COMPLIANCE TEST REPORT

for

THE M-600 THERMAL OXIDIZER

at

Rogers Printing, Inc.
3350 Main Street
Ravenna, Michigan

Test Date: July 19, 2016

Report Date: September 1, 2016

Prepared by:

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EXECUTIVE SUMMARY

On July 19, 2016, a compliance demonstration test program was conducted at the Rogers Printing facility located in Ravenna, Michigan. The purpose of the test program was to determine the discharge concentration of Volatile Organic Compounds (VOC) from the thermal oxidizer associated with the Heidelberg M-600 offset lithographic print line (EUHEIDELBERG03).

The test program was conducted in accordance with the test plan dated May 11, 2016, and approval letter provided by the Michigan Department of Environmental Quality (MDEQ) dated July 8, 2016. A copy of the test plan and the MDEQ confirmation is included in Appendix A.

The subject integrated thermal oxidizer (ITO) has been identified as the approved control equipment for EUHEIDELBERG03 by the MDEQ-AQD in Permit-to-Install No. 114-01D. The testing was conducted to satisfy special condition number V.2 of EUHEIDELBERG03 and to confirm compliance with special condition number IV.1 of the same emission unit.

The overall compliance test program was coordinated by Mr. Bruce Connell, of Environmental Partners, Inc. and witnessed by Mr. David Patterson, MDEQ-AQD and Steve LaChance, MDEQ-AQD. The results of testing, as presented in Table 1, indicate that the process control equipment was in compliance with the above stated permit conditions.

Table 1 – Emissions Test Summary

Permit Condition	**Permit Limit**	**Test Average**
Discharge Concentration (ppmv – as Hexane Dry)	20 ppmv	12.7 ppmv

1.0 PROCESS AND CONTROLS SYSTEMS DESCRIPTION

EUHEIDELBER03 is a web offset lithographic print line (Heidelberg M-600) with five print web-fed units and a natural gas fired dryer unit to set the ink on the paper. The dryer section (Ecotherm) of the press is heated by two (2) integrated thermal oxidizers, which heat the incoming web. As the web is heated, the volatile organic compounds are released and drawn into the burner intake to the oxidizers to be combusted, in order to supply heat to the incoming web.

Offset lithography is based on the repulsion of oil and water whereby the image to be printed receives ink from ink rollers while the non-printing area attracts a water-based film (called "fountain solution"), keeping the non-printing areas ink-free. As mentioned above the web press is comprised of five (5) printing units, each of which contains an inking system, a dampening system, a plate cylinder, and a blanket (offset) cylinder.

Each print unit applies an image using a specific color ink. The proximity of the images to one another and the use of the four basic colors (magenta, yellow, cyan, black, and sometimes a project specific specialty color) used allow the press to give the appearance of a multitude of color within a picture when in fact only up to five colors are used.

The materials used in the process include inks and fountain solutions in printing, and washup (blanket wash) solutions for press cleaning. The release of the VOCs from the inks and the bulk of the VOCs from the fountain solution occur during the drying phase of the process. The dryer and chiller sections work together to ensure that the ink on the printed roll is dry. To dry the ink, the web is passed through a dryer, following the last print unit, elevating the temperature of the web to approximate 300 - 350°F in a few seconds.

The two (2) integrated thermal oxidizers (ITOs) are part of the Ecotherm dryer section design, having a design destruction efficiency of 95%. In accordance with Special Condition IV.1 of EUHEIDELBERG03 (PTI #114-01D), the oxidizer must maintain a minimum combustion chamber temperature of 1418°F or a minimum temperature as achieved during the most recent acceptable stack test. Appendix B contains both periodic hand written recordings of the combustion chamber temperature and a continuous chart recording of the combustion chamber.

Testing of the ITOs was conducted on July 19, 2016. Due to the location of the oxidizer units within the Ecotherm dryer section, inlet sampling points were not possible. Figure 1 presents a schematic diagram of the ITO. Therefore, this test was conducted using the discharge concentration as the only data point. Special Condition I.2 allows for compliance to be determined based on test protocols where the discharge concentration must be at or below 20 ppmv as hexane, on a dry basis.

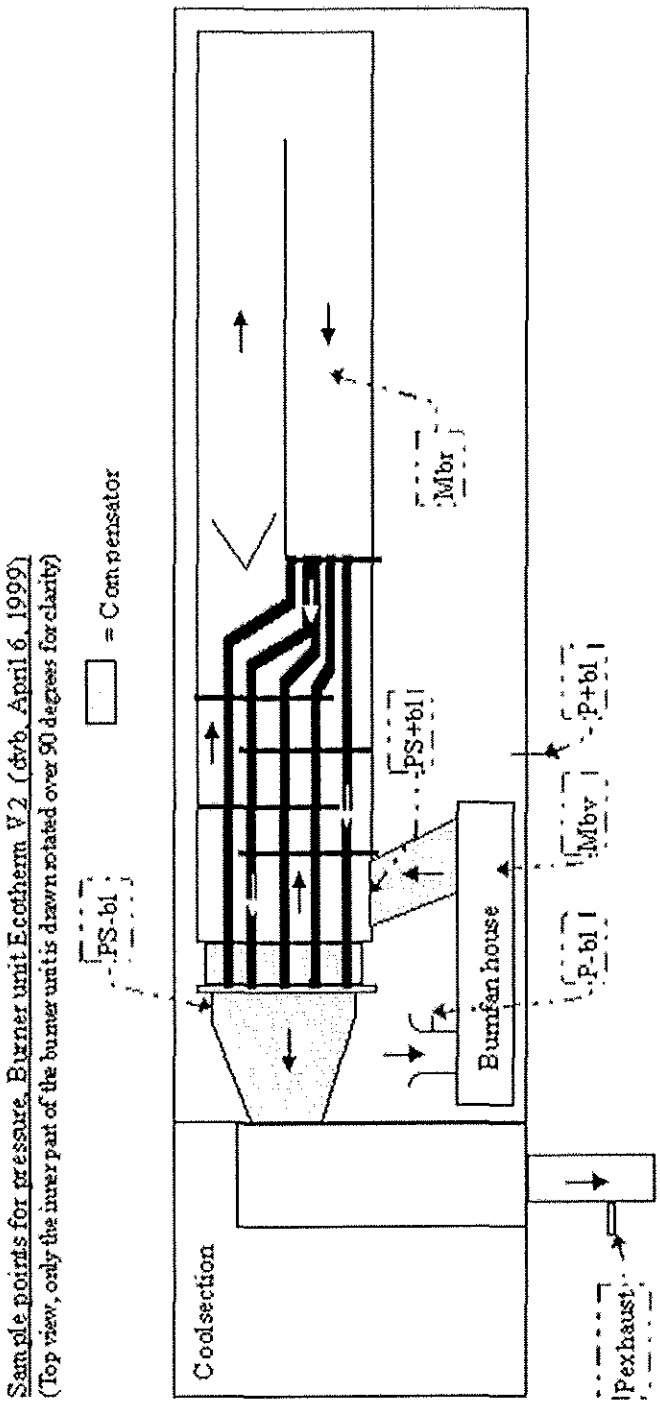

Figure 1
ITO Equipment Diagram
Rogers Printing, Inc.
Ravenna, Michigan

2.0 TEST METHODOLOGIES

Three one-hour test runs were performed in the discharge stack to the Ecotherm dryer. This point also represented the outlet of the combined oxidizer units. For each test run, the concentrations of VOCs at the outlet test location was measured as parts per million as propane, corrected to hexane, and corrected for moisture content. The resulting concentration is compared to the permit limit of 20 ppmv, as hexane on a dry basis to determine compliance with the VOC destruction efficiency requirements. All tests were conducted in accordance with USEPA Methods 1,4 and 25A, as described in the *Code of Federal Regulations, Title 40, Part 60, Appendix A*. Descriptions of these methods are as follows:

USEPA Method	Description
1	Sample and Velocity Traverses for Stationary Sources
4	Determination of Moisture Content in Stack Gases
25A	Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer

2.1 Volumetric Flow Rate Determination – USEPA Methods 1and 4

The discharge sampling location was identified to meet the specifications of USEPA Method 1.

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

Moisture content measurements were made at the stack discharge location for each one hour test run, one just before and one just after each test. The completion of each test run and the start of the subsequent test run were reasonably coincidental, therefore the ending measurement for the previous test run was utilized as the beginning measurement for the subsequent test run.

2.2 Total Gaseous Organic Concentration Determination – USEPA Method 25A

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

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

VOC emission results for each test are presented on a concentration basis (parts per million by volume as propane, ppmv C_3H_8), and then corrected to a concentration basis for hexane. The discharge concentration for each test run is shown in Table 4.

3.0 PRESENTATION OF PRODUCTION DATA

The MDEQ-AQD stack test approval letter, dated July 8, 2016, requested that the process be operated at a maximum routine operating rate. On the day of testing, the Heidelberg M-600 unit was operating at a press speed of 270 meters per minute (28,076 impressions per hour). The web width for this process was 31.5 inches.

A copy of the process print signatures for each test run and the ITO combustion chamber data is provided in Appendix B.

Table 2 – ITO Combustion Chamber Temperature Summary

ITO Combustion Zone	Test 1	Test 2	Test 3
Combustion Chamber Min	1,405 F	1,404 F	1,409 F
Combustion Chamber Avg	1,412 F	1,411 F	1,412 F

4.0 PRESENTATION AND DISCUSSION OF TEST RESULTS

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

Table 3
Discharge Concentration Test Summary

Parameter	**1**	**2**	**3**	**Avg.**
Start Time	08:00	09:50	11:10	
Stop Time	09:35	10:56	12:10	
Outlet VOC Concentration (ppmv Hexane, Dry Basis)	14.0	12.0	12.1	12.7
Permit Limit (ppmv Hexane Dry)	**<20**	**<20**	**<20**	**<20**

The test plan and MDEQ acknowledgement letter, process operational data, control device data, summary calculations, field test data sheets, VOC concentration readings, equipment calibrations and calibration gas certification sheets are included in the following Appendices:

Appendix	Description
A	Test Plan and Letter of Approval
B	Process and Control Device Operating Parameters and Field Test Data Sheets
C	Stack Test Group Report