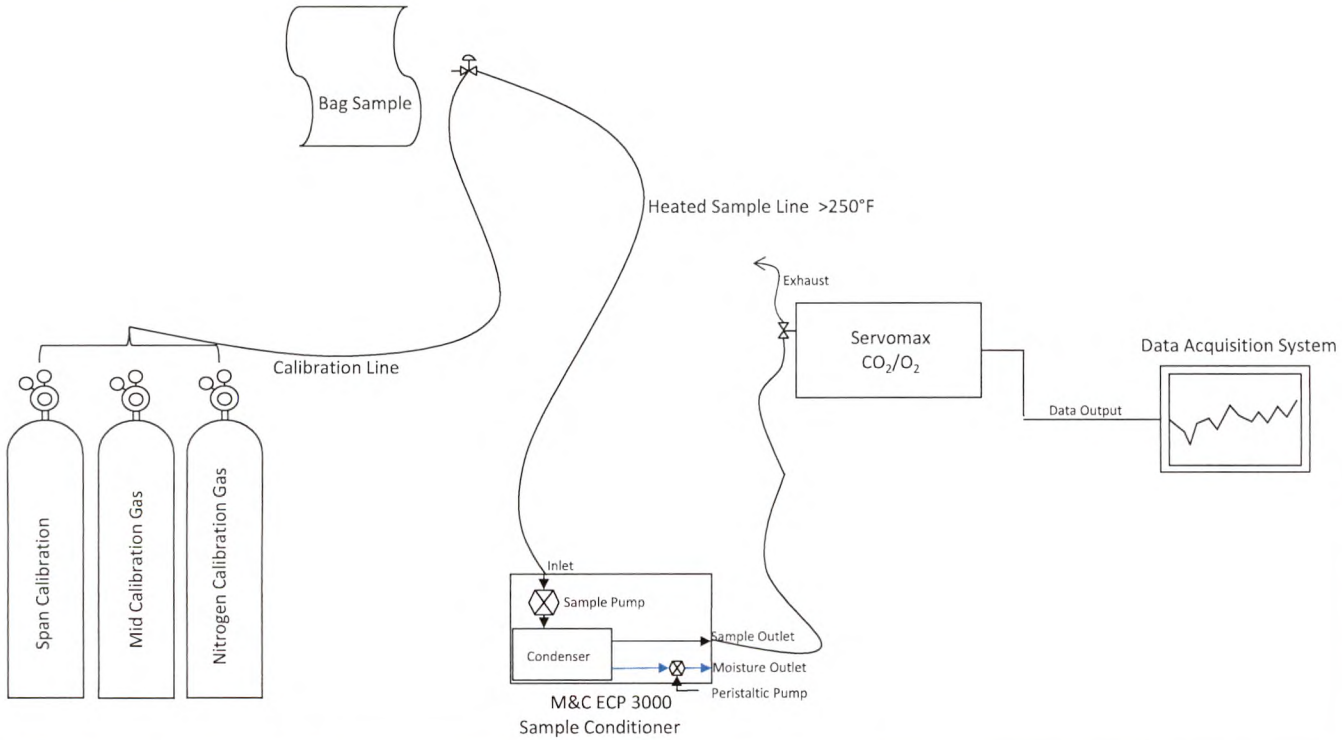
Detroit, MI

Project# 2410211

Figure 2

Date: Sept. 24, 2024

Figure No. 3: USEPA Method 3A Schematic



USEPA Method 3A (Bag Sample)

FCA US, LLC

Detroit Assembly Complex - Jefferson (DACJ)

Topcoat 2 Booth TO

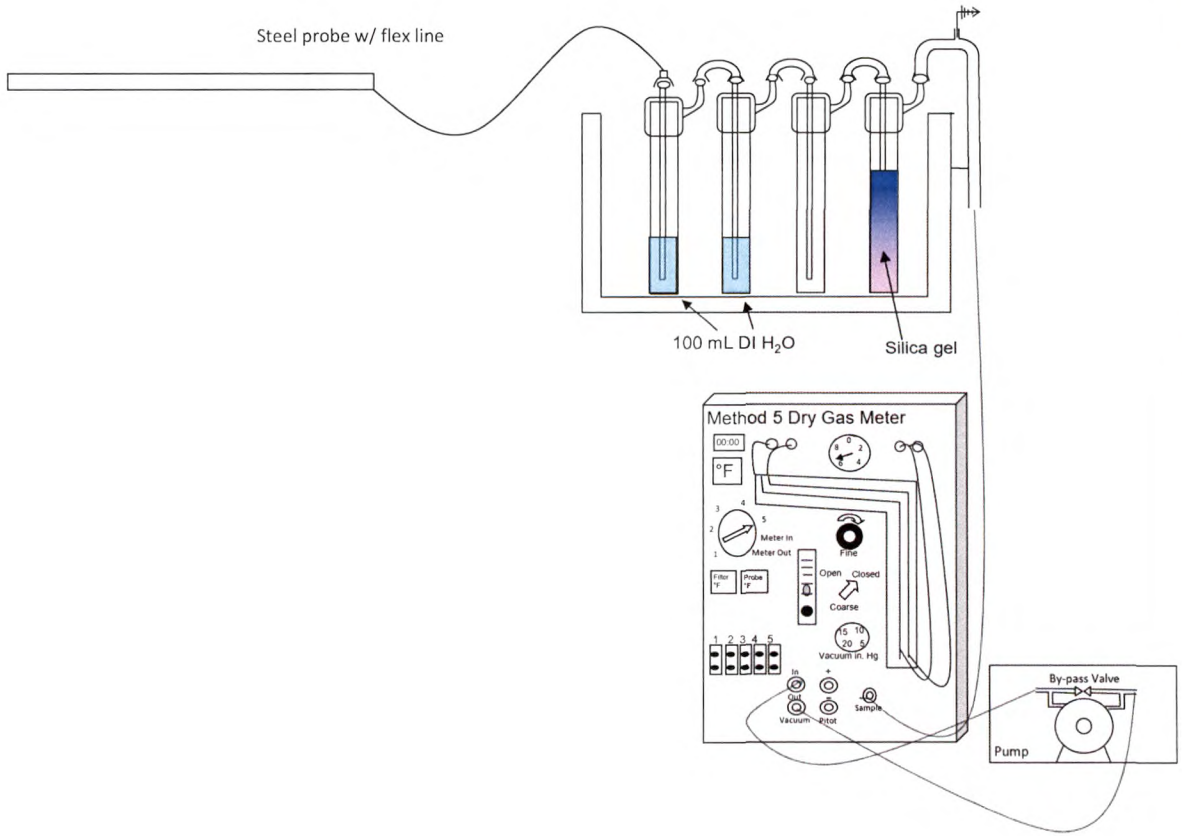
Detroit, MI

Project# 2410211

Figure 3

Date: Sept. 24, 2024

Figure No. 4: Schematic of US EPA Method 4 Sampling Train



USEPA Method 4

FCA US, LLC

Detroit Assembly Complex - Jefferson (DACJ)

Topcoat 2 Booth TO

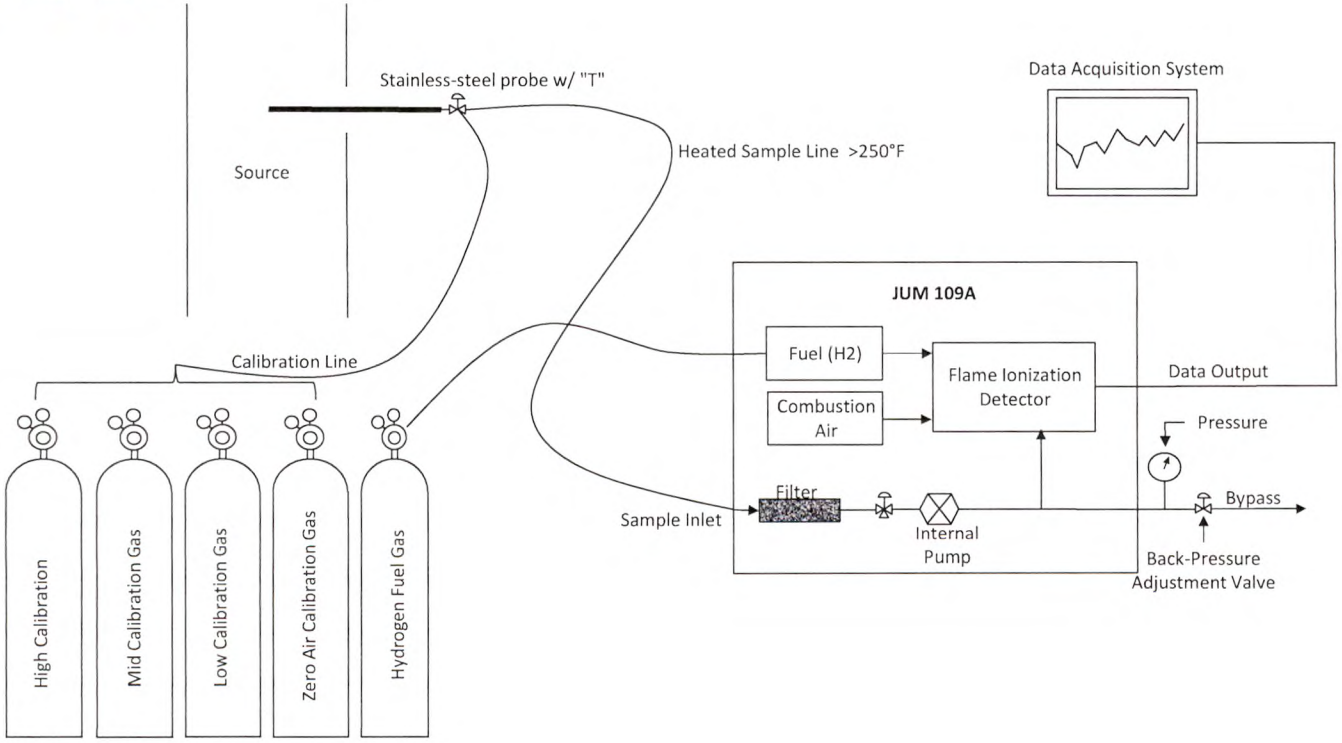
Detroit, MI

Project #2410211

Figure 4

Date: Sept. 24, 2024

Figure 5: Schematic of US EPA Method 25A Sampling Train



USEPA Method 2

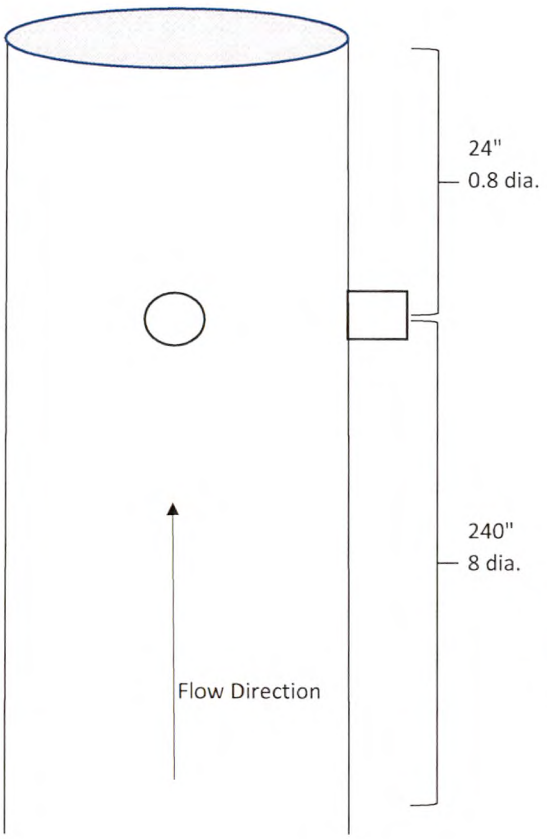
FCA US, LLC
Detroit Assembly Complex - Jefferson (DACJ)
Topcoat 2 Booth TO
Detroit, MI

Project# 2410211

Figure 5

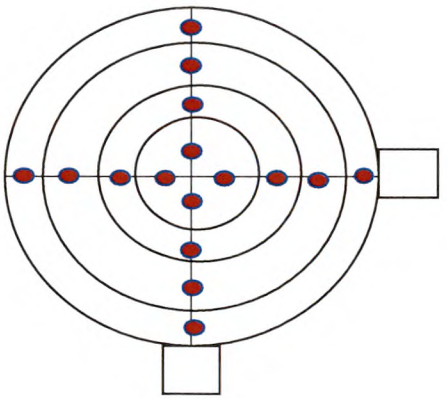
Date: Sept. 24, 2024

Figure No. 6: EU-TOPCOAT2 Booth TO Inlet



Diameter: 29.5 inches

Sampling Points (in.)	
1	1.00
2	3.10
3	5.72
4	9.53
5	19.97
6	23.78
7	26.40
8	28.50



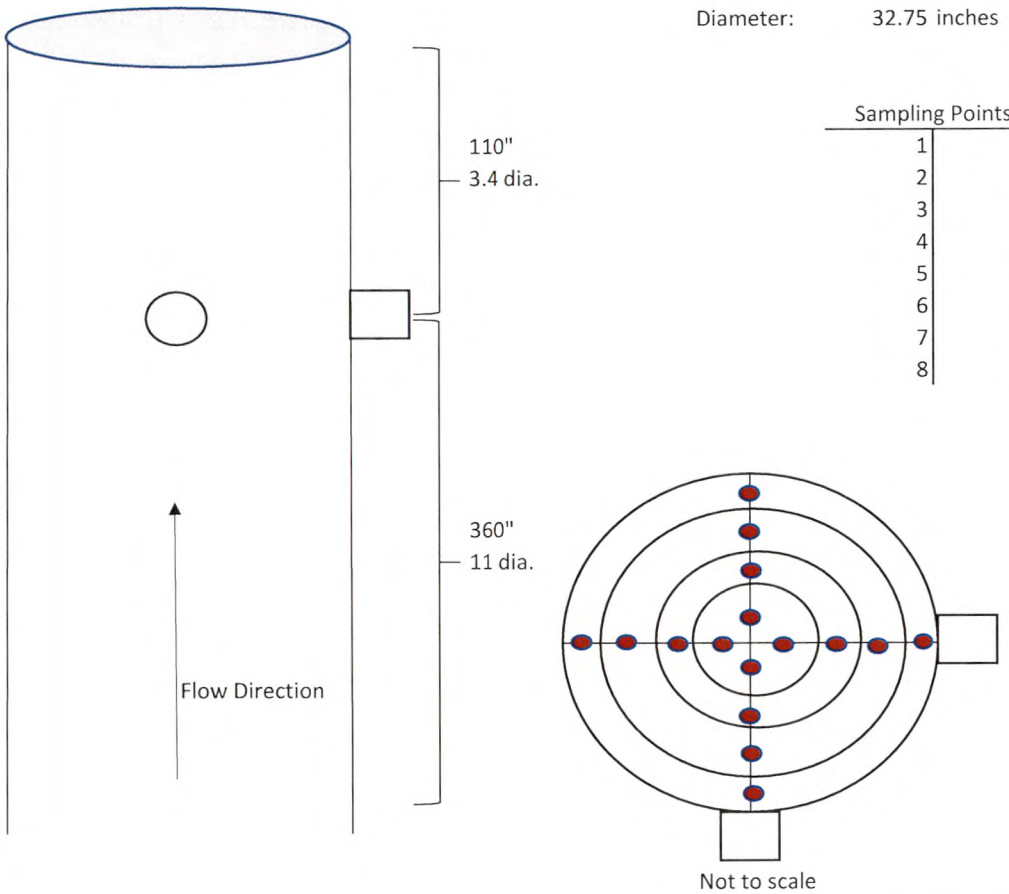
Not to scale

EU-TOPCOAT2 - Booth TO Inlet
FCA US LLC
Detroit Assembly Complex - Jefferson (DACJ)
Detroit, MI

Date:
Sept. 24th, 2024

RWDI USA LLC
24445 Forterra Drive
Warren, MI 48089

Figure No. 7: EU-TOPCOAT2 Booth TO Outlet



Diameter: 32.75 inches

Sampling Points (in.)	
1	1.05
2	3.44
3	6.35
4	10.58
5	22.17
6	26.40
7	29.31
8	31.70

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