

**AIR EMISSION TEST REPORT  
FOR THE  
VERIFICATION OF VOLATILE ORGANIC  
COMPOUND  
DESTRUCTION EFFICIENCY**

**Prepared for:  
LexaMar Corporation  
SRN N2812**

**Test Dates: April 16-19, 2024**

**ICT Project No.: 2300191  
June 6, 2024**



## Report Certification

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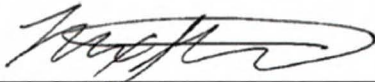
### AIR EMISSION TEST REPORT FOR THE VERIFICATION OF VOLATILE ORGANIC COMPOUND DESTRUCTION EFFICIENCY

LexaMar Corporation  
Boyne City, MI

#### Report Certification

The material and data in this document were prepared under the supervision and direction of the undersigned.

Impact Compliance & Testing, Inc.



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Max Fierro  
Project Manager

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## 1.0 Introduction

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LexaMar Corporation (LexaMar) has received State of Michigan Renewable Operating Permit (ROP) No. MI-ROP-N2812-2023 for the operation of spray coating and dip coating processes at its facility located in Boyne City, Charlevoix County, Michigan (State Registration No. (SRN) N2812).

Volatile organic compound (VOC) emissions from the spray and dip coating processes are collected and exhausted to an emission control system consisting of two regenerative thermal oxidizers (RTO) connected in parallel.

Conditions within the ROP require LexaMar to verify VOC:

- Destruction efficiency associated with the RTO emissions control system at three (3) different operating scenarios; and
- Capture efficiency (CE) of EU-BT1PANEL (BT1PANEL).

The VOC destruction efficiency (DE) testing was performed April 16-19, 2024, by Impact Compliance & Testing, Inc. (ICT) representatives Max Fierro, Clay Gaffey, and Scott Herron. All three (3) RTO operating scenarios (RTO Bed B at 100%, RTO Bed A at 100%, and RTO Bed A at 50%/Bed B at 50%) for VOC DE testing were completed during this test event. The capture efficiency (CE) testing/demonstration was performed on April 17, 2024.

The project was coordinated by Mr. Kelly Bellant, Environmental Engineer for LexaMar. Mr. David Bowman, Mr. DJ Droste, and Ms. Amy Breaver of the State of Michigan Department of Environment, Great Lakes, and Energy – Air Quality Division (EGLE-AQD) were on-site to observe portions of the compliance testing.

The destruction efficiency evaluation, capture efficiency evaluation, exhaust gas sampling, and analyses were performed using procedures specified in the Emission Test Plan dated August 30, 2023, that was reviewed and approved by EGLE-AQD prior to the compliance test event. Testing was postponed from the original test date due to the United Auto Workers Union strike.

Appendix 1 provides a copy of the EGLE-AQD test plan approval letter.

Questions regarding this emission test report should be directed to:

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## 2.0 Source Description

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### 2.1 Coating Line Processes

LexaMar operates spray and dip coating processes that support automobile parts manufacturing operations. The primary processes include the Body Color Paint Line (EU-BCPL), the Ursa Minor Coating Line (EU-URSAMINOR), and the Robotic Blackout Coating Applicator (EU-BT1PANEL).

The BCPL consists of five (5) spray booths, five (5) flash-off areas, a curing oven, and an exhaust air recirculation system for the spray booths. Parts to be coated are loaded onto a rack conveyor and transported through the coating line. Paints and coatings are applied by conventional hand spray applicators, electrostatic rotary atomizers, and robotic spray guns. The interior of the BCPL operates as a permanent total enclosure (PTE) such that all VOC applied by the process is exhausted to the RTO emission control system.

The Ursa Minor Dip Coat Line consists of cleaning tanks, two (2) dip coating tanks (prime and topcoat) and two (2) curing ovens (prime and topcoat ovens). Parts to be coated are loaded onto a rack conveyor, pre-cleaned in a series of dip-cleaning tanks (ultrasonic tanks operated with no emissions) and transported through one set of double doors into the prime dip coating booth. The coated parts exit the prime dip coating booth through one set of double doors and are transported to the prime curing oven. The process is repeated for the topcoat. Each dip coating booth operates as a PTE such that all VOC that flashes off within the booth is exhausted to the RTO emissions control system. The curing oven exhausts contain a minimal amount of VOC and are released directly to the ambient air (no emissions control).

The BT1PANEL coating line consists of a robotic blackout coating applicator to coat polycarbonate automotive roof panel perimeters with a 6-inch-wide blackout border. The applied coating in a booth is partially controlled by two exhaust fans and routed to the existing RTO. Near the booth, a separate, manual operation applies a primer to metal roof frames with in-plant emissions (uncontrolled emissions). The associated purge, wipe, and cleanup operations are included.

### 2.2 Type of Raw Materials Used

The BCPL applies an adhesion promoter, base (color) coat, and clear coat. The Ursa Minor Coating line uses a primer and topcoat coatings. The BT1PANEL coating line applies a clear etching primer and a blackout primer. The coatings are reduced with solvent as needed to maintain a target viscosity. The actual coating use rate for each line is dependent on the part configuration (i.e., surface area to be coated).

### 2.3 Emission Control System Description

Solvent laden process air from the BCPL, Ursa Minor, and BT1PANEL coating booths is combined and directed to the RTO emission control system.

The RTO emission control system consists of two RTO units connected in parallel to the process air collection system. Each RTO unit is equipped with an isolation damper and a dedicated variable frequency drive (VFD) blower.



The RTO emissions control system consists of two (2) individual regenerative thermal oxidizer units operated in parallel (connected to a common inlet duct). Each unit is fueled exclusively with natural gas to achieve an operating temperature that was determined during the test event in accordance with 40 CFR Part 63.4567(a), resulting in minimum VOC destruction efficiency of 95% by weight. Each unit has a maximum airflow rate of 25,000 standard cubic feet per minute (scfm). Effluent gas from the units is exhausted to the atmosphere through a common 36.75-inch diameter vertical exhaust stack.

## 2.4 Process Operating Conditions During the Compliance Testing

During RTO DE testing for RTO B, the facility coated 1,585 parts per hour (parts/hr).

During RTO DE testing for RTO A, the facility coated between 1,380 and 1,585 parts/hr.

During RTO DE testing for RTO A and B, the facility coated between 1,380 and 1,530 parts/hr.

Conditions during the DE tests were representative of normal operating conditions.

VOC DE for the RTO emission control system was tested at the following operating scenarios during this compliance test event:

1. RTO B operated at maximum capacity (100%) and RTO A was isolated from the coating process exhaust;
2. RTO A operated at maximum capacity (100%) and RTO B was isolated from the coating process exhaust and;
3. Both RTO A and B were operated simultaneously at approximately 50% capacity each.

During the RTO DE test periods for RTO B, a minimum 3-hour RTO combustion chamber temperature of 1,604°F was established according to 40 CFR 63.4567(a), for operation of RTO B.

During the RTO DE test periods for RTO A, a minimum 3-hour RTO combustion chamber temperature of 1,568°F was established according to 40 CFR 63.4567(a), for operation of RTO A.

During the RTO DE test periods for RTO A and B, a minimum 3-hour RTO combustion chamber temperature of 1,596°F was established according to 40 CFR 63.4567(a), for operation of RTO A and B.

During the BT1PANEL CE evaluation, the process operated normally. Two (2) exhaust fans operated continuously during the evaluation.

Table 2.1 presents a summary of the process operating conditions during the RTO DE test periods.

Appendix 2 provides coating line production data, pressure drop measurements, material composition data sheets, and RTO temperature records.

**Table 2.1 Summary of process operating conditions during the VOC destruction efficiency test periods**

Date	Time	Parts Coated (parts/hr)	RTO A Operation	RTO B Operation
<b><u>RTO-B VOC DE</u></b>				
4/16/2024	0715-0815	1,585	Idle	100%
4/16/2024	0855-0955	1,585	Idle	100%
4/16/2024	1030-1130	1,585	Idle	100%
<b><u>RTO-A VOC DE</u></b>				
4/16/2024	1210-1310	1,585	100%	Idle
4/18/2024	0818-0947	1,380	100%	Idle
4/18/2024	1037-1137	1,380	100%	Idle
<b><u>RTO-A/B VOC DE</u></b>				
4/18/2024	1217-1317	1,380	50%	50%
4/19/2024	0817-0917	1,530	50%	50%
4/19/2024	1005-1105	1,530	50%	50%



## 3.0 Summary of Test Results

### 3.1 Results for RTO VOC Destruction Efficiency

VOC DE is required to be determined for three operating scenarios: RTO A at 100% capacity (with RTO B in idle mode); RTO B at 100% capacity (with RTO A in idle mode); and RTO A and B operating simultaneously at approximately 50% capacity each.

The RTO inlet and outlet/exhaust gas streams were monitored simultaneously to calculate the VOC mass flowrate entering and exiting the emission control system for VOC DE determination.

Based on the measured VOC mass flowrates the three-hour average VOC DE for each RTO operating scenario exceeded 95% by weight, as required by conditions of the ROP. The combustion chamber temperature setpoint for all three operating conditions was 1,600 °F. The actual combustion chamber temperature was recorded throughout each test period and the three-hour average combustion chamber was calculated for each operating scenario.

The VOC DE test results are summarized in Table 3.1.

**Table 3.1 Summary of RTO VOC DE test results and recorded operating temperature**

Control System Operating Scenario	Avg. RTO A Bed Temp <sup>1</sup> (°F)	Avg. RTO B Bed Temp <sup>1</sup> (°F)	VOC Destruction Efficiency <sup>1</sup> (% wt)
RTO B 100%	N/A	1,630	95.8%
RTO A 100%	1,617	N/A	95.9%
RTO A 50%/B 50%	1,641	1,693	97.8%
Permit Limit			>95.0%

1. Three-hour average for the specified operating scenario.

### 3.2 Results for BT1PANEL Capture Efficiency

The results of the capture efficiency evaluation are presented in Table 3.2. The enclosure exhibited inward flow as indicated by the observation of air current smoke.

The average measured differential pressure for the enclosure exceeded -0.007 inches of water (the PTE criteria).

The captured gas flowrate measured 4,287 actual cubic feet per minute (ACFM) over a three-flowrate average.

**Table 3.2 Summary of BT1PANEL capture efficiency test results**

BT1PANEL Line Location	Smoke Tube Verified Inward Flow (Y/N)	Differential Pressure <sup>1</sup> (inches w.c.)
North Skirt	Y	-0.020
South Skirt	Y	-0.022
Loading Zone	Y	-0.022
Unloading Zone	Y	-0.022

1. Requirement is to maintain a differential pressure of at least 0.007 inches of w.c. (-0.007).

## 4.0 Sampling and Analytical Procedures

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A Stack Test Protocol for the air emission testing was reviewed and approved by EGLE-AQD. This section provides a summary of the sampling and analytical procedures that were used during the testing periods.

### 4.1 RTO VOC DE Sampling Methods

Method 1	Velocity and sampling locations based on physical stack measurements in accordance with USEPA Method 1.
Method 2	Gas flowrate determined using a type S Pitot tube in accordance with USEPA Method 2.
Method 2	RTO inlet gas dry molecular weight $w$ determined as specified in Section 8.6 of Method 2.
Method 3A	RTO exhaust gas $O_2$ and $CO_2$ content determined using instrumental analyzers.
Method 4	RTO exhaust gas moisture determined based on the water weight gain in chilled impingers. RTO Inlet sampling locations determined by wet bulb/dry bulb temperature measurements.
Method 25A	Total hydrocarbon (THC) concentrations using flame ionization analyzers (FIA) compared to a propane standard.

### 4.2 BT1PANEL CE Sampling Methods

Method 1	Velocity and sampling locations based on physical stack measurements in accordance with USEPA Method 1.
Method 2	Gas flowrate determined using a type S Pitot tube in accordance with USEPA Method 2.
Method 2	BT1PANEL gas dry molecular weight determined as specified in Section 8.6 of Method 2.
Method 4	BT1PANEL moisture determined by wet bulb/dry bulb temperature measurements.

### 4.3 Sampling Locations (USEPA Method 1)

#### 4.3.1 RTO VOC Destruction Efficiency Sampling Locations

The sampling location for the combined coating line exhaust (RTO inlet) is in the 43-inch diameter duct on the roof of the LexaMar facility, prior to the Y connection that connects the two RTO units to the main duct. The sampling location is approximately 18 feet



downstream of the nearest flow disturbance (connection to BCPL oven exhaust) and 93 inches upstream from the nearest flow disturbance (duct elbow).

The sampling location for the RTO outlet/exhaust is in the 36.75-inch vertical exhaust stack. The sampling location is approximately 19 feet downstream of the nearest flow disturbance (where RTO A and B breach the stack) and 18 feet upstream from the stack atmospheric discharge.

#### **4.3.2 BT1PANEL Capture Efficiency Sampling Locations**

The sampling location for the BT1PANEL capture efficiency test is in the 17.875-inch diameter duct on the roof of the LexaMar facility. The sampling location is approximately 272 inches downstream of the nearest flow disturbance (duct elbow where line goes through the roof) and 336 inches upstream from the nearest flow disturbance (stack elbow).

Appendix 3 provides diagrams of the performance test sampling locations.

#### **4.4 Process Air Velocity Determination (USEPA Method 2)**

Velocity traverse locations for the sampling points were determined in accordance with USEPA Method 1 based on the stack diameter and distance to upstream and downstream flow disturbances.

The RTO inlet, outlet/exhaust, and BT1PANEL line stack gas velocities and volumetric flow rates were determined using USEPA Method 2 once during each test period. An S-type Pitot tube connected to a red-oil manometer was used to determine velocity pressure and a K-type thermocouple mounted to the Pitot tube was used for temperature measurements.

The Pitot tube and connective tubing were leak-checked periodically throughout the test periods to verify the integrity of the measurement system.

The absence of significant cyclonic flow at each sampling location was verified using an S-type Pitot tube and oil manometer. The Pitot tube was positioned at each velocity traverse point with the planes of the face openings of the Pitot tube perpendicular to the stack cross-sectional plane. The Pitot tube was then rotated to determine the null angle (rotational angle as measured from the perpendicular, or reference, position at which the differential pressure is equal to zero).

#### **4.5 Gas Molecular Weight Determinations (USEPA Methods 3A & 2)**

CO<sub>2</sub> and O<sub>2</sub> content in the RTO outlet/exhaust exhaust gas stream were measured continuously throughout each test period in accordance with USEPA Method 3A. The CO<sub>2</sub> content of the exhaust was monitored using a Servomex 4900 infrared gas analyzer. The O<sub>2</sub> content of the exhaust was monitored using a Servomex 4900 gas analyzer that uses a paramagnetic sensor.

During each sampling period, a continuous sample of the RTO outlet/exhaust gas stream was extracted from the stack using a stainless-steel probe connected to a Teflon® heated sample line. The sampled gas was conditioned by removing moisture prior to being

introduced to the analyzers; therefore, measurement of O<sub>2</sub> and CO<sub>2</sub> concentrations correspond to standard dry gas conditions. Instrument response data were recorded using an ESC Model 8864 data acquisition system that monitored the analog output of the instrumental analyzers continuously and logged data as one-minute averages.

Prior to, and at the conclusion of each test, the instruments were calibrated using upscale calibration and zero gas to determine analyzer calibration error and system bias (described in Section 5.0 of this document). Sampling times were recorded on field data sheets.

Appendix 5 provides O<sub>2</sub> and CO<sub>2</sub> calculation sheets. Raw instrument response data are provided in Appendix 6.

The RTO inlet gas, and BT1PANEL coating line gas is captured building air and a dry molecular weight of 29.0 was used as specified in Section 8.6 of Method 2.

#### 4.6 Gas Moisture Content (USEPA Method 4)

Moisture content for the RTO outlet/exhaust gas was determined using the USEPA Method 4 chilled impinger method. Moisture content for the RTO inlet gas stream was determined based on wet bulb-dry bulb temperature measurements using a type-K thermocouple and calibrated digital pyrometer (USEPA Method 4 approximation technique using a psychometric chart).

#### 4.7 THC Concentration Measurements (USEPA Method 25A)

USEPA Method 25A, *Determination of Total Gaseous Organic Concentration Using A Flame Ionization Detector*, was used to determine the THC concentration relative to a propane standard. The measured THC concentrations were used with the measured volumetric air flowrate to calculate a VOC mass flow rate (pounds per hour (lb/hr) as propane) for each test period.

The THC concentration measurements were performed using a Thermo Environmental Instruments, Inc. (TEI) Model 51i FIA analyzer.

Throughout each test period, a sample of the gas from each measurement location was delivered to a dedicated flame ionization analyzer (FIA) using an extractive gas sampling system and heated Teflon® sample line equipped with a heating element and temperature controller to maintain the temperature of the sample line at approximately 300°F. The sampled gas streams were not dried prior to being introduced to the FIA instruments; therefore, THC concentration measurements correspond to standard conditions with no moisture correction. Instrument response for each analyzer was recorded on an ESC Model 8864 data logging system that monitors the analog output of the instrumental analyzers continuously and logs data as one-minute averages.

Prior to the first test period of each test day, appropriate high-range, mid-range, and low-range span gases (USEPA protocol 1 certified calibration gases of propane in air) followed by a zero gas (hydrocarbon free air) were introduced into each sampling system to verify instrument response and sampling system integrity. The calibration gas was delivered to the sampling system through a spring-loaded check valve and a stainless steel "Tee"

installed at the base of the sample probe. At the conclusion of each test period, instrument calibration was verified against a mid-range calibration gas and zero gas. A STEC Model SGD-710C 10-step gas divider was used to obtain intermediate calibration gas concentrations as needed.

The average instrument reading for each test period was adjusted for calibration bias based on the pre-test and post-test calibration error test results.

Appendix 3 provides diagrams and a description of the USEPA Method 25A sample trains.



## 5.0 QA/QC Activities

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### 5.1 Flow Measurement Equipment

Prior to arriving onsite (or onsite prior to beginning compliance testing), the instruments used during the source test to measure exhaust gas properties and velocity (pyrometer, Pitot tube, and scale) were calibrated to specifications in the sampling methods.

### 5.2 Gas Divider Certification (USEPA Method 205)

A STEC Model SGD-710C 10-step gas divider was used to obtain appropriate calibration span gases. The ten-step STEC gas divider was NIST certified (within the last 12 months) with a primary flow standard in accordance with Method 205. When cut with an appropriate zero gas, the ten-step STEC gas divider delivered calibration gas values ranging from 0% to 100% (in 10% step increments) of the USEPA Protocol 1 calibration gas that was introduced into the system. The field evaluation procedures presented in Section 3.2 of Method 205 were followed prior to use of gas divider. The field evaluation yielded no errors greater than 2% of the triplicate measured average and no errors greater than 2% from the expected values.

### 5.3 Instrumental Analyzer Interference Check

The instrumental analyzers used to measure O<sub>2</sub> and CO<sub>2</sub> have had an interference response test performed prior to their use in the field, pursuant to the interference response test procedures specified in USEPA Method 7E. The appropriate interference test gases (i.e., gases that would be encountered in the exhaust gas stream) were introduced into each analyzer, separately and as a mixture with the analyte that each analyzer is designed to measure. All of analyzers exhibited a composite deviation of less than 2.5% of the span for all measured interferent gases. No major analytical components of the analyzers have been replaced since performing the original interference tests.

### 5.4 Instrument Calibration and System Bias Checks

Accuracy of the instrumental analyzers used to measure THC, O<sub>2</sub>, and CO<sub>2</sub> concentration was verified prior to and at the conclusion of each test period using the calibration procedures in Methods 25A, 3A, and 7E.

At the beginning of each test day, appropriate high-range, mid-range, and low-range span gases followed by a zero gas were introduced to the THC analyzers, in series at a tee connection, which is installed between the sample probe and the particulate filter, through a poppet check valve. After each one-hour test period, mid-range and zero gases were re-introduced in series at the tee connection in the sampling system to check against the method's performance specifications for calibration drift and zero drift error.

The instruments were calibrated with USEPA Protocol 1 certified concentrations of CO<sub>2</sub> and O<sub>2</sub> in nitrogen and zeroed using hydrocarbon free nitrogen. The THC instruments were calibrated with USEPA Protocol 1 certified concentrations of propane in air and zeroed using hydrocarbon-free air. A STEC Model SGD-710C ten-step gas divider was used to obtain intermediate calibration gas concentrations as needed.

## 5.5 Determination of Exhaust Gas Stratification

A stratification test was performed for the RTO inlet and outlet/exhaust stacks. The stainless-steel sample probe was positioned at sample points correlating to 16.7, 50.0 (centroid) and 83.3% of the stack diameters. Pollutant concentration data were recorded at each sample point for a minimum of twice the maximum system response time.

The recorded concentration data for each exhaust stack indicate that the measured pollutant concentrations did not vary by more than 5% of the mean across the stack diameter. Therefore, the exhaust stack gas was considered to be unstratified and the compliance test sampling was performed at a single sampling location within each RTO stack.

## 5.6 Meter Box Calibrations

The dry gas meter sampling console used for moisture testing was calibrated prior to and after the testing program. This calibration uses the critical orifice calibration technique presented in USEPA Method 5. The metering console calibration exhibited no data outside the acceptable ranges presented in USEPA Method 5.

The digital pyrometer in the metering console was calibrated using a NIST traceable Omega® Model CL 23A temperature calibrator.

## 5.7 System Response Time

The response time of each sampling system was determined prior to the compliance test program by introducing upscale gas and zero gas, in series, into the sampling system using a tee connection at the base of the sample probe. The elapsed time for the analyzer to display a reading of 95% of the expected concentration was determined using a stopwatch.

Results of the response time determinations were recorded on field data sheets. For each test period, test data were collected once the sample probe was in position for at least twice the maximum system response time.

Appendix 4 provides quality assurance and calibration records for the sampling equipment used during the test periods, including gas divider and instrumental analyzer calibration records, calibration gas certificates, Pitot tube inspection sheets, meter box, and field equipment calibrations.