

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

**Prepared for:
LexaMar Corporation
SRN N2812**

Test Dates: April 12-14, 2022

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Report Certification

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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.



Blake Beddow
Project Manager

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1.0 Introduction

LexaMar Corporation (LexaMar) has received State of Michigan Renewable Operating Permit (ROP) No. MI-ROP-N2812-2015b (expired March 2, 2020) for the operation of spray coating and dip coating processes at its facility located in Boyne City, Charlevoix County, Michigan (State Registration No. N2812). An ROP application was submitted August 8, 2019, and the renewal is currently in process.

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 different operating scenarios; and
- Overall control efficiency associated with the Ursa Minor Dip Coat Line (EU-URSAMINOR) and Body Color Paint Line (EU-BCPL).

The VOC destruction efficiency (DE) and capture efficiency (CE) testing was performed April 12-14, 2022 by Impact Compliance & Testing, Inc. (ICT) representatives Blake Beddow, Andrew Eisenberg, and Max Fierro. Only one DE operating scenario (RTO Bed B at 100%) was able to be completed at the time of testing due to various circumstances presented in section 6.4 of this report.

The project was coordinated by Mr. Kelly Bellant, Environmental Engineer. Mr. Robert Dickman and Mr. Dave Bowman of the Michigan Department of Environment, Great Lakes and Energy – Air Quality Division (EGLE-AQD) were on-site to observe portions of the compliance testing.

The control efficiency evaluation and exhaust gas sampling and analysis was performed using procedures specified in the Test Plan dated February 28, 2022 that was submitted to EGLE-AQD for review and approval.

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

Questions regarding this emission test report should be directed to:

Blake Beddow
Project Manager
Impact Compliance & Testing, Inc.
37660 Hills Tech Drive
Farmington Hills, MI 48331
(734) 464-3880
Blake.Beddow@impactCandT.com

Kelly J. Bellant
Environmental Engineer
LexaMar Corporation
100 LexaMar Drive
Boyne City, Michigan 49712
(231) 348-9226
Kj.Bellant@magna.com

2.0 Source Description

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) and the Ursa Minor Coating Line (EU-URSAMINOR).

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 top coat) and two (2) curing ovens (prime and top coat 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 top coat. 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).

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 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 and the Ursa Minor 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 exhaust stack.

2.4 Process Operating Conditions During the Compliance Testing

During the RTO destruction efficiency test, the BCPL coated between 1,152 and 1,192 parts per hour and the Ursa Minor coating line processed between 732 and 748 parts per hour.

The Ursa Minor coating line processed between 512 and 688 parts per hour during the capture efficiency test periods.

Conditions during the destruction and capture efficiency tests were representative of normal operating conditions.

Due to limited production hours and other logistical difficulties presented in section 6.4 of this report, destruction efficiency for the RTO emission control system was only tested at the following operating scenario:

1. RTO B operated at maximum capacity and RTO A was isolated from the coating process exhaust.

The following operating scenarios will be tested at a future date that is to be determined:

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

During the RTO destruction efficiency test period, a minimum 3-hour RTO combustion chamber temperature of 1,664°F was established according to 40 CFR 63.4567(a).

Table 2.1 presents a summary of the process operating conditions during the RTO destruction efficiency and Ursa Minor coating line capture efficiency test periods.

Appendix B 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 and capture efficiency test periods

Date	Time	Ursa Minor (parts/hr)	BCPL (parts/hr)	RTO A Operation	RTO B Operation
<u>RTO Destruction Effic.</u>					
4/13/22	1400-1500	748	1,192	Idle	100%
4/14/22	0615-0715	732	1,152	Idle	100%
4/14/22	0816-0916	732	1,152	Idle	100%
<u>Ursa Minor Capture Effic.</u>					
4/12/22	1130-1230	512	--	--	--
4/12/22	1304-1404	512	--	--	--
4/12/22	1430-1530	688	--	--	--

3.0 Summary of Test Results

3.1 Results for RTO VOC Destruction Efficiency

VOC destruction efficiency 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.

However, limited production and other testing difficulties, as presented in section 6.4, only allowed for one operating scenario to be tested (RTO B). The RTO inlet and exhaust gas streams were monitored simultaneously to calculate the VOC mass flowrate entering and exiting the emission control system for VOC destruction efficiency determination.

Based on the measured VOC mass flowrates the three-hour average VOC destruction efficiency for each RTO operating scenario exceeded 95% by weight as required by conditions of the ROP. The combustion chamber temperature setpoint for RTO B was 1600°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 destruction efficiency test results are summarized in Table 3.1.

3.2 Results for Ursa Minor Dip Coat Line VOC Capture Efficiency

VOC capture efficiency for the Ursa Minor coating line was determined by simultaneously measuring the VOC mass flowrate in the prime coat oven exhaust to atmosphere, the top coat oven exhaust to atmosphere, and captured gas stream to the RTO emissions control system.

For the Ursa Minor coating line, permit conditions specify a minimum VOC capture efficiency of 90% by weight.

Based on the measured VOC mass flowrates, 93.2% of the VOC exhausted from the Ursa Minor coating line is captured and directed to the RTO emissions control system; 6.8% of the VOC is released to atmosphere through the uncontrolled oven exhausts.

The VOC capture efficiency test results are summarized in Table 3.2.

3.3 BCPL Permanent Total Enclosure Verification

A BCPL permanent total enclosure verification PTE was performed prior to the test event by LexaMar personnel, and was approved by EGLE-AQD for previous test events. No changes have mad to the PTE since previous testing. The measurements made by LexaMar personnel verified that the BCPL PTE meets USEPA Method 204 criteria.

Table 3.1 Summary of RTO VOC destruction efficiency test results and recorded operating temperature

Control System Operating Scenario	Avg. RTO A Bed Temp¹ (°F)	Avg. RTO B Bed Temp¹ (°F)	VOC Destruction Efficiency¹ (% wt)
RTO B 100% Permit Limit	NA	1,664	96.7% >95.0%

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

Table 3.2 Summary of VOC capture efficiency test results for the Ursa Minor coating line

Parameter	Test No.1 Results (% wt)	Test No.2 Results (% wt)	Test No.3 Results (% wt)	Average (% wt)	Permit Limit
VOC Captured	92.9%	93.1%	93.6%	93.2%	>90%

4.0 Sampling and Analytical Procedures

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 concentration using a flame ionization analyzer (FIA) compared to a propane standard.

4.2 Ursa Minor VOC 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 All captured gas streams are predominately ambient air
- Method 4 Moisture determination was performed using wet-bulb/dry bulb temperature measurements
- Method 25A Total hydrocarbon concentration using a flame ionization analyzer (FIA) compared to a propane standard.
- Method 204 Physical measurements to verify permanent total enclosure design criteria.

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 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 Ursa Minor Dip Coat Line VOC Capture Efficiency Sampling Locations

The sample and velocity pressure measurement location for the top coat oven exhaust gas is in the 14-inch diameter exhaust duct for the top coat oven blower. This location is 5.1 duct diameters from the nearest upstream flow disturbance (exhaust fan) and at least 2.3 duct diameters from the nearest downstream flow disturbance (measurement to the underside of the ceiling).

The sample and velocity pressure measurement location for the prime coat oven exhaust gas is in the 12-inch diameter exhaust duct for the prime coat oven blower. This location is 6.7 duct diameters from the nearest upstream flow disturbance (exhaust fan) and at least 2.6 duct diameters from the nearest downstream flow disturbance (measurement to the underside of ceiling).

The sample and velocity pressure measurement location for the combined coating booth exhaust to the RTO is in the 17 7/8-inch diameter horizontal duct above the coating line. This location is 17.3 duct diameters from the nearest upstream flow disturbance (lateral duct adjoining the two coating booth exhausts) and 7.3 duct diameters from the nearest downstream flow disturbance (90-degree elbow prior to the booster fan).

Appendix C 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.

Exhaust gas velocity pressure and temperature were measured at each sampling location in accordance with USEPA Method 2. 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.

4.5 Gas Molecular Weight Determinations (USEPA Method 3A, 2)

Due to a failed oxygen (O₂) cell within the carbon dioxide (CO₂) and O₂ instrumental analyzer, continuous RTO exhaust gas data could not be recorded for CO₂ and O₂. An RTO exhaust gas sample was taken during the second test run of RTO B from 7:03 AM to 7:10 AM. A one-liter Tedlar® bag (sample bag) was purged with nitrogen three times, and then a vacuum was pulled on the sample bag with a diaphragm pump. The inlet line to the CO₂ and O₂ instrumental analyzer was attached to the sample bag and it was filled over a 7-minute period. This sampling location is downstream of the gas conditioning system, so the sample bag gas was dried using a refrigerant-based condenser prior to analysis. Once sampling was completed, the valve was closed, and the bag was stored for later transport.

Upon returning to a functioning CO₂ and O₂ instrumental analyzer, three-point instrument calibrations were performed, and the sample bag was attached to the instrument inlet. A Non-Dispersive Infrared (NDIR) gas analyzer was used to measure the CO₂ content; a gas analyzer equipped with a zirconia ion sensor was used to measure the O₂ content. Once the sample bag valve was opened, instrument response was recorded on an ESC Model 8816 data logging system that monitored the analog output of the instrumental analyzers continuously and logged data as one-minute averages. Data was recorded for 20 minutes. After sampling was complete, the instrument was checked for calibration drift.

These recorded CO₂ and O₂ concentrations were used for exhaust gas molecular weight calculations according to USEPA Method 3A.

Instrument calibration data is presented in Appendix 4.

The RTO inlet gas, and Ursa Minor 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 exhaust gas was determined using the USEPA Method 4 chilled impinger method. Moisture content for all other gas streams 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 Hydrocarbon Concentration Measurements (USEPA Method 25A)

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

The THC concentration measurements were performed using Thermo Environmental Instruments, Inc. (TEI) Model 51 Total Hydrocarbon Analyzers, TEI Model 51c Total

Hydrocarbon Analyzers, or a California Analytical Instruments, Inc. (CAI) Model 600 HFID Total Hydrocarbon 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 8816 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 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 or a STEC Model SGD-SC-5L five-step gas divider was used to obtain intermediate calibration gas concentrations as needed.

Due to the large swing in measured concentrations for the RTO exhaust gas (THC peaks that occur during the RTO valve switch and change in airflow direction) the scale for the FIA instrument used for the RTO exhaust gas was set to 500 ppmv on the second day of testing. On the first day of testing, the calibration error test was performed based on a 0-100 ppmv span and an additional calibration error test injection was performed at the end of a test period whenever a 1-minute average data point was logged over 100 ppmv span, to verify accuracy of the instrument at the peak of the measurement range.

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

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.

The absence of cyclonic flow for each sampling location was verified using an S-type Pitot tube and oil manometer. The Pitot tube was positioned at each of the velocity traverse points 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).

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 O₂ and CO₂ 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, O₂, and CO₂ 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.

Prior to the sample bag analysis for CO₂ and O₂, initial three-point instrument calibrations were performed for the CO₂ and O₂ analyzers by injecting calibration gas directly into the inlet sample port for each instrument. Following the sample bag analysis, the same three-point gas concentrations were injected directly into each instrument to check for calibration drift.

The THC (VOC) instruments were calibrated with USEPA Protocol 1 certified concentrations of propane in air and zeroed using hydrocarbon-free air. The CO₂ and O₂ instruments were calibrated with USEPA Protocol 1 certified concentrations of CO₂ and O₂ in nitrogen and zeroed using hydrocarbon free nitrogen. A STEC Model SGD-710C ten-step gas 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 exhaust stack. The stainless steel sample probe was positioned at sample points correlating to 16.7, 50.0 (centroid) and 83.3% of the stack diameter. 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 the RTO exhaust 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, and meter box, scale, barometer, and pyrometer calibrations.

6.0 Results

6.1 RTO VOC Destruction Efficiency

6.1.1 Summary of Test Procedures and Calculations

THC concentration in the RTO inlet and exhaust gas streams was monitored simultaneously to determine the VOC mass flowrate entering and exiting the emission control system. Due to limited production hours and other logistical difficulties presented in section 6.4 of this report, destruction efficiency for the RTO emission control system was only tested at one operating scenario (RTO B at 100% capacity, with RTO A in idle mode). Three (3) one-hour sampling periods were performed at this operating scenario.

Air flowrate measurements were performed near the beginning and end of each one-hour test period. Gas molecular weight measurements (fixed gases and moisture determinations) were performed for each one-hour test period.

The VOC mass flowrate into and out of the RTO emission control system was calculated using the following equation:

$$M_{VOC} = Q [C_{VOC}] (MW_{C_3}) (60 \text{ min/hr}) / V_M / 1E+06$$

Where: M_{VOC} = Mass flowrate VOC (lb/hr)
 Q = Volumetric flowrate (scfm)
 C_{VOC} = THC concentration (ppmv C_3)
 MW_{C_3} = Molecular weight of propane (44 lb/lb-mol)
 V_M = Molar volume of ideal gas at standard condition (385 scf/lb-mol)

The THC destruction efficiency of the RTO emission control system was determined for each test period using the following equation:

$$DE = [1 - (M_{VOC \text{ in}} / M_{VOC \text{ out}})] * 100\%$$

Where: DE = VOC destruction efficiency (%wt)
 $M_{VOC \text{ in}}$ = VOC mass flowrate into the RTO (lb/hr)
 $M_{VOC \text{ out}}$ = VOC mass flowrate exhausted from the RTO (lb/hr)

6.1.2 RTO VOC Destruction Efficiency Test Results

Table 6.1 presents measured gas conditions and results for each destruction efficiency test period.

The RTO B destruction efficiency tests were performed on April 13 and 14, 2022. Recorded data (flowrate and instrument response) and calculations for each test period are presented

in Appendix 5 as test periods 1, 2, and 3 for RTO B. The calculated VOC destruction efficiency for RTO B averaged 96.7%.

The other operating scenarios required by the ROP (RTO A, RTO A/B) will be scheduled for a later date.

The three-hour average VOC destruction efficiency is greater than the minimum destruction efficiency required by the ROP (95% by weight).

6.2 Ursa Minor Coating Line VOC Capture Efficiency

6.2.1 Summary of Test Procedures and Calculations

VOC emissions from the Ursa Minor coating booths are captured within individual permanent enclosures and exhausted to the RTO emissions control system. The prime and topcoat curing oven exhausts are vented directly to atmosphere via individual vertical exhaust stacks.

THC concentration (based on a propane reference) in the captured gas stream and individual uncontrolled curing oven exhausts were monitored simultaneously throughout three (3) one-hour test periods to determine the VOC mass flowrate directed to the control device and exhausted to atmosphere. Air flowrate measurements were performed once for each one-hour test period.

The controlled (captured) and uncontrolled VOC mass flowrates were determined simultaneously at the three (3) sampling locations using the equation presented in Section 5.1.1 of this document. The percentage of VOC captured (and directed to the RTO emissions control device) was determined using the following equation:

$$\text{Captured VOC Emissions (\%)} = \frac{\text{VOC in captured stream (lb/hr)}}{\text{VOC in captured stream (lb/hr)} + \Sigma \text{ VOC in uncaptured stream (lb/hr)}}$$

6.2.2 Ursa Minor Dip Coat Line VOC Capture Efficiency Test Results

Table 6.2 presents measured gas conditions and results for each capture efficiency test period.

The Ursa Minor Dip Coat Line capture efficiency tests were performed on April 12, 2022. Recorded data (flowrate and instrument response) and calculations for each test period are presented in Appendix 6. The permanent total enclosures for each coating booth operated normally such that all VOC emissions within the booths was captured by the process air collection system.

The amount of VOC captured by the process air collection system, compared to the overall Ursa Minor Dip Coat Line VOC emission rate (captured VOC plus uncollected VOC) ranged between 92.9 and 93.6% and averaged 93.2%.

The calculated VOC capture efficiency for all individual one-hour test periods is greater than the minimum capture efficiency as agreed upon with EGLE-AQD (90% by weight).

6.2.3 Capture Efficiency Data Quality Objective (DQO) Criteria

The capture efficiency test procedures used for the Ursa Minor Dip Coat Line are consistent with those in §63.4565(d) *Gas-to-gas protocol using a temporary total enclosure or a building enclosure*, except that §63.4565 requires that:

Each test run must be at least 3 hours duration or the length of a production run, whichever is longer, up to 8 hours. For the purposes of this test, a production run means the time required for a single part to go from the beginning to the end of the production, which includes surface preparation activities and drying and curing time.

The capture efficiency results for this test event (and previous test events) are based on one-hour sampling periods and are subject to the criteria of the Data Quality Objective (DQO) or the Lower Confidence Limit (LCL) approach in accordance with §63.4565(e) *Alternative capture efficiency protocol*.

The three-test data set for EU-URSAMINOR capture efficiency (92.9, 93.1 and 93.6%) satisfies the DQO criteria in that the calculated DQO Indicator (P value) is less than 5%.

6.3 Process Operating Conditions During the Compliance Test Periods

The emission testing was performed while the RTO emissions control system and associated processes operated at normal production rates.

Process and control device operation data collected by LexaMar representatives is provided in Appendix 2.

6.4 Variations from Normal Sampling Procedures or Operating Conditions

The testing was performed in accordance with the Test Plan that was approved by EGLE-AQD. During the testing program the coating lines were operated at normal operating conditions, at or near maximum capacity and satisfied the parameters specified in the EGLE-AQD test plan approval letter.

Testing could not be completed as presented in the Test Plan that was approved by EGLE-AQD. This is because of a combination of the following reasons:

- The aerial lift could not reach the sampling location, so a rental need to be ordered. Proximate aerial lift rental companies did not offer same day delivery.
- The plant production schedule for Friday April 15, 2022 was canceled as a result of the Good Friday holiday. The air compliance team was not aware of this schedule change until Tuesday April 12, 2022.
- High winds on Thursday April 14, 2022 exceed the safe operating wind speed limits presented in the aerial lift operator manual.

Follow-up testing is currently in discussion with LexaMar and ICT to complete the ROP required operating scenario tests (RTO A and RTO A/B).

A cell failed in the O₂ instrumental analyzer so continuous concentrations could not be recorded throughout each test run. Under EGLE-AQD approval, ICT sampled the exhaust gas for later analysis. A full explanation of the sampling and analysis procedures are presented in section 4.4 of this report.

7.0 Verification of Body Color Paint Line Total Enclosure

7.1 Physical Design and Operating Criteria

ROP No. MI-ROP-N2812-2015b requires LexaMar to maintain a PTE for the Body Color Paint Line such that all VOC emitted by the process is captured and directed to the RTO emission control system.

7.2 PTE Description and Physical Measurements

Parts are loaded onto the Body Color Paint Line conveyor, cleaned in a high-pressure water washing system and conveyed through a flash tunnel for drying. The parts enter the PTE portion of the Body Color Paint Line through a 2.0-ft. by 7.6-ft. conveyor window into the adhesion promoter application booth. The parts are conveyed through the adhesion promoter booth, two (2) basecoat application booths, and two (2) clearcoat application booths. Flash-off tunnels are positioned after the adhesion promoter booth and the second basecoat booth. Parts are conveyed through a final cure oven after second clearcoat booth and exit the PTE through a 3.0-ft. by 8.0-ft. conveyor window at the exit of the cure oven.

The two conveyor windows identified in the preceding text are the only natural draft openings present in the enclosure resulting in a total NDO area of 39.2 square feet. The total enclosure surface area, not including the final cure oven, is approximately 7,294 square feet.

7.3 Verification of PTE Criteria

7.3.1 NDO to Enclosure Area Ratio

Based on the dimensions of the enclosure areas and the NDOs, the NDO to enclosure area ratio (NEAR) is less than 5%. Other than the two conveyor windows, all points of access into the enclosure are used for intermittent personnel or maintenance access and remain closed during routine operation of the Body Color Paint Line.

$$\text{NEAR: } 39.2 \text{ ft}^2 / 7,294 \text{ ft}^2 * 100 = 0.54\%$$

7.3.2 Differential Pressure

Differential pressure readings were recorded during each test period by LexaMar representatives and are presented in Appendix 2.

7.3.3 NDO Spacing Relative to VOC Sources

The closest VOC emitting point relative to the PTE entrance is the adhesion promoter robotic spray applicator.

The PTE entrance NDO has dimensions of 2.0-ft. by 7.6-ft., which results in the requirement to maintain a minimum spacing of 12.7 feet between the NDO and the closest VOC emitting point (i.e., four times the opening area divided by the perimeter as specified by the ROP).

$$4 [(2 \times \text{NDO Area}) / (\text{NDO Perimeter})] = 4 [(2 (2.0\text{ft.} \times 7.6\text{ ft.}) / (2.0\text{ ft.} + 7.6\text{ ft.}))] = 12.7\text{ ft.}$$

The physical location of the robot maintains a minimum spacing of 16-feet between the adhesion promoter spray applicator and the PTE entrance NDO. This physical robot location satisfies the spacing requirement.

The closest VOC emitting point relative to the PTE exit NDO is the second clearcoat application booth. The final cure oven is of sufficient length to maintain a spacing of significantly greater than four equivalent diameters between the second clearcoat application booth and the PTE exit NDO.

Table 6.1 RTO-B measured gas conditions and destruction efficiency test results

Test No.	1	2	3	
Test date	4/13/2022	4/14/2022	4/14/2022	Three Test
Test period (24-hr clock)	1400-1500	0615-0715	0816-0916	Average
RTO-B Bed Temperature (°F)	1,673	1,652	1,668	1,664
<u>RTO Inlet</u>				
Temperature (°F)	116	113	114	114
Flowrate (scfm)	20,745	21,045	20,867	20,886
Average THC Conc. (ppmv C ₃)	527	326	450	434
VOC Mass Flow (lb/hr)	75.1	47.2	64.5	62.3
<u>RTO Exhaust</u>				
Temperature (°F)	196	206	207	203
Flowrate (scfm)	18,021	24,208	17,900	20,043
Average THC Conc. (ppmv C ₃)	21.0	10.0	15.1	15.4
VOC Mass Flow (lb/hr)	2.60	1.67	1.86	2.04
<u>Calculated Destruction Efficiency</u>				
1 - [VOCout / VOCin] x 100%	96.5	96.5	97.1	96.7
<i>Permit Limit</i>	-	-	-	>95%

Table 6.2 Ursa Minor Dip Coat Line measured gas conditions and capture efficiency test results

Test No.	1	2	3	Three Test
Test date	4/12/2022	4/12/2022	4/12/2022	Average
Test period (24-hr clock)	1130-1230	1304-1404	1430-1530	
<u>Prime Coat Oven Exhaust</u>				
Temperature (°F)	211	210	211	211
Flowrate (scfm)	1,338	1,184	1,306	1,276
Average THC Conc. (ppmv C ₃)	30.2	25.9	25.9	27.3
VOC Mass Flow (lb/hr)	0.28	0.21	0.23	0.24
<u>Top Coat Oven Exhaust</u>				
Temperature (°F)	202	210	207	206
Flowrate (scfm)	2,524	2,667	2,541	2,577
Average THC Conc. (ppmv C ₃)	25.8	25.3	21.6	24.3
VOC Mass Flow (lb/hr)	0.45	0.46	0.38	0.43
<u>Coating Booths to RTO</u>				
Temperature (°F)	91	91	100	94
Flowrate (scfm)	4,253	4,499	4,404	4,385
Average THC Conc. (ppmv C ₃)	327	295	294	305
VOC Mass Flow (lb/hr)	9.55	9.13	8.90	9.19
<u>Calculated Capture Efficiency</u>				
VOC Captured / Total VOC				
Measured	92.9%	93.1%	93.6%	93.2%
Permit Limit	-	-	-	>90.0%

APPENDIX 1

TEST PLAN APPROVAL LETTER



GRETCHEN WHITMER
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF
ENVIRONMENT, GREAT LAKES, AND ENERGY
CADILLAC DISTRICT OFFICE



LIESL EICHLER CLARK
DIRECTOR

March 28, 2022

Mr. Charlie Siska, General Manager
LexaMar Corporation
100 LexaMar Drive
Boyne City, Michigan 49712
County

SRN: N2812, Charlevoix

Dear Mr. Siska:

SUBJECT: Approval of Test Protocol for Emissions Testing.

The Department of Environment, Great Lakes, and Energy (EGLE), Air Quality Division (AQD) has completed review of the protocol for the emissions testing at LexaMar Corporation located in Boyne City, Charlevoix County. This protocol was received by EGLE on March 11, 2022. Testing is scheduled to begin April 12, 2022. Testing is required by Renewable Operating Permit MI-ROP-N2812-2015b and Title 40 of the Code of Federal Regulations, Part 63, Subpart PPPP. Emissions testing will be conducted as listed below:

Source	Parameter	Minimum Limit	Unit	Method*
EU-BCPL	VOC	95	% Control Efficiency	1,2,3,4,25A
EU-URSAMINOR	VOC	95	% Destruction Efficiency	1,2,3,4,25A
		90	% Capture Efficiency	1,2,3,4,25A

*EPA Method

VOC = Volatile Organic Compounds

The proposed methods are acceptable given the following stipulations:

- TESTING
 - Cyclonic flow check shall be performed for each sampling location if proof of past cyclonic flow checks cannot be provided.
 - Testing shall be performed with EU-BCPL and EU-URSAMINOR operating at maximum normal operating rates.
 - Capture Efficiency testing runs on EU-URSAMINOR shall be a minimum of one hour in duration.
 - Testing will not occur during periods of process startup, shutdown or malfunction.
 - Flow measurements will be taken during associated pollutant measurements.
 - Regenerative Thermal Oxidizer (RTO) inlet and outlet measurements will be taken simultaneously.
 - Ports must remain plugged during testing.

Mr. Charlie Siska, General Manager
LexaMar Corporation
March 28, 2022

- Process conditions that need to be recorded for each test run:
 - EU-BCPL and EU-URSAMINOR
 - Pressure drop across each Permanent Total Enclosure (PTE)
 - Parts production rate in parts per hour
 - Coatings used:
 - Identification numbers
 - VOC/HAP content
 - RTO
 - Combustion zone temperatures of each chamber
 - Variable frequency drive output for each oxidizer unit system fan
- Testing will be performed in accordance with DEQ, AQD, Air Pollution Control Rules, Part 10, Intermittent Testing and Sampling.
- All requirements and specifications of the above methods apply; any modifications of the test methods onsite must be approved by the AQD.

- REPORT
 - All process data listed above to include:
 - Each individual reading.
 - Average/total for each testing run.
 - The average RTO temperature during performance testing
 - Permanent Total Enclosure evaluation including a Method 204 Evaluation for each source.
 - Inclusion of traverse point and sample locations inside stacks.
 - Distances to nearest upstream and downstream disturbances.
 - All pre-test and post-test meter box calibration, pitot tube calibration, nozzle calibration and field data sheets.
 - All calibration and cyclonic flow checks.
 - All data should be presented in tabular format.
 - Certificate of Analysis sheets shall be included for all calibration gases used.
 - All aborted, failed or repeated runs must be included in the report.

Please submit a complete copy of the final test report to both:

Mr. Dave Bowman
Environmental Quality Analyst
EGLE, Air Quality Division
2100 West M-32
Gaylord, Michigan 49735

Supervisor, Technical Programs Unit
EGLE, Air Quality Division
P.O. Box 30260
Lansing, Michigan 48909

Please inform Mr. Dave Bowman, of the Gaylord District Office, at 989-395-6298 and me of any change in the test date. If you have any questions regarding this letter, please contact me at 231-878-4697 or by email at dickmanr@michigan.gov.

Mr. Charlie Siska, General Manager
LexaMar Corporation
March 28, 2022

Sincerely,

A handwritten signature in black ink that reads "Rob Dickman". The signature is fluid and cursive, with the first name "Rob" being more prominent than the last name "Dickman".

Rob Dickman
Environmental Quality Analyst
Air Quality Division
231-878-4697
dickmanr@michigan.gov

cc/via email: Mr. Kelly Bellant, LexaMar Corporation
Mr. Tyler Wilson, Impact Compliance and Testing
Ms. Karen Kajiya-Mills, EGLE
Mr. Shane Nixon, EGLE
Mr. Dave Bowman, EGLE

APPENDIX 2

**PRODUCTION DATA AND
RTO OPERATING RECORDS**

RTO Vs Oven URSA

Test 1

Time	Delta Prime	Delta TopCoat	Parts	RTO Temp	RTO Set Point	RTO Fan Hz
11:30	0.0268	0.0147	0	1627	1600	57
11:45	0.0296	0.019	128	1619	1600	57
12:00	0.0207	0.02	128	1614	1600	57
12:15	0.0281	0.0185	128	1614	1600	57
12:30	0.0307	0.019	128	1615	1600	57

Test 2

Time	Delta Prime	Delta TopCoat	Parts	RTO Temp	RTO Set Point	RTO Fan Hz
1:04	0.023	0.021	0	1617	1600	57
1:19	0.0289	0.0113	128	1615	1600	57
1:34	0.0284	0.0181	128	1606	1600	57
1:49	0.0286	0.0179	128	1598	1600	57
2:04	0.023	0.014	128	1599	1600	57

Test 3

Time	Delta Prime	Delta TopCoat	Parts	RTO Temp	RTO Set Point	RTO Fan Hz
2:30	0.0301	0.0142	0	1644	1600	57
2:45	0.0287	0.0176	172	1666	1600	57
3:00	0.0302	0.0167	172	1668	1600	57
3:15	0.0285	0.016	172	1661	1600	57
3:30	0.0257	0.0114	172	1646	1600	57

Date of Test 1-3, 4/12/22

RTO Bed B

Test 1

Time	Parts URSA	Parts BCPL	RTO Temp	RTO Set Point	RTO Fan Hz
2:00	0	0	1673	1600	57
2:15	187	298	1676	1600	57
2:30	187	298	1683	1600	57
2:45	187	298	1666	1600	57
3:00	187	298	1666	1600	57

Test 2

Time	Parts URSA	Parts BCPL	RTO Temp	RTO Set Point	RTO Fan Hz
6:15	0	0	1615	1600	57
6:30	183	288	1643	1600	57
6:45	183	288	1664	1600	57
7:00	183	288	1668	1600	57
7:15	183	288	1668	1600	57

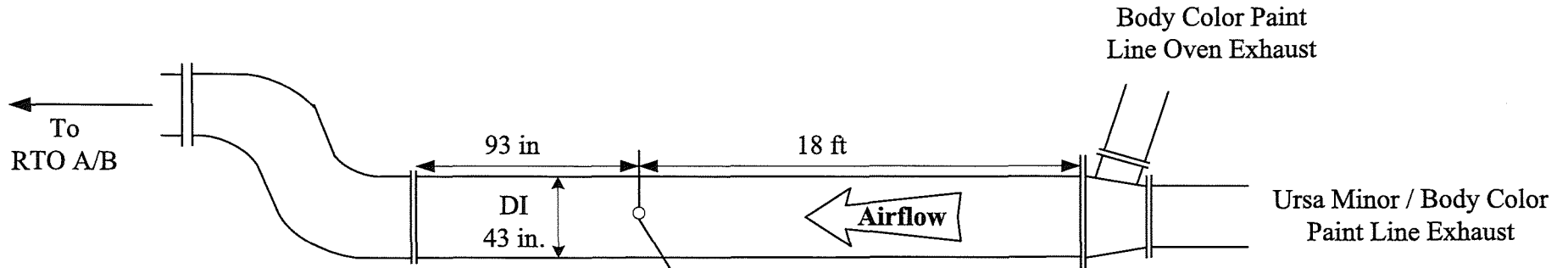
Test 3

Time	Parts URSA	Parts BCPL	RTO Temp	RTO Set Point	RTO Fan Hz
8:16	0	0	1655	1600	57
8:31	183	288	1668	1600	57
8:46	183	288	1670	1600	57
9:01	183	288	1677	1600	57
9:16	183	288	1668	1600	57

Test 1 Date 4/13, Test 2-3 Date 4/14

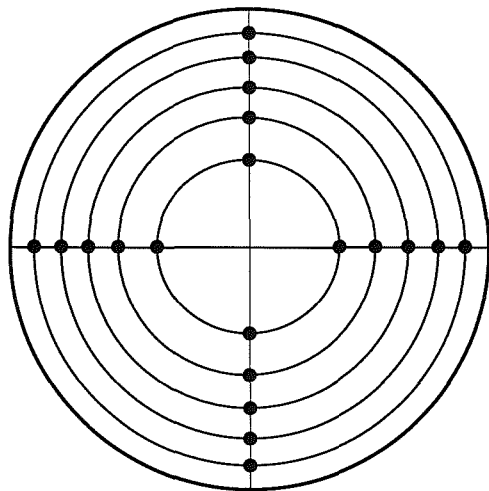
APPENDIX 3
SAMPLING LOCATION AND
SAMPLING TRAIN DIAGRAMS

Plan View Roof



Velocity sample locations as measured from inlet duct wall

Pt. #	in.
1	1.11
2	3.53
3	6.28
4	9.72
5	14.70
6	28.29
7	33.28
8	36.72
9	39.47
10	41.88

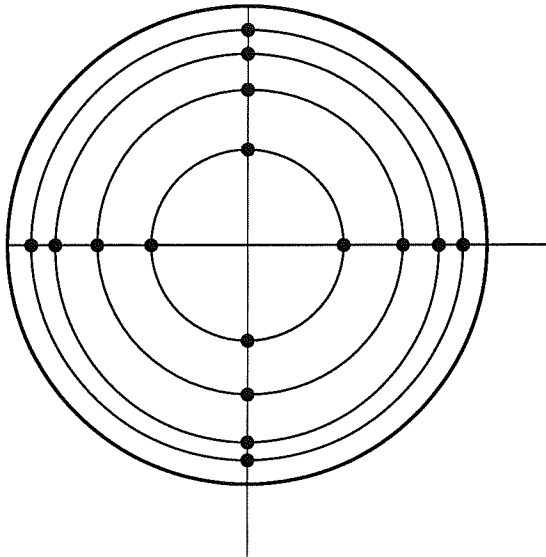


RTO Inlet Sample Location

3/20/12	Lexamar Corp.		
	RTO Inlet Sample Location		
	Scale None	Sheet 1 of 1	DES Project No. 1702027

RTO Outlet

Sample and velocity
traverse location

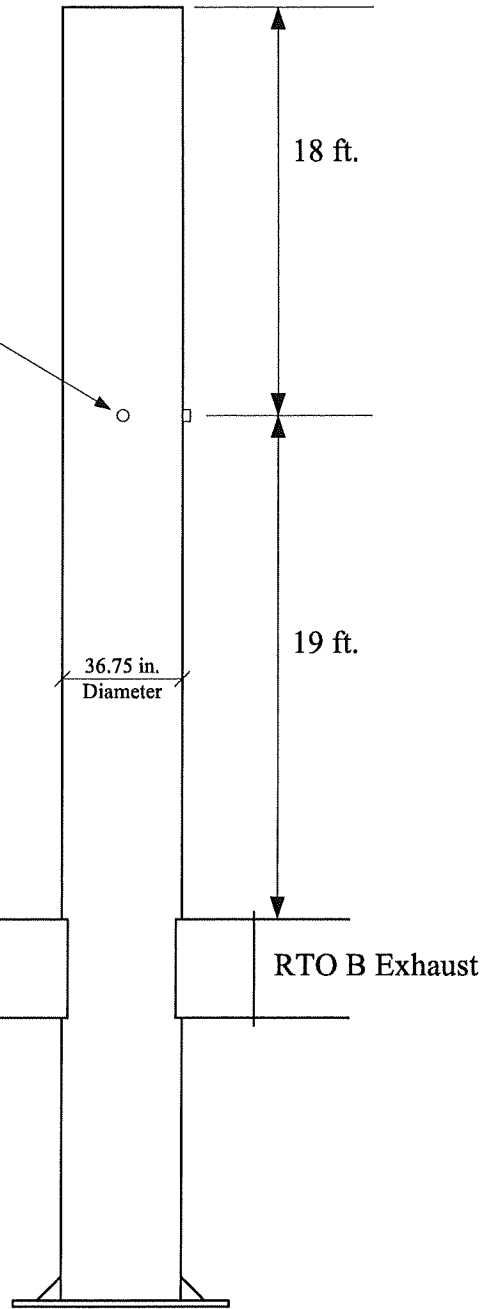


Velocity sample locations
measured from stack wall

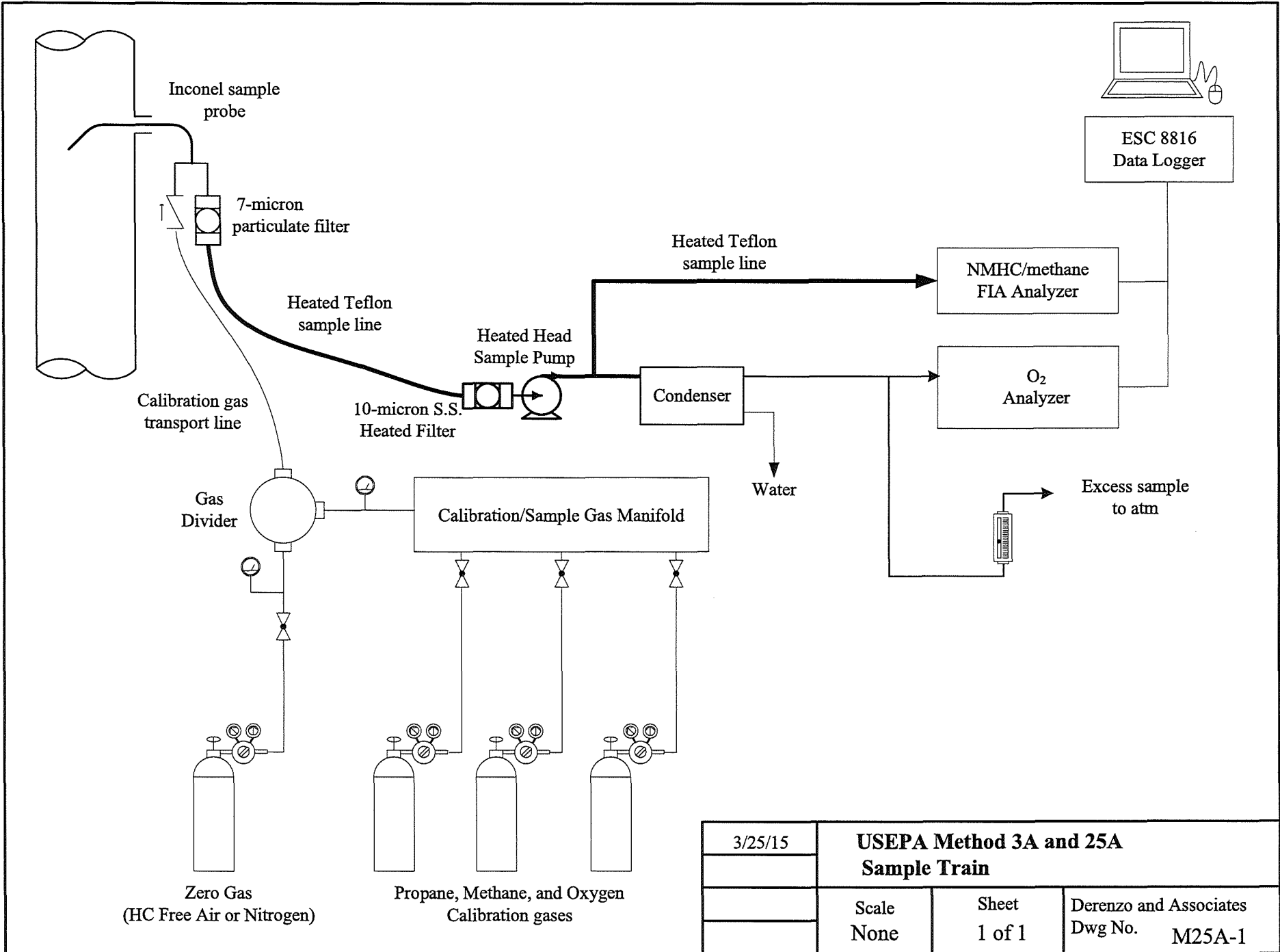
1	1.18"
2	3.86"
3	7.13"
4	11.83"
5	24.88"
6	29.62"
7	32.89"
8	35.57"

RTO A Exhaust

RTO B Exhaust

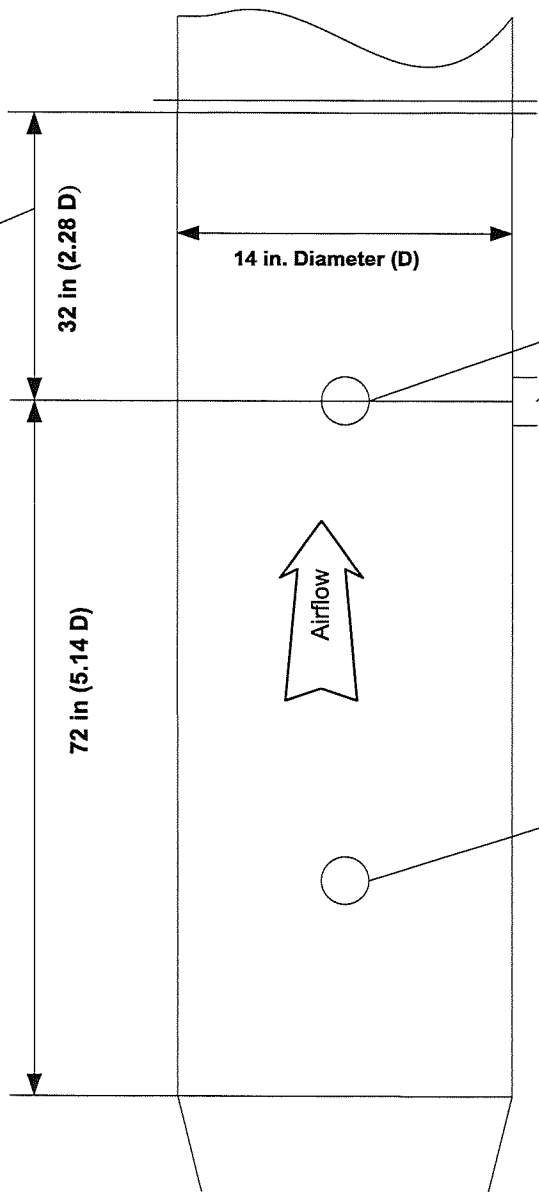


3/20/12	LexaMar Corp.		
	RTO Stack Sample Location		
	Scale	Sheet	DES Project No.
	None	1 of 1	1702027



3/25/15	USEPA Method 3A and 25A Sample Train		
	Scale None	Sheet 1 of 1	Derenzo and Associates Dwg No. M25A-1

Measurement to underside of roof (ceiling)

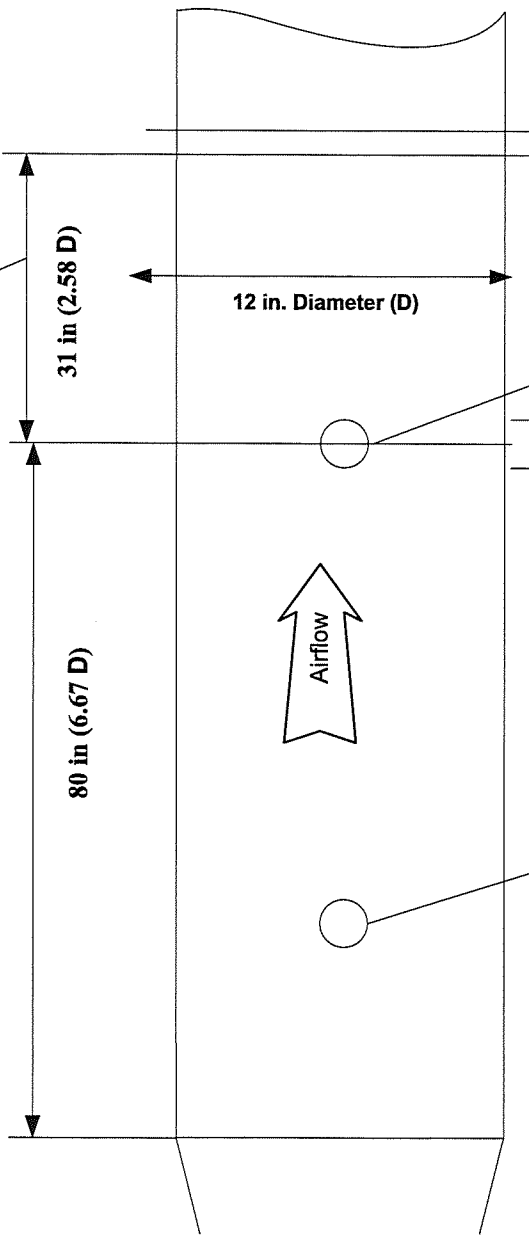


Velocity Traverse testing point

Method 25A sample point

	Top Coat Oven Exhaust		
	Scale	Sheet	DES
	None	1 of 1	Project No. 1702027

Measurement to underside of roof (ceiling)



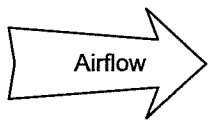
Velocity Traverse testing point

Method 25A sample point

	Prime Coat Oven Exhaust		
	Scale	Sheet	DES
	None	1 of 1	Project No. 1702027

From Top Coat Dip Booth

From Prime Dip Booth



310" (17.34 D)

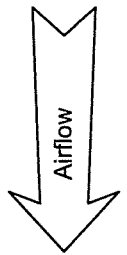
17 7/8" Diameter (D)

135" (7.55 D)

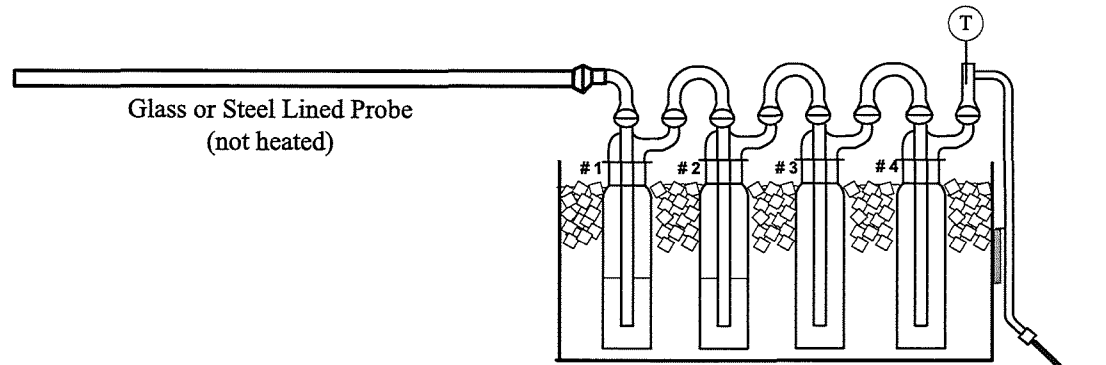
Method 25A sample point

Velocity traverse testing point

To RTO Fan



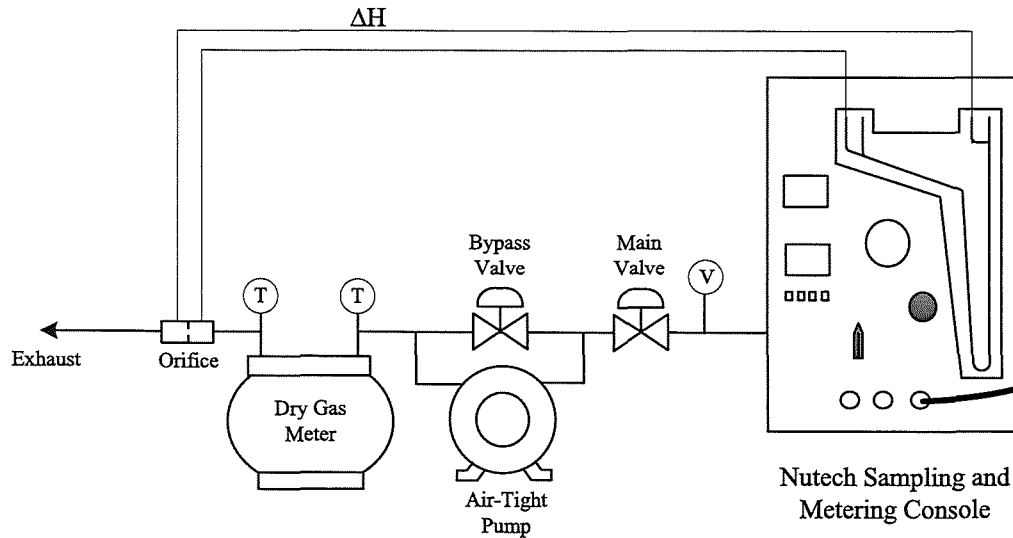
3/20/12	Coating Booth Exhaust To RTO		
	Scale	Sheet	DES
	None	1 of 1	Project No. 1702027



Impinger Contents (indicate Standard or Modified)

- Impinger # 1: 100 mL Water (std)
- Impinger # 2: 100 mL Water (mod)
- Impinger # 3: Empty (std)
- Impinger # 4: Dried silica gel (mod)

Ⓥ = Vacuum Gauge
 Ⓣ = Temperature Measurement



3/1/10	USEPA Method 4 Sample Train		
	Scale None	Sheet 1 of 1	Derenzo Environmental Dwg No. M4-03

ATTACHMENT B

EXHAUST GAS MOISTURE SAMPLING PROCEDURES

Sample probe – A non-heated stainless steel-lined probe will be connected to an impinger train that will consist of a set of impingers, connected in series and immersed in an ice bath. Crushed ice will be placed around the impingers to keep the temperatures of the gases leaving the last impinger at 68°F or less. The weight of each impinger, and the volume of water contained within each impinger will be measured before and after each test to determine the net moisture gained.

Impinger train - The impinger train will be constructed and charged as follows:

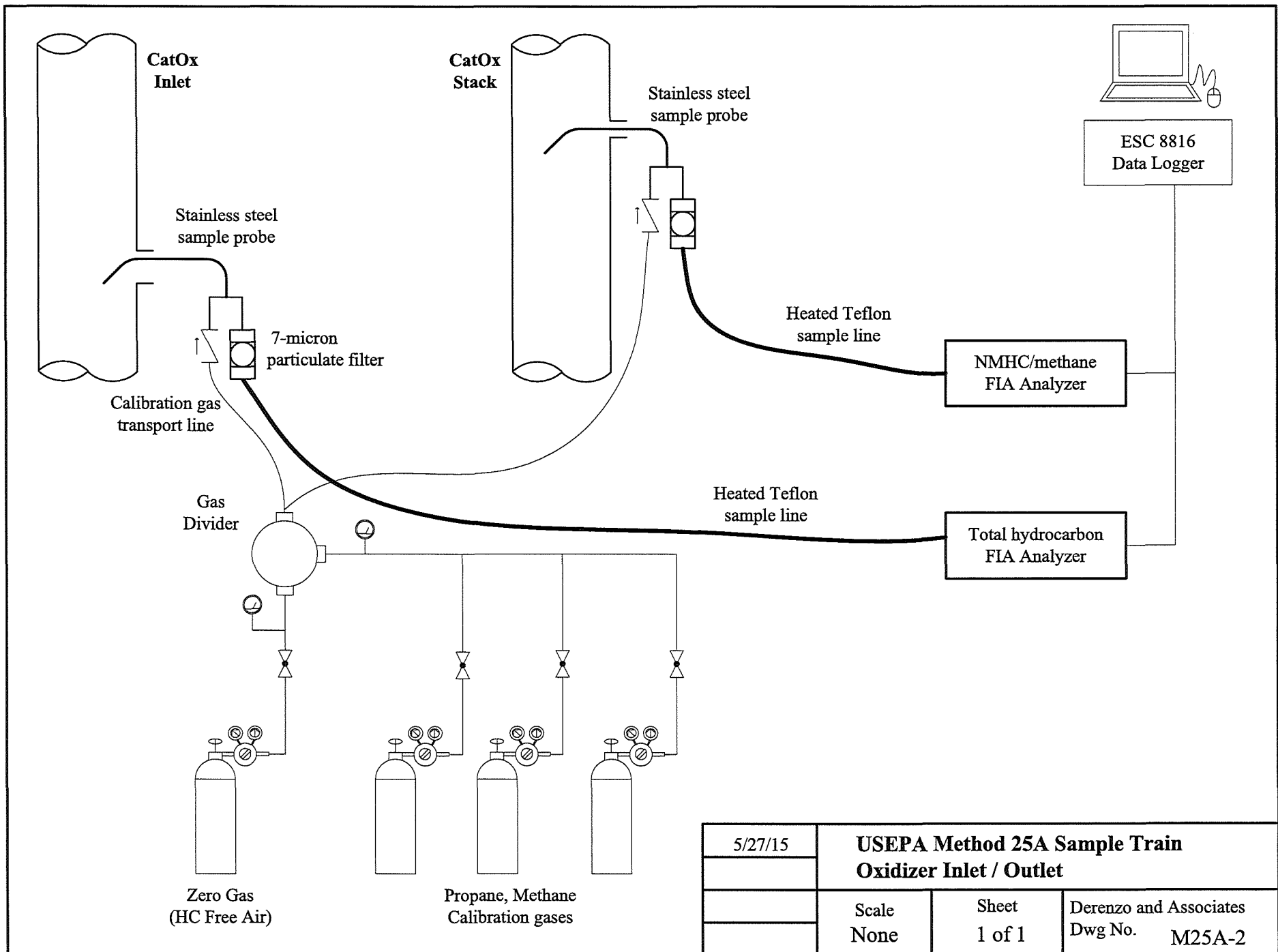
1. modified Greensburg-Smith (GS) impinger containing 100 ml of DI water;
2. standard GS impinger containing 100 ml of DI water;
3. modified GS impinger, empty; and
4. modified GS impinger containing approximately 200 - 300 grams of pre-dried silica gel and glass fiber.

Umbilical line - An umbilical line will be used to connect the sample probe and impinger train to the Nutech® Metering System. The umbilical line includes type-K thermocouples, used to measure the impinger outlet.

Metering System – A Nutech® Metering System that consists of a vacuum gauge, leak-free carbon vane pump, calibrated dry gas meter and thermocouples will be used to maintain a steady sampling rate and to determine sample volume. USEPA requires that a minimum sample volume of 21 cubic feet (ft³) be drawn for each sampling period. The thermocouples are connected to a digital thermometer that displays readings from the umbilical line thermocouples and dry gas meter.

Prior to each test run, the moisture sampling train will be assembled and leak-checked at the sampling site by plugging the inlet to the probe and pulling a vacuum of approximately 15 inches of mercury (in. Hg). At the conclusion of each test run, the sampling train will be leak-checked by drawing a vacuum equal to the highest vacuum measured during the test run.

During sampling, a single representative sample location will be used in lieu of collecting the sample across the velocity traverse profile. At 5-minute intervals, sampling train data will be recorded. An aneroid-type barometer will be used to measure the barometric pressure of the ambient air. All sampling data will be recorded on field data sheets. Percent moisture will be calculated using the measured gravimetric gain of the impingers along with the metering console and calibration data.



5/27/15	USEPA Method 25A Sample Train Oxidizer Inlet / Outlet		
	Scale None	Sheet 1 of 1	Derenzo and Associates Dwg No. M25A-2