OPERATION, MAINTENANCE, AND CAM

OPERATION AND MAINTENANCE

Operation

RTO Overview

VOC and HAP laden process gas is pulled into the inlet manifold of the oxidizer via a system fan. Flow control valves then direct this gas into energy recovery chambers where it is preheated. The process gas and contaminants are progressively heated in the ceramic media beds as they move toward the combustion chamber.

Once oxidized in the combustion chamber, the hot purified air releases thermal energy as it passes through the media bed in the outlet flow direction. The outlet bed is heated and the gas is cooled so that the outlet gas temperature is only slightly higher than the process inlet temperature. Valves alternate the airflow direction into the media beds to maximize energy recovery within the oxidizer. The high energy recovery within these oxidizers reduces the auxiliary fuel requirement and saves operating cost.

Start-Up/Shut down: Follow PR-MT019 Start Up and Shut Down Regenerative Thermal Oxidizer

Carbon Concentrator Overview

Process air, containing VOCs, is drawn from the production areas by the process fan. The process fan injects the process exhaust into the bottom section of the adsorber. After entering the inlet section plenum, the gas flows upward through the inlet gas diffuser section. The inlet gas diffuser consists of an upper and lower sieve tray through which the process air is directed, and by which it is forced to be evenly distributed prior to flowing into the adsorption tray section.

Process air next flows upward through the tray section. The 6 trays in this section are made from perforated stainless-steel plate. They are oriented horizontally, in a parallel and level manner. Each tray has a downcomer section on one end, which allows carbon to flow from one tray to the next. These downcomers are located at opposite ends of the trays from those above or below. The downcomer is critical, since it is undesirable to have BAC passing directly from tray to tray via the main perforated plate area.

As the air is passing upward through the tray section, fresh BAC is being continuously delivered to the top tray. The design of the tray section is such that the gas velocity through the holes in the tray is high enough to suspend the beads of carbon in the air above the tray. At the design adsorber process gas flow rate, the beads will form a fluid bed, which will be approximately 1 inch deep. T this airflow rate, there should be no higher elevation of carbon particles, and minimal carbon “leakage” from tray to tray.

As the air flows upward through the 6 trays, the intimate contact with the carbon beads results in the transfer of VOC from the air to the beads. The design provides counter current removal for optimized efficiency. That is, as the air moves upward from tray to tray, the VOCs become more difficult to collect (mass transfer favors higher VOC content in the air). However, the air contacts cleaner carbon at each successive tray level, and therefore collection efficiency is maintained.

The carbon moves from one end of he tray to the other by displacement. As the carbon enters the top tray from the return pipe, or the lower trays via the downcomers, it displaces carbon already on the tray. In this way, each carbon bead travels the entire length of all trays, optimizing residence time and adsorber effectiveness

The fully "saturate" beads fall through the downcomer on the bottom tray enter the adsorber collection hopper. From here, they flow to the carbon transfer nozzle, and are conveyed to the top of the desorber. This nozzle is adjustable so that the carbon transfer rate can be controlled. The carbon in the desorber forms a fluidized bed, similar to that of the adsorber. As the carbon flows through 6 sieve trays of the desorber, it is heated and stripped using hot gas from the RTO. As the VOCs are desorbed, the hot carrier gas constantly purges them upward and out of the top of the desorber. As the BAC passes downward in the heated section, it becomes increasingly "cleaner". At the same time, the carrier air to which it is exposed is increasingly fresher. This allows continuous mass transfer from BAC to carrier gas.

As the carrier gas with highly concentrated VOCs exits the top of the heated tubes, it is conveyed via the desorbate outlet pipe to the RTO. The regenerated BAC exits the bottom of the heated section, flows into the bottom cone, and then out to the airlift nozzle. The nozzle conveys the carbon back to the top of the adsorber for reuse. The nozzle is adjustable so that the rate of carbon flow through the desorber can be properly set for each particular application, or to accommodate production rate changes.

Carbon Concentrator Start-Up/Shut Down: Follow PR-MT022 Start Up and Shut Down Fluid Bed Concentrator

Maintenance

Schedule: Follow FO-MT001 Maintenance PM Tracking

RTO: RC-MT023;

Carbon Concentrator: RC-MR032; RC-MT033

RTO and Concentrator: RC-MT059; RC-MT060; RC-MT034

CAM PLAN

Background

1. Description

   A plastic parts (except business machine plastic parts) and metal parts (clear coatings and extreme performance coatings) coating line consisting of holding devices for up to 6 applicators per booth, 7 dry filter spray booths, 6 mask washers, 1 prime bake oven, 1 base coat oven (infrared), 1 main bake-off oven (zone 1 and 2), 1 carbon adsorber unit, 1 regenerative thermal oxidizer, and application equipment with 6 robotic applicators / reciprocators, or equivalent technology.

2. Applicable Regulation, Emission Limit, Monitoring Requirements
   a. Application Regulation
      i. Permit Number: MI-ROP-N0802-2015
   b. Emission Limits

Pollutant	Limit	Time Period/ Operating Scenario	Equipment	Monitoring/ Testing Method	Underlying Applicable Requirements
1. VOC	1,668 pounds[2]	Per calendar day for EU-LN3 and EU-LN2&3 combined	7 dry filter spray booths with 6 robotic applicators/reciprocators or equivalent technology per booth, 6 mask washers, 1 prime bake oven, 1 infrared basecoat oven, and 1 main bake-off oven with 2-zones. or Combined equipment from EU-LN2 and EU-LN3 operated as a single partially controlled coating line.	SC VI.1.-3.	**R 336.1205,** **R 336.1224,** **R 336.1225**
2. VOC	137.7 tons[2]	Per 12-month rolling time period as determined at the end of each calendar month for EU-LN3 and EU-LN2&3 combined	7 dry filter spray booths with 6 robotic applicators/reciprocators or equivalent technology per booth, 6 mask washers, 1 prime bake oven, 1 infrared basecoat oven, and 1 main bake-off oven with 2-zones or Combined equipment from EU-LN2 and EU-LN3 operated as a single partially controlled coating line.	SC VI.1.-3.	**R 336.1205,** **R 336.1224,** **R 336.1225,** **R 336.1702(d), 40 CFR 52.21 Subparts (j) & (x)**

Pollutant	Limit	Time Period/ Operating Scenario	Equipment	Monitoring/ Testing Method	Underlying Applicable Requirements
3. VOC and Acetone	157.7 tons[2]	Per calendar day per 12-month rolling time period as determined at the end of each calendar month for EU-LN3 and EU-LN2&3 combined	7 dry filter spray booths with 6 robotic applicators/reciprocators or equivalent technology per booth, 6 mask washers, 1 prime bake oven, 1 infrared basecoat oven, and 1 main bake-off oven with 2-zones.	SC VI.1.-3.	**R 336.1205, R 336.1224, R 336.1225, R 336.1702(d), 40 CFR 52.21**
4. VOC – coating of metal parts using clear coatings	4.3 pounds per gallon of coating, minus water, as applied2	Calculated on a volume weighted calendar day average per coating line	As described in EU-LN1, EU-LN2, EU-LN3, and EU-LN2&3	SC VI.1.-3	**R 336.1205, R 336.1225, R 336.1702(a)**
5. VOC – coating of metals parts using extreme performance coatings	3.5 pounds per gallon of coating, minus water, as applied2	Calculated on a volume weighted calendar day average per coating line	As described in EU-LN1, EU-LN2, EU-LN3, and EU-LN2&3	SC VI.1.-3	**R 336.1205, R 336.1225, R 336.1702(a)**
6. VOC – Solvent based adhesion promoter(s)	5.88 pounds per gallon of coating, minus water, as applied2	Calculated on a volume weighted, calendar day average per coating line	As described in EU-LN1, EU-LN2, EU-LN3, EU-LN4, and EU-LN2&3	SC VI.1.-3	**R 336.1702(a), 40 CFR 52.21**
7. VOC – High bake coatings for both interior and exterior parts in the Prime-Flexible Coating Category3,4	4.5 pounds per gallon of coating, minus water, as applied2	Calculated on a volume weighted, calendar day average per coating line	As described in EU-LN1, EU-LN2, EU-LN3, and EU-LN2&3	SC VI.1.-3	**R 336.1702(d)**

Pollutant	Limit	Time Period/ Operating Scenario	Equipment	Monitoring/ Testing Method	Underlying Applicable Requirements
8. VOC – High bake coatings for both interior and exterior parts in the Prime-Non Flexible Coating Category 3,4	3.5 pounds per gallon of coating, minus water, as applied2	Calculated on a volume weighted, calendar day average per coating line	As described in EU-LN1, EU-LN2, EU-LN3, and EU-LN2&3	SC VI.1.-3	**R 336.1702(d)**
9. VOC – High bake coatings for both interior and exterior parts in the Topcoat-Basecoat Coating Category3,4	4.3 pounds per gallon of coating, minus water, as applied2	Calculated on a volume weighted, calendar day average per coating line	As described in EU-LN1, EU-LN2, EU-LN3, and EU-LN2&3	SC VI.1.-3	**R 336.1702(d)**
10. VOC – High bake coatings for both interior and exterior parts in the Topcoat-Clearcoat Coating Category3,4	4.0 pounds per gallon of coating, minus water, as applied2	Calculated on a volume weighted, calendar day average per coating line	As described in EU-LN1, EU-LN2, EU-LN3, and EU-LN2&3	SC VI.1.-3	**R 336.1702(d)**
11. VOC – High bake coatings for both interior and exterior parts in the Topcoat-Non-Basecoat/Clearcoat Coating Category3,4	4.3 pounds per gallon of coating, minus water, as applied2	Calculated on a volume weighted, calendar day average per coating line	As described in EU-LN1, EU-LN2, EU-LN3, and EU-LN2&3	SC VI.1.-3	**R 336.1702(d)**
12. VOC – Air dried coatings for exterior parts in the Prime-Coating Category 3,5	4.8 pounds per gallon of coating, minus water, as applied2	Calculated on a volume weighted, calendar day average per coating line	As described in EU-LN1, EU-LN2, EU-LN3, and EU-LN2&3	SC VI.1.-3	**R 336.1702(d)**
13. VOC – Air dried coatings for exterior parts in the Topcoat-Basecoat Coating Category 3,5	5.0 pounds per gallon of coating, minus water, as applied2	Calculated on a volume weighted, calendar day average per coating line	As described in EU-LN1, EU-LN2, EU-LN3, and EU-LN2&3	SC VI.1.-3	**R 336.1702(d)**

Pollutant	Limit	Time Period/ Operating Scenario	Equipment	Monitoring/ Testing Method	Underlying Applicable Requirements
14. VOC – Air dried coatings for exterior parts in the Topcoat-Clearcoat Coating Category 3,5	4.5 pounds per gallon of coating, minus water, as applied2	Calculated on a volume weighted, calendar day average per coating line	As described in EU-LN1, EU-LN2, EU-LN3, and EU-LN2&3	SC VI.1.-3	**R 336.1702(d)**
15. VOC – Air dried coatings for exterior parts in the Topcoat-Non-Basecoat/Clearcoat Coating Category 3,5	5.0 pounds per gallon of coating, minus water, as applied2	Calculated on a volume weighted, calendar day average per coating line	As described in EU-LN1, EU-LN2, EU-LN3, and EU-LN2&3	SC VI.1.-3	**R 336.1702(d)**
16. VOC – Air dried coatings for interior parts 3,5	5.0 pounds per gallon of coating, minus water, as applied2	Calculated on a volume weighted, calendar day average per coating line	As described in EU-LN1, EU-LN2, EU-LN3, and EU-LN2&3	SC VI.1.-3	**R 336.1702(d)**
17. VOC – Touch-up and repair 5	5.2 pounds per gallon of coating, minus water, as applied2	Calculated on a volume weighted, calendar day average per coating line	As described in EU-LN1, EU-LN2, EU-LN3, and EU-LN2&3	SC VI.1.-3	**R 336.1702(d)**

[3]For red and black coatings, the emission limitation shall be determined by multiplying the appropriate limit by 1.15.

[4]When Method 24 is used to determine the volatile organic compound content of a coating, the applicable emission limitation shall be determined by adding 0.5 to the appropriate limit.

[5]When Method 24 is used to determine the volatile organic compound content of a coating, the applicable emission limitation shall be determined by adding 0.1 to the appropriate limit.

c. Monitoring Requirements
   i. RTO combustion chamber outlet temperature
   ii. RTO pressure drop
   iii. Carbon Concentrator desorption gas inlet temperature
   iv. Carbon Concentrator pressure drop

3. Control Device
   a. RTO

        i. Destruction 93.9%
    b. Carbon Concentrator
        i. Capture 81.6%
        ii. Control 95%
    c. Uncontrolled Emissions 27.21%
    d. The Line 3 base coat and clear coat booths are control by the fluidized bed Carbon Concentrator and the RTO. The Carbon Concentrator uses adsorbtion to collect VOCs from the large volume (low VOC concentration) exhaust stream and then transfer the VOCs to a smaller volume (higher concentration) air stream via desorption. The concentrated VOCs are then destroyed by the RTO.
4. Unit is subject to CAM due to the emission unit be being a large pollutant-specific emission unit.

Monitoring Approach

Monitored Device	**Indicator**	**Indicator Range**	**Bypass System Detection**
RTO Temperature	RTO combustion temperature is measured with one thermocouple in the combustion chamber. The temperature is monitored continuously and recorded at equally spaced intervals at least once every 15 minutes.	The RTO temperature shall be a minimum of 1471 F.	For each control device in operation during production (e.g., coating of parts), the permittee shall conduct bypass monitoring for each bypass line such that the valve or closure method cannot be opened without creating an alarm condition for which a record shall be made. Records of the bypass line(s) that was open and the length of time the bypass was open shall be kept on file.
RTO Pressure Drop	RTO pressure drop is measured with one transducer in the burner chamber. The pressure drop is monitored continuously and recorded at equally spaced intervals at least once every 15 minutes.	The RTO pressure drop shall be a minimum of >3.46 inwc	
Concentrator Temperature	Concentrator desorption gas inlet temperature is measured with one thermocouple. The temperature is monitored continuously and recorded at equally spaced intervals at least once every 15 minutes.	The Concentrator desorption gas inlet temperature shall be above the temperature from the most recent acceptable performance test minus 15 F. The temperature of the most recent test was 440 F.	
Concentrator Pressure Drop	Concentrator pressure drop is measured with one transducer in the adsorption chamber. The pressure drop is monitored continuously and recorded at equally spaced intervals at least once every 15 minutes.	The Concentrator pressure drop shall be a minimum of 0.97 inwc	

Performance Criteria

<table>
<tr><th>Monitored Device</th><th>Data Representativeness</th><th>QA/QC Practices and Criteria</th><th>Monitoring Frequency</th><th>Data Collection Procedures and Averaging</th><th>Excursion Determination</th></tr>
<tr><td>RTO Temperature</td><td>There is one thermocouple located in the combustion chamber.</td><td>Validation of the thermocouple accuracy or recalibration occurs once every 12 months.</td><td>Continuous and recorded at equally spaced intervals at least every 15 minutes.</td><td>Temperature is collected via PLC and stored on MS Access database where a 3-hour average is generated.</td><td rowspan="4">A temperature or pressure excursion occurs when the 3-hour average falls below the applicable indicator range.

A monitoring excursion occurs when the equipment monitoring the temperature or pressure fail to record the temperature or pressure.

A monitoring excursion may also occur if the equipment used to monitor the temperature or pressure is not properly implemented or maintained.

Upon confirming an excursion, the site will follow the requirements of General Conditions 21 and 22.</td></tr>
<tr><td>RTO Pressure Drop</td><td>There is one transducer located in the burner chamber</td><td>Validation of the transducer accuracy or recalibration occurs once every 12 months.</td><td>Continuous and recorded at equally spaced intervals at least every 15 minutes.</td><td>Temperature is collected via PLC and stored on MS Access database where a 3-hour average is generated.</td></tr>
<tr><td>Concentrator Temperature</td><td>There is on thermocouple located at the inlet of the desorption gas chamber</td><td>Validation of the thermocouple accuracy or recalibration occurs once every 12 months.</td><td>Continuous and recorded at equally spaced intervals at least every 15 minutes.</td><td>Temperature is collected via PLC and stored on MS Access database where a 3-hour average is generated.</td></tr>
<tr><td>Concentrator Pressure Drop</td><td>There is one transducer located in the adsorption chamber.</td><td>Validation of the transducer accuracy or recalibration occurs once every 12 months.</td><td>Continuous and recorded at equally spaced intervals at least every 15 minutes.</td><td>Temperature is collected via PLC and stored on MS Access database where a 3-hour average is generated.</td></tr>
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Justification

The Carbon Concentrator inlet desorption gas temperature and the RTO combustion chamber temperature were selected because they are indicative of the VOC removal occurring in the concentrator and the destruction within the RTO. Both are widely accepted methods of monitoring. If the combustion chamber temperature decreases significantly, then complete combustion may not occur, reducing the destruction efficiency. If the inlet desorption temperature decreases significantly, then proper VOC removal cannot occur, reducing removal efficiency. Temperature monitoring is specifically required in EU-LN3 SC III.

The Carbon Concentrator pressure drop and the RTO pressure drop were selected because they are indicative of the VOC removal occurring in the concentrator and the destruction within the RTO. Both are widely accepted methods of monitoring. If the pressure drop of the RTO decreases significantly, then complete combustion may not occur due to a lack of VOC rich air, reducing the destruction efficiency. If the concentrator pressure drop decreases significantly, then proper VOC removal cannot occur due to a lack of VOC rich air, reducing removal efficiency. Pressure Drop monitoring is specifically required in EU-LN3 SC III.

The rational for the selection of the indicator ranges were determined based on achieving the best removal / destruction efficiency that occurred during the most recent performance test.

The last RTO VOC destruction Efficiency testing was performed December 7, 2017. The RTO destruction efficiency was 93.85%. The last Carbon Concentrator VOC removal test occurred December 6, 2017. The Concentrator removal efficiency was 95.01%. The last Carbon Concentrator Capture Efficiency was performed on June 21, 2016. The Concentrator capture efficiency was 81.57%.