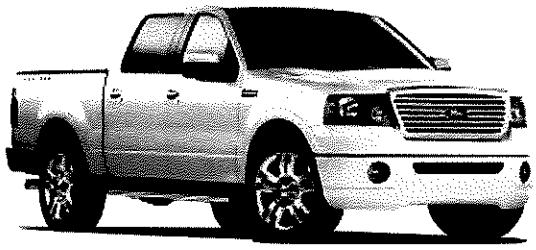
Ford Dearborn Assembly Plant
Dearborn, Michigan



Environmental Testing Program – August 2015

Prime Booth Capture Efficiency

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AIR QUALITY DIV.

Prepared By:

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MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

RENEWABLE OPERATING PERMIT REPORT CERTIFICATION

Authorized by 1994 P.A. 451, as amended. Failure to provide this information may result in civil and/or criminal penalties.

Reports submitted pursuant to R 336.1213 (Rule 213), subrules (3)(c) and/or (4)(c), of Michigan's Renewable Operating (RO) Permit program must be certified by a responsible official. Additional information regarding the reports and documentation listed below must be kept on file for at least 5 years, as described in General Condition No. 22 in the RO Permit and be made available to the Department of Environmental Quality, Air Quality Division upon request.

Source Name: Ford Motor Company - Dearborn Assembly Plant County: Wayne

Source Address: 3001 Miller Road City: Dearborn

AQD Source ID (SRN): 48121 RO Permit No.: MI-ROP-A8648-2010a RO Permit Section No.: 1

Please check the appropriate box(es):

☐ **Annual Compliance Certification (General Condition No. 28 and No. 29 of the RO Permit)**

Reporting period (provide inclusive dates): From _____ To _____

☐ 1. During the entire reporting period, this source was in compliance with **ALL** terms and conditions contained in the RO Permit, each term and condition of which is identified and included by this reference. The method(s) used to determine compliance is/are the method(s) specified in the RO Permit.

☐ 2. During the entire reporting period this source was in compliance with all terms and conditions contained in the RO Permit, each term and condition of which is identified and included by this reference, **EXCEPT** for the deviations identified on the enclosed deviation report(s). The method used to determine compliance for each term and condition is the method specified in the RO Permit, unless otherwise indicated and described on the enclosed deviation report(s).

☐ **Semi-Annual (or More Frequent) Report Certification (General Condition No. 23 of the RO Permit)**

Reporting period (provide inclusive dates): From _____ To _____

☐ 1. During the entire reporting period, **ALL** monitoring and associated recordkeeping requirements in the RO Permit were met and no deviations from these requirements or any other terms or conditions occurred.

☐ 2. During the entire reporting period, all monitoring and associated recordkeeping requirements in the RO Permit were met and no deviations from these requirements or any other terms or conditions occurred, **EXCEPT** for the deviations identified on the enclosed deviation report(s).

☒ **Other Report Certification**

Reporting period (provide inclusive dates): From _____ To _____

Additional monitoring reports or other applicable documents required by the RO Permit are attached as described:

Air Emissions Test Report Submission for Booth Capture Effocoemcy testing of the Guideooat (Prime) System

I certify that, based on information and belief formed after reasonable inquiry, the statements and information in this report and the supporting enclosures are true, accurate and complete.

Bradford Huff	Plant Manager	313-845-2480
Name of Responsible Official (print or type)	Title	Phone Number

Signature of Responsible Official — Date: 10/16/2015

* Photocopy this form as needed.

EQP 5736 (Rev 9/01)

1.0 Executive Summary

JLB Industries, LLC completed a compliance environmental testing program on August 19, 20215 at the Ford Dearborn Assembly Plant (DAP) facility in Dearborn, Michigan. The testing program included Booth Capture Efficiency (BCE) testing of the Prime Booth. Determination of CE was conducted in accordance with all applicable procedures contained in USEPA document *Protocol for Determining the Daily Volatile Organic Compound Emission Rate of Automobile and Light-Duty Truck Topcoat Operations*. The test results will be used to demonstrate compliance with Auto MACT requirements and in monthly emissions compliance calculations.

Capture Efficiency values were derived using the Ford F150 truck model, which currently accounts for the majority of production volume at the facility. Personnel from the paint shop, Ford environmental staff and JLB Industries, LLC conducted the testing. These groups worked together at each stage of testing to ensure that the results were representative of production conditions. JLB Industries used highly accurate weighing systems to determine the panel weights before and after coating application.

Material samples were collected from the paint circulation tanks directly after vehicle spray out. Determination of percent solids by weight and density was performed by Advanced Technologies of Michigan laboratories, located in Livonia, Michigan.

Table 1 – Testing Results Summary

Prime Booth Capture Efficiency	**43.9%**

2.0 Introduction

JLB Industries, LLC (JLBI) was contracted by Ford Dearborn Assembly Plant (DAP) to perform a Capture Efficiency (CE) testing program on the Prime system at the Dearborn Assembly Plant located in Dearborn, Michigan. This testing was conducted on Ford F150 truck model on August 19, 2015.

3.0 Sampling and Analytical Procedures

Capture Efficiency Tests

A panel weigh station (PWS) was assembled at the Prime Spraybooth. A precision balance with measurement capability to 0.001 gram was placed on an isolation platform inside an enclosure to minimize vibration and air movement.

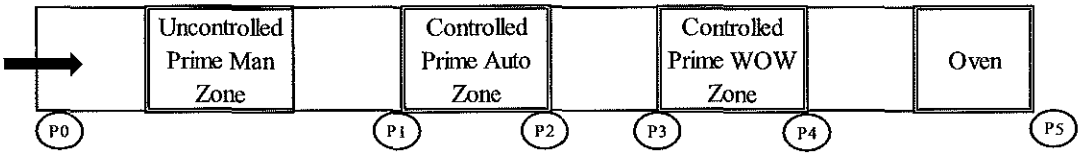
The testing conformed to the methods described in ASTM 5087-02 for solvent borne coatings. Capture Efficiency values for the controlled booth zones were calculated using the procedures outlined in the 40 CFR, Part 63.

Test panels were placed on a Ford F150 cab and box, and processed with normal production spray programming.

Four electrocoated panels were used for the tests. Each group of test panels was weighed in four locations (see panel test diagram) to determine the relative distribution of VOC that is released in the controlled booth zones. The panels were attached to test vehicles by magnet, which allowed for removal of the wet panels with minimal disturbance to the coating during handling. Panel mounting locations were chosen to achieve a representative coating film based on the observation of normal vehicle production.

Before the panels were coated, they were marked (1, 2, 3, 4, blank) and weighed to establish the initial unpainted panel weights (P0). The panels were then attached to a test vehicle and routed through the Spraybooth. After coating, the panels were carefully removed from the test vehicle and brought to the balance for weighing immediately upon exit from the controlled booth zone (P1). Panels were weighed again before entering the controlled bake oven (P2). The panels were then placed on the test vehicle for travel through the curing oven. Upon exiting the oven, the panels were allowed to cool and then weighed a final time (P3).

Diagram 1 – Panel Testing Diagram



4.0 Test Equipment and Calibration

Panel Weigh Station

A panel weigh station (PWS) with measurement capability to 0.001 gram was used to measure panel weights. The balance was warmed up and then calibrated with a 300 gram test weight. The balance was tested with 100, 20, 10 and 2 gram weights before commencing weighing operations. A blank panel weight was measured at the beginning of the testing program and again at the time of each subsequent panel weight measurement. The balance was placed on an isolation platform and inside an enclosure to minimize vibration and airflow at the measurement point.

5.0 Discussion of Test Results

There were no significant disruptions to the testing program. Blank panels weighed to within 0.001 grams throughout the testing procedure.

6.0 Summary of Results

To accurately reflect the emissions being captured separate panels were used for to represent prime manual and prime exterior. (See Diagram 2) To determine the amount of emissions captured from the manual zone panel weights were taken at the beginning & ending of the Prime Exterior Robot Controlled Zone & at the beginning and ending of the Wet-on-Wet (WOW) Robot Controlled Zone. To determine the amount of emissions captured from the prime exterior robots panel weights were taken at the beginning & ending of the Prime Exterior Robots Controlled Zone & at the beginning and ending of the Wet-on-Wet (WOW) Robot Controlled Zone.

Diagram 2 – Prime Booth Controlled and Uncontrolled Zones

Uncontrolled	Controlled	Uncontrolled	Controlled
Prime Manual	Prime Exterior Robots	Prime Under-hood Robots	Wet-on-Wet Robots

The panel testing is the procedure to measure the Section Capture Efficiency (CE) in a controlled zone from a specific spray zone. To convert to the Booth CE, the Section CE is multiplied by the ratio of paint sprayed in the spray zone. The results for each zone are then added to obtain the total Booth CE.

Paint Usage Ratio

Zone	Manual	Exterior Robots	Under-hood Robots	Total
Paint Usage (cc)	202	1974	193	2369
Percentage of Paint Usage	8.5%	83.3%	8.2%	100%

The results of multiplying the ratio of paint sprayed in the spray zone and the measured Section CE are shown the table below.

Booth Capture Efficiency Results

Spray Zone	Control Zone	Section CE (%)	Paint Usage Ratio	Contribution to Booth CE (%)
Manual	Exterior Robots	4.2%	8.5%	0.36%
	WoW Robots	0.1%	8.5%	0.01%
Exterior Robots	Exterior Robots	49.7%	83.3%	41.3%
	WoW Robots	2.6%	83.3%	2.2%
Weighted Booth Capture Efficiency				43.9%

Example:
4.2% of the VOC applied in the Manual Zone was captured in the Prime Exterior Robots Controlled zone. The Manual Zone accounts for 8.5% of the coating applied in the prime booth. Thus the Manual Zone contribution to total booth CE is 0.36%

4.2% * 8.5% = 0.36%

Table 2 -- Prime Section VOC Capture Efficiency
Exterior Robots in Exterior Robots

Sample	Blank Panel Weights (g)	Wet Panel Weights - Control Zone Exit (g)	Panel Weights - after bake (g)	Weight of Coating Solids Deposited (g)	Weight of VOC remaining after zone (g)	Weight of VOC remaining per Weight Solids Deposited (g)	Mass Fraction Solids	Mass Fraction VOC in Coating	Percent of VOC remaining on Panel after Zone	Booth Section Capture Efficiency (%)
Variable	P0	P1	P3	Wsdep	Wrem	Pm	Ws	Wvoc	Pvoc	CE
Formula				P3-P0	P1-P3	Wrem/Wsdep			(Pm)(Ws)/(Wvoc)	1-Pvoc
P1	187.099	189.030	188.491	1.392	0.539	0.387				
P2	186.663	188.407	187.950	1.287	0.457	0.355				
P3	186.804	188.520	188.093	1.289	0.427	0.331				
P4	187.694	189.120	188.770	1.076	0.350	0.325				
Average	187.065	188.769	188.326	1.261	0.443	0.352	0.589	0.411	0.503	**49.7%**

Table 3 -- Prime Section VOC Capture Efficiency
Exterior Robots in WOW Robots

Solvent Loading

Sample	Blank Panel Weights (g)	Wet Panel Weights - Enter Zone (g)	Wet Panel Weights - Exit Zone (g)	Panel Weights - After Bake (g)	Weight of Coating Solids Deposited (g)	Weight of VOC available for abatement (g)	Weight of VOC available per volume of coating solids (lb/GACS)
Variable	P0	P1	P2	P5	Wcos	Wa	CL
Formula					P5-P0	P1-P2	$(W_a/W_{cos})*D_{cos}$
1	187.099	188.989	188.948	188.491	1.392	0.041	0.30
2	186.663	188.375	188.344	187.950	1.287	0.031	0.24
3	186.804	188.492	188.464	188.093	1.289	0.028	0.22
4	187.694	189.095	189.063	188.770	1.076	0.032	0.30
Average	187.065	188.738	188.705	188.326	1.261	0.033	**0.26**

Material Properties

Sample	Coating Density (lb/gal)	Mass Fraction Solids	Volume Fraction Solids	Film Build Thickness (mil)	VOC mass fraction	Solids Density (lb/gal)
Variable	W_c	W_s	V_s	mil	W_{voc}	D_{cos}
Formula						(Ws*Wc)/Vs
Prime	9.30	0.5888	0.5428	1.0	0.4112	10.09

Capture Efficiency

Mass Fraction VOC in Coating	Coating Density (lb/gal)	Mass VOC per Volume Coating (lb/gal)	Transfer Efficiency (%)	Volume Fraction Solids	Volume Solids Deposited per Volume Coating Sprayed	Panel Test Result (lb VOC/ gal Solids)	Booth Section VOC Capture Efficiency (%)
W_{voc}	D_c	VOC	TE	V_s	V_{sdep}	P	CE
		(Dc)(Wvoc)			$(V_s)(TE)$		$(P)(V_{sdep})(100)/(VOC)$
0.4112	9.30	3.824	70.4%	0.5428	0.382	0.26	**2.6%**

Table 4 -- Prime Sectin VOC Capture Efficiency
Manual in Exterior Robots

Solvent Loading

Sample	Blank Panel Weights (g)	Wet Panel Weights - Enter Zone (g)	Wet Panel Weights - Exit Zone (g)	Panel Weights - After Bake (g)	Weight of Coating Solids Deposited (g)	Weight of VOC available for abatement (g)	Weight of VOC available per volume of coating solids (lb/GACS)
Variable	P0	P3	P4	P5	Wcos	Wa	CL
Formula					P5-P0	P3-P4	$(W_a/W_{cos})*D_{cos}$
1	188.354	188.690	188.670	188.618	0.264	0.020	0.71
2	186.349	186.709	186.694	186.638	0.289	0.015	0.49
3	186.535	186.835	186.825	186.772	0.237	0.010	0.40
4	186.899	187.224	187.218	187.161	0.262	0.006	0.21
Average	187.034	187.365	187.352	187.297	0.263	0.013	**0.45**

Material Properties

Sample	Coating Density (lb/gal)	Mass Fraction Solids	Volume Fraction Solids	Film Build Thickness (mil)	VOC mass fraction	Solids Density (lb/gal)
Variable	W_c	W_s	V_s	mil	W_{voc}	D_{cos}
Formula						(Ws*Wc)/Vs
Prime	8.87	0.5543	0.5244	0.3	0.4457	9.38

Capture Efficiency

Mass Fraction VOC in Coating	Coating Density (lb/gal)	Mass VOC per Volume Coating (lb/gal)	Transfer Efficiency (%)	Volume Fraction Solids	Volume Solids Deposited per Volume Coating Sprayed	Panel Test Result (lb VOC/ gal Solids)	Booth Section VOC Capture Efficiency (%)
W_{voc}	D_c	VOC	TE	V_s	V_{sdep}	P	CE
		(Dc)(Wvoc)			$(V_s)(TE)$		$(P)(V_{sdep})(100)/(VOC)$
0.4457	8.87	3.953	70.4%	0.5244	0.369	0.45	**4.2%**

Table 5 -- Prime Section VOC Capture Efficiency
Manual in WOW Robots

Solvent Loading

Sample	Blank Panel Weights (g)	Wet Panel Weights - Enter Zone (g)	Wet Panel Weights - Exit Zone (g)	Panel Weights - After Bake (g)	Weight of Coating Solids Deposited (g)	Weight of VOC available for abatement (g)	Weight of VOC available per volume of coating solids (lb/GACS)
Variable	P0	P3	P4	P5	Wcos	Wa	CL
Formula					P5-P0	P3-P4	$(W_a/W_{cos})*D_{cos}$
1	188.354	188.665	188.669	188.618	0.264	-0.004	-0.14
2	186.349	186.687	186.687	186.638	0.289	0.000	0.00
3	186.535	186.824	186.824	186.772	0.237	0.000	0.00
4	186.899	187.212	187.207	187.161	0.262	0.005	0.18
Average	187.034	187.347	187.347	187.297	0.263	0.000	**0.01**

Material Properties

Sample	Coating Density (lb/gal)	Mass Fraction Solids	Volume Fraction Solids	Film Build Thickness (mil)	VOC mass fraction	Solids Density (lb/gal)
Variable	W_c	W_s	V_s	mil	W_{voc}	D_{cos}
Formula						(Ws*Wc)/Vs
Prime	8.87	0.5543	0.5244	0.3	0.4457	9.38

Capture Efficiency

Mass Fraction VOC in Coating	Coating Density (lb/gal)	Mass VOC per Volume Coating (lb/gal)	Transfer Efficiency (%)	Volume Fraction Solids	Volume Solids Deposited per Volume Coating Sprayed	Panel Test Result (lb VOC/ gal Solids)	Booth Section VOC Capture Efficiency (%)
W_{voc}	D_c	VOC	TE	V_s	V_{sdep}	P	CE
		(Dc)(Wvoc)			$(V_s)(TE)$		$(P)(V_{sdep})(100)/(VOC)$
0.4457	8.87	3.953	70.4%	0.5244	0.369	0.01	**0.1%**