DESTRUCTION EFFICIENCY
TEST REPORT
for
EU-PAINTLINE1

at

Yanfeng Global Automotive Interior Systems
5050 Kendrick, SE
Kentwood, Michigan

Test Date: January 19, 2017

Report Date: February 8, 2017

Report Due Date: February 19, 2017

Prepared by:

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EXECUTIVE SUMMARY

A compliance stack test program was performed at the Yanfeng Global Automotive Interior Systems (Yanfeng) manufacturing facility located at 5050 Kendrick SE, Kentwood, Michigan on January 19, 2017. The purpose of the test program was to determine the Volatile Organic Compound (VOC) destruction efficiency for paint line #1 (EU-PAINTLINE1). EU-PAINTLINE1 is a conveyorized interior automotive plastic parts coating operation, with a regenerative thermal oxidizer used to control emissions released from the paint booths, flash tunnel, and cure oven.

The test program was conducted in accordance with the test plan dated July 14, 2016, and confirmed by the Michigan Department of Environmental Quality (MDEQ) by letter dated August 3, 2016. A copy of the test plan and the MDEQ confirmation letter is included in Appendix A.

The paint process evaluated is regulated by the Michigan issued New Source Review Permit to Install No. 222-10C. The testing was conducted to satisfy EU-PAINTLINE1 special conditions number V.2 and V.3 and to confirm compliance with special condition numbers IV.3 and IV.4.

The overall compliance test program was coordinated by Mr. Bruce Connell, of Environmental Partners, Inc. The compliance test program was performed by The Stack Test Group. Plant operations were coordinated by Mr. Ken Harbour, Yanfeng. The compliance test program was witnessed by Mr. Tom Gasloli, and Mr. Dave Morgan of the Michigan Department of Environmental Quality, Air Quality Division (MDEQ-AQD). The results of capture testing, as presented in Table 1 and a summary of the results from the destruction efficiency test are presented in Table 2. The results indicate that the process control equipment was in compliance with the above stated permit conditions.

Table 1 – NFE Capture Demonstration and Destruction Efficiency Test Summary

TEST	Paint Booth 1 Entrance ΔP ("H_2O)	Cure Oven Exit ΔP ("H_2O)	RTO INLET VOC (lb/hr)	RTO OUTLET VOC (lb/hr)	DESTRUCTION EFFICIENCY (%)
1	-0.0072	-0.010	39.97	2.26	94.35%
2	-0.0063	-0.012	44.03	1.65	96.24%
3	-0.0053	-0.012	44.36	1.09	97.55%
AVG	-0.0063	-0.011	42.79	1.67	96.05%
PERMIT	**Negative**	**Negative**			**95%**

1.0 PROCESS AND CONTROLS SYSTEMS DESCRIPTION

The Paint Line #1 (EU-PAINTLINE1) is a conveyorized automotive plastic parts coating line consisting of a surface prep station, two (2) dry filter paint spray booths, an enclosed flash zone, and a cure oven. The system is completely enclosed with the exception of the load / unload section where parts are added and coated parts removed. The regenerative thermal oxidizer (RTO) controls emissions from both paint application booths, the flash zone, and the cure oven.

The paint spray booths are equipped dry filter particulate spray booths with horizontal air movement supplied from behind two robotic paint applicators equipped with HVLP. Paint is supplied to each robot from a paint delivery area, located in a separate room adjoining the paint booth. On the day of testing, the plastic parts were coated with solvent based topcoat in both booths or with an adpro primer followed by solvent based basecoat (wet-on-wet application).

The regenerative thermal oxidizer is Turner Enviro-Logic Regenerative Thermal Oxidizer with a rated airflow rate of 40,000 scfm and a design destruction efficiency of 95%.

In accordance with Special Condition IV.3 of FGPAINT (PTI #222-10C) the oxidizer must maintain a minimum combustion chamber temperature above 1400°F when operating the coating line. Appendix B contains both periodic hand written recordings of the combustion chamber temperature and a table of values downloaded from the RTO's data-logging system for the combustion chamber.

During the day of testing, sampling was conducted in the RTO inlet and the RTO exhaust stack (outlet). In addition, differential pressure readings were recorded across the paint booth entrance and cure oven exit to demonstrate that the paint envelope was under negative pressure to the surrounding area. These observations are located in Appendix B.

During each destruction efficiency emissions test, sampling was conducted simultaneously at the inlet and outlet of the control device, while the controlled equipment was operating under representative operating conditions.

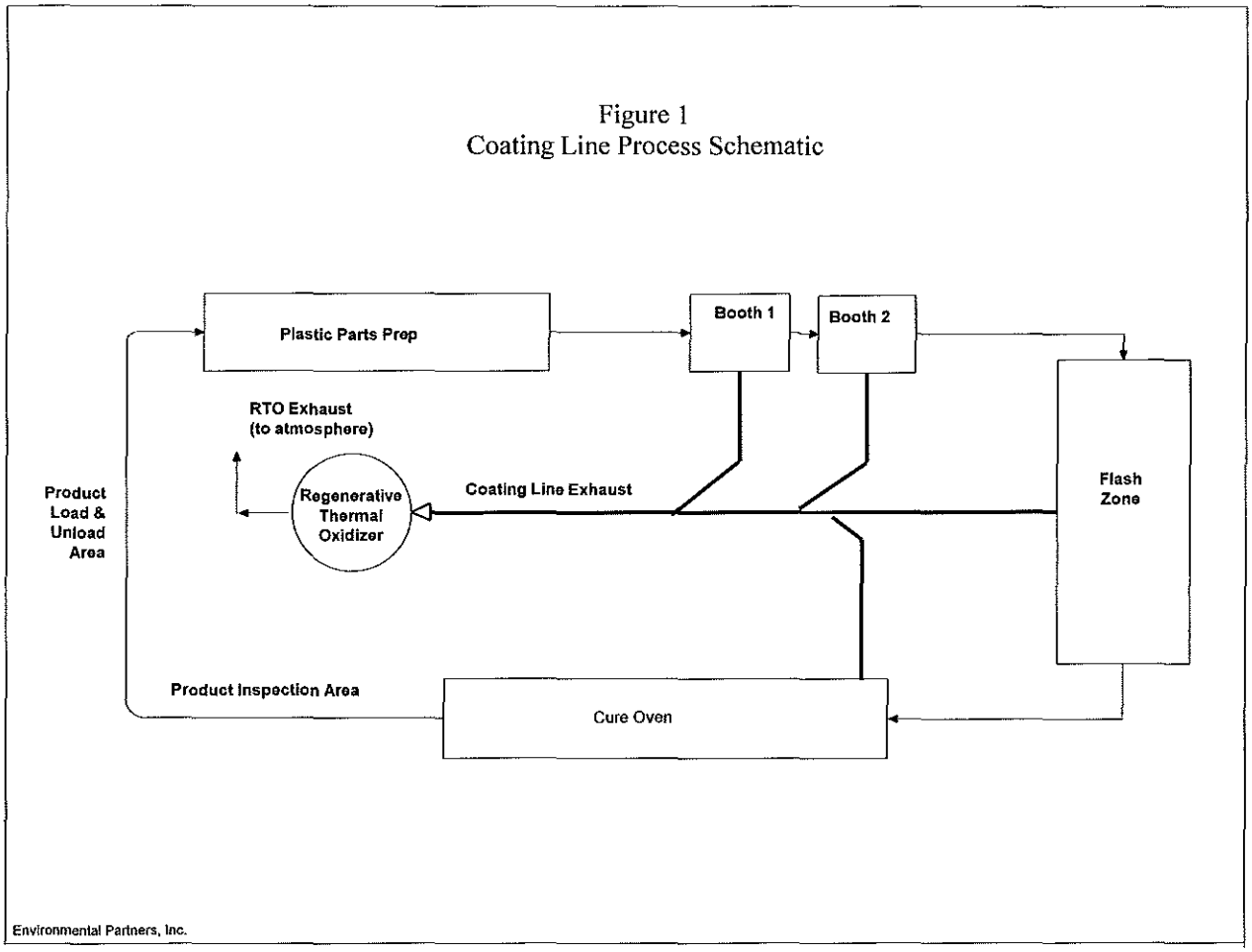

Figure 1
Process and Control Equipment Diagram
Yanfeng Global Automotive Interior Systems
Kentwood, Michigan

2.0 TEST METHODOLOGIES

Three one-hour test runs were performed at the inlet and outlet of the oxidizer unit. For each test run, the concentrations and mass emission rates of VOCs at the inlet and outlet test locations were compared in order to determine the VOC destruction efficiency. All tests were conducted in accordance with USEPA Methods 1-4, and 25A, as described in the *Code of Federal Regulations, Title 40, Part 60, Appendix A*. Descriptions of these methods are as follows:

USEPA Method	Description
1	Sample and Velocity Traverses for Stationary Sources
2	Determination of Stack Gas Velocity and Volumetric Flow Rate
3	Gas Analysis for Carbon Dioxide, Oxygen, Excess Air, and Dry Molecular Weight
4	Determination of Moisture Content in Stack Gases
25A	Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer

2.1 Volumetric Flow Rate Determination – USEPA Methods 1 - 4

The volumetric flow rate of the exhaust was determined following USEPA Methods 1 through 4. Velocity measurement points were selected in accordance with USEPA Method 1. Gas stream velocities were determined using a Type-S pitot tube and inclined manometer in accordance with USEPA Method 2.

Two velocity measurements were made at each test location for each one hour test run, one just before and one just after each test. The completion of the first and second test runs were reasonably temporally coincidental to the start of the subsequent test runs, therefore the ending velocity measurement for the previous test run was utilized as the beginning velocity measurement for the subsequent test run.

Concentrations of carbon dioxide were determined using the instrumental analyzer technique in accordance with USEPA Method 3A. Gas stream moisture contents were determined by passing the exhaust sample gas through a series of four chilled impingers containing pre-measured amounts of absorbing solution, followed by an impinger containing silica gel. Volumetric determinations were made of moisture gain, and equivalent water vapor volumes were determined in accordance with USEPA Method 4.

2.2 Total Gaseous Organic Concentration Determination – USEPA Method 25A

The procedures outlined in USEPA Method 25A were followed to determine the total gaseous organic concentration in the exhaust streams at the inlet and outlet of the oxidizer. For each test run, a gas sample was collected continuously for a minimum of 60 minutes from a single representative sampling point. The gas sample stream was passed through a heated filter and stainless steel probe, and drawn to a flame ionization analyzer via a Teflon sample line that was heated to at least 250°F. Both the inlet and outlet concentrations were measured with a JUM Model 3-300A Flame Ionization Analyzer.

The flame ionization analyzer was pre-calibrated in the applicable ranges. Appropriate mid-range and zero calibration gases were introduced, and the analyzer response was checked between each test run, as well as after the final test run. Calibration gases consisted of certified (Protocol 1) concentrations of propane in air. Sixty one-minute averages for each run were totaled and averaged to determine an average organic concentration for each of the three test runs. Organic concentrations are expressed on a parts per million by volume as propane (ppmv C_3H_8) basis.

3.0 PRESENTATION OF PRODUCTION DATA

The MDEQ-AQD stack test approval letter, dated August 3, 2016 requested that the process be operated at a normal process rate. On the day of testing, the paint line was operating at a conveyor speed of 8.8 feet per minute (2.5 racks/min).

Table 2 presents a summary of the paint usage data for a five hour window (7am – noon) in which the conveyor completed four separate rounds of painting. Table 3 presents a summary of the combustion chamber temperatures during each test. Table 4 provides a summary of the differential pressure measurements during each test. A copy of the process data for each test run and the RTO combustion chamber data is provided in Appendix B.

Table 2 – Coating Summary Data

Paint Description	Paint Supplier	Coating Type	Paint (gal)
Black	United Paint	2-Component Solvent Based	3.4
Premium Black Metallic	Red Spot	2-Component Solvent Based	3.4
Obsidian	United Paint	2-Component Solvent Based	3.4
Cast Metal	United Paint	2-Component Solvent Based	1.7
Armour	United Paint	2-Component Solvent Based	1.7
Alloy	United Paint	2-Component Solvent Based	6.8
Clear Olefinic Primer	Red Spot	1-Component Solvent Based	1.68
Total			22.08

Table 3 – RTO Combustion Chamber Temperature Summary

RTO Combustion Zone	Test 1	Test 2	Test 3
Combustion Chamber Min °F	1,606.2	1,607.2	1,601.2
Combustion Chamber Max °F	1,663.4	1,666.4	1,666.4
Combustion Chamber Avg °F	1,632.3	1,634.6	1,635.7

Table 4 – Paint Enclosure Differential Pressure Measurements/Observations

	Test 1	Test 2	Test 3
Paint Booth Entrance			
Differential Pressure Min – in. H_20	-0.007	-0.005	-0.005
Differential Pressure Max – in H_2O	-0.009	-0.007	-0.007
Differential Pressure Avg – in. H_20	-0.0072	-0.0063	-0.0053
Cure Oven Exit			
Differential Pressure Min – in. H_20	-0.010	-0.012	-0.012
Differential Pressure Max – in. H_20	-0.012	-0.012	-0.012
Differential Pressure Avg – in. H_20	-0.010	-0.012	-0.012

In between test run 1 and test run 2, Bruce Connell (EPI) and Dave Morgan (MDEQ-AQD) inspected the envelope of the paint system with a smoke tube (paint booth entrance, cure oven exit, and all access doors) to determine if the system had any leaks. Two leaks were determined. The first was in an access door to the flash tunnel following the second paint booth and the second was an access door to the flash zone just prior to the cure oven. In both cases, the leak appeared to be situated in the upper corner of the door, where the door casing and door did not fully seat.

At Dave Morgan's request, duct tape was used to seal the door jam across the top and down each side to approximately mid-level. With this modification, Mr. Morgan was accepting of the enclosure. In addition, Yanfeng committed to having both doors repaired at the next available downtime for the paint line.

4.0 PRESENTATION AND DISCUSSION OF TEST RESULTS

The results of the compliance test program are summarized in the following tables:

Table 5
Destruction Efficiency Test Summary

Parameter	**1**	**2**	**3**	**Avg.[1]**
Start Time	08:00	09:45	11:05	
Stop Time	09:00	10:45	12:05	
Inlet Volumetric Flow Rate (dscfm)	30,984	30,678	29,768	30,969
Inlet VOC Concentration (ppmv C_3H_8)	185.5	206.1	213.8	201.8
Inlet VOC Mass Emission Rate (lbs/hr C_3H_8)	39.97	44.03	44.36	42.79
Outlet Volumetric Flow Rate (dscfm)	37,158	35,385	33,002	35,182
Outlet VOC Concentration (ppmv C_3H_8) less methane	8.7	6.7	4.7	6.7
Outlet VOC Mass Emission Rate (lbs/hr C_3H_8)	2.26	1.65	1.09	1.67
VOC Destruction Efficiency (%)	**94.35**	**96.24**	**97.55**	**96.05**

The permit limit for the destruction efficiency is 95%. The average of the three test runs demonstrates that the destruction efficiency on the day of the test was above the permit limit.

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