

TEST REPORT

for the

REGENERATIVE THERMAL OXIDIZER

CONTROLLING HEATSET WEB OFFSET LITHOGRAPHIC PRESSES



Dickinson Press Inc.

5100 33rd Street SE
Grand Rapids, Michigan

Test Date – April 3, 2014
Report Date – May 5, 2014

Prepared by:

*Environmental Partners, Inc.
305 Hoover Boulevard, Suite 200
Holland, Michigan 49423*



1.0 Introduction

Dickinson Press Inc., in conjunction with Environmental Partners, Inc., has prepared the following air emissions compliance test report for the determination of the Volatile Organic Compound (VOC) destruction efficiency of the Adwest regenerative thermal oxidizer (RTO) used to control the VOC emissions from the dryers of the heat set web offset lithographic printing presses located at 5100 33rd St SE, Grand Rapids, Michigan. The compliance test was performed on Thursday April 3, 2014.

The purpose of the test program was to satisfy the requirement of Special Condition V.2 of emission unit FG-Offset Litho, permit to install number 114-13, as issued by the Michigan Department of Environmental Quality, Air Quality Division (MDEQ-AQD). The VOC destruction efficiency results will be used to determine compliance with Special Condition FG-Offset Litho IV.1 which requires a minimum 95% VOC destruction efficiency. The average VOC destruction efficiency determined during the test program was 98.4%.

The test plan and approval letter are included in the report as Attachment A. The process and control device data are included in the report as Attachment B. The complete Stack Test Group test report is included in the report as Attachment C.

2.0 VOC Destruction Efficiency Testing Methodologies

Testing of the Adwest RTO was conducted during a single day of production. Testing was conducted utilizing USEPA Methods 1, 2, 3, 4, and 25A as described in the *Code of Federal Regulations, Title 40, Part 60, Appendix A*.

Descriptions of these methods are as follows:

VOC Destruction Efficiency Test Methods

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

Three separate one-hour test runs were performed utilizing USEPA Methods 1 - 4 and 25A. The average oxidizer outlet VOC concentrations were below 50 ppmv as carbon, therefore U.S. EPA Method 25A was the appropriate test method. For each test run, the concentration and mass emission rate of VOC in the oxidizer exhaust was compared to the corresponding concentration and mass input rate of VOC into the oxidizer for the determination of the average VOC destruction efficiency.

Test locations, volumetric flow rates, and concentrations of oxygen, carbon dioxide and moisture in the exhaust streams were determined in accordance with EPA Methods 1 - 4. Velocity measurements were made in accordance with USEPA Methods 1 and 2. Molecular weight and moisture determinations were made in accordance with USEPA Methods 3 and 4.

Gaseous samples were extracted and analyzed continuously and simultaneously at the inlet and outlet of the oxidizer to determine total gaseous organic concentrations during each test run using flame ionization analyzers, in accordance with Method 25A. The sample streams were collected through a heated filter and stainless steel probe, and drawn to the analyzer via heated Teflon sample lines. The sampling line was heated to at least 250°F to prevent condensation of the high molecular weight heatset ink oil. The flame ionization analyzers were pre-calibrated in the applicable ranges. Appropriate mid-range span and zero calibration gases were introduced and the analyzer response was checked between each test run, as well as after the final test run. Calibration gases consisted of certified Protocol 1 concentrations of propane in air. See Attachment C.

Sixty one-minute averages were totaled and averaged to determine the average VOC concentration for each test run. VOC emission results for each test are presented on a concentration basis (parts per million by volume as propane, ppmv C₃H₈), and mass input or emission rate basis (pounds per hour as propane). The VOC destruction efficiency of the regenerative thermal oxidizer for each test run was calculated by comparing the mass rate of VOC measured at the RTO inlet to the mass emission rate of VOC measured in the RTO exhaust. The overall VOC destruction efficiency for the test was determined by calculating the arithmetic average of the three test run efficiencies.

3.0 Operating Conditions and Process and Control Device Monitoring

Testing was conducted while the heatset web offset lithographic presses listed below were operated under conditions representative of worst case operating conditions:

<u>Heatset Press</u>	<u>Press Manufacturer</u>	<u>Press Model</u>
EU-M1000	Harris	M1000
EU-47	Timson	47
EU-54	Timson	54

The following process and control device parameters were recorded during each test run:

1. RTO operating temperature;
2. Web speeds and widths for each press;
3. Print job names and example signatures;
4. Identification of the inks applied and their VOC contents.

No coatings were applied on the heatset web offset printing presses during the tests; coatings are only applied to the cold set presses at Dickinson Press.

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4. Summary of Test Results

The results of the compliance test program are summarized below:

Parameter	Run 1	Run 2	Run 3	Average
Inlet VOC Mass Flow Rate (lbs/hr C ₃ H ₈)	9.028	20.379	19.423	16.276
Outlet VOC Mass Flow Rate (lbs/hr C ₃ H ₈)	0.190	0.268	0.253	0.237
VOC Destruction Efficiency (%)	97.89	98.68	98.70	98.43
Average RTO Operating Temperature (°F)	1580	1580	1580	1580

5. List of Attachments

Attachment Description

- A Test Plan and Approval Letter
- B Process and Control Device Data
- C Stack Test Group Report