MONTROSE
AIR QUALITY SERVICES

Coating Machine
Permanent Total Enclosure Evaluation
Summary Report

Prepared for:

Hutchinson Antivibration Systems

Grand Rapids Plant
460 Fuller Avenue Northeast
Grand Rapids, Michigan 49503

Project No. 049AS-452053
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Executive Summary

Montrose Air Quality Services, LLC (MAQS) was retained by Hutchinson Antivibration Systems (Hutchinson) to evaluate the permanent total enclosure status of four coating application and drying machines at the Hutchinson facility located in Grand Rapids, Michigan. The purpose of the evaluation was to verify that the machines satisfy the criteria for permanent total enclosures as specified by Section 6 of Method 204 codified at Title 40, Part 51, Appendix M of the Code of Federal Regulations. Fieldwork for the Method 204 evaluation was completed on March 8, 2019.

The overall results of the Method 204 evaluation are summarized by Table 1.

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1.0 Introduction

Montrose Air Quality Services, LLC (MAQS) was retained by Hutchinson Antivibration Systems (Hutchinson) to evaluate the permanent total enclosure status of four coating application and drying machines at the Hutchinson facility located in Grand Rapids, Michigan. The purpose of the evaluation was to verify that the machines satisfy the criteria for permanent total enclosures as specified by Section 6 of Method 204 codified at Title 40, Part 51, Appendix M of the Code of Federal Regulations. Fieldwork for the Method 204 evaluation was completed on March 8, 2019.

The following BTEC professionals participated in the completion this evaluation: Randal Tysar, Senior Environmental Engineer, Mason Sakshaug, Field Project Manager, and Michael Nummer, Environmental Technician. Mr. James Niesen, Maintenance Manager with Hutchinson, provided on-site coordination for this project.

2.0 Process Description

Machines included in the evaluation are described in Michigan RO Permit No. MI-ROP-E5094-2018 as EUADHESIVE1, EUADHESIVE2, EUADHESIVE3, and EUADHESIVE4. These enclosures as well as their respective natural draft openings are summarized by Table 1. Each enclosure has a single exhaust duct. Each individual exhaust duct vents to a common header that routes the exhaust gas to a regenerative thermal oxidizer.

3.0 Evaluation Methodology

The procedure for verification of permanent total enclosure status is included in Sections 8.1 through 8.4 of Method 204. The procedure specifications as well as summaries of the methodologies used to satisfy Method 204, Sections 8.1 through 8.4 are summarized in Sections 3.1 through 3.4 of this report, respectively. The overall results of the Method 204 evaluation are summarized by Table 1.

3.1 NDO Distances

"Determine the equivalent diameters of the NDO's and determine the distances from each VOC emitting point to all NDO's. Determine the equivalent diameter of each exhaust duct or hood and its distance to all NDO's. Calculate the distances in terms of equivalent diameters. The number of equivalent diameters shall be at least four."

Table 1 summarizes, for each coating application machine, the NDO's, their equivalent diameters, and their distances from each VOC emitting point. The distances from each NDO to an exhaust duct or hood is not summarized because the criteria of Method 204, Section 5.2 does not apply to permanent total enclosures.

3.2 NEAR Ratio

"Measure the total surface area (AT) of the enclosure and the total area (AN) of all NDO's in the enclosure. Calculate the NDO to enclosure area ratio (NEAR) as follows:

$$NEAR = \frac{A_N}{A_T}$$

The NEAR must be ≤0.05."

Table 1 summarizes, for each coating application machine, the NDO's, the total area of the NDO's of each machine, the total surface area of the enclosure, and NEAR for each machine.

3.3 Average Facial Velocity

"Measure the volumetric flow rate, corrected to standard conditions, of each gas stream exiting the enclosure through an exhaust duct or hood using EPA Method 2. In some cases (e.g., when the building is the enclosure), it may be necessary to measure the volumetric flow rate, corrected to standard conditions, of each gas stream entering the enclosure through a forced makeup air duct using Method 2. Calculate FV using the following equation:

$$FV = \frac{Q_O - Q_I}{A_N}$$

Where:

QO= the sum of the volumetric flow from all gas streams exiting the enclosure through an exhaust duct or hood.

QI= the sum of the volumetric flow from all gas streams into the enclosure through a forced makeup air duct; zero, if there is no forced makeup air into the enclosure.

AN= total area of all NDO's in enclosure.

The FV shall be at least 3,600 m/hr (200 fpm). Alternatively, measure the pressure differential across the enclosure. A pressure drop of 0.013 mm Hg (0.007 in. H2O) corresponds to an FV of 3,600 m/hr (200 fpm)."

Exhaust gas flowrates were measured in triplicate for each duct exhausting air from each machine. Because all of the exhaust ducts were 12 inches in diameter, exhaust gas velocities were measured using using the procedures of Methods 1 and 2. There is a single exhaust duct from each machine for a total of four exhaust ducts from which exhaust gas flowrates were measured.

Exhaust gas flowrate results are summarized by Table 2. Exhaust gas flowrate summaries and field measurement sheets are included in Appendix A. Average NDO facial velocities for each machine are summarized by Table 1.

3.4 Flow Directions

"Verify that the direction of air flow through all NDO's is inward. If FV is less than 9,000 m/hr (500 fpm), the continuous inward flow of air shall be verified using streamers, smoke tubes, or tracer gases. Monitor the direction of air flow for at least 1 hour, with checks made no more than 10 minutes apart. If FV is greater than 9,000 m/hr (500 fpm), the direction of air flow through the NDOs shall be presumed to be inward at all times without verification."

On March 8, 2019, flow directions at each NDO were verified at 10 minute intervals for one hour using smoke tubes. The flow direction was clearly inward at each NDO. Flow direction verification field sheets for the smoke tube testing are included in Appendix B.

4.0 Overall Results

The overall results of the permanent total enclosure verification testing are summarized by Table 1.

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Table 1
Method 204 Evaluation Results Summary
Hutchinson Antivibration Systems
Grand Rapids, Michigan

Machine	NDO Description	NDO Dimensions[A]	NDO Area[B] (in^2)	NDO Equivalent Diameter[C] (in)	Distance to Nearest VOC Emitting Point[D] (in)	Section 5.1 - Number of NDO Diameters from Nearest VOC-Emitting Point[E]	Enclosure Average Exhaust Gas Flowrate[F] (scfm)	PTE Total NDO Area[G] (ft^2)	Section 5.4 - NDO Average Facial Velocity[H] (ft/min)	PTE Height (in)	PTE Width (in)	PTE Length (in)	Total PTE Area of Ceiling, Walls, and Floor[I] (ft^2)	Section 5.3 - Area of NDO's as % of PTE Surface Area[J]
EUADHESIVE1	Operator Left Booth Door	3.5" x 0.375" (4)	1.31	1.29	29	22	232	0.87	266	67 or 50	67	128	80.7	1.1%
	Operator Right Booth Door	3.5" x 0.375" (4)	1.31	1.29	29	22								
	Operator Left Oven Opening	10" x 5.75"	57.50	8.56	57	7								
	Operator Right Oven Opening	10" x 5.75"	57.50	8.56	57	7								
EUADHESIVE2	Operator Left Booth Door	3.5" x 0.375" (4)	1.31	1.29	29	22	593	0.87	680	67 or 50	67	128	80.7	1.1%
	Operator Right Booth Door	3.5" x 0.375" (4)	1.31	1.29	29	22								
	Operator Left Oven Opening	10" x 5.75"	57.50	8.56	57	7								
	Operator Right Oven Opening	10" x 5.75"	57.50	8.56	57	7								
EUADHESIVE3	Operator Left Booth Door	3.5" x 0.375" (4)	1.31	1.29	29	22	349	0.87	400	67 or 50	67	128	80.7	1.1%
	Operator Right Booth Door	3.5" x 0.375" (4)	1.31	1.29	29	22								
	Operator Left Oven Opening	10" x 5.75"	57.50	8.56	57	7								
	Operator Right Oven Opening	10" x 5.75"	57.50	8.56	57	7								
EUADHESIVE4	Operator Left Booth Door	3.5" x 0.375" (4)	1.31	1.29	29	22	556	0.87	638	67 or 50	67	128	80.7	1.1%
	Operator Right Booth Door	3.5" x 0.375" (4)	1.31	1.29	29	22								
	Operator Left Oven Opening	10" x 5.75"	57.50	8.56	57	7								
	Operator Right Oven Opening	10" x 5.75"	57.50	8.56	57	7								

Notes:

(A) All natural draft openings (NDO) consist of rectangular openings. For example, the NDO's for EUADHESIVE1 consist of two rectangular openings at the part entry/exit point that are 5.75" wide and 10" high and eight rectangular openings in the doors on the front of the coating machine.

(B) The NDO Area is the area of each NDO. For example, for EUADHESIVE1:

5.75" x 10" x 2 = 115 in^2
3.5" x 0.375" x 8 = 10.5 in^2
115 in^2 + 10.5 in^2 = 125.5 in^2
125.5 in^2/144 = 0.87

(C) For rectangular holes, the equivalent diameter is the diameter of a circle that would have the same area as the rectangle. For example, for one of the small (3.5" x 0.375") openings in the EUADHESIVE1 doors:

(3.5 in) x (0.375 in) = 1.3125 in^2
((1.3125 in^2) x (4/pi))$^{0.5}$ = 1.29 in

(D) For each NDO, the distance to the nearest VOC emitting point is the distance from the NDO to the coating spray applicator tip.

(E) For example, for EUADHESIVE1:

(29 in)/(1.29 in) = 22.5

(F) The exhaust gas flowrate from each enclosure is summarized by Table 2 as well as the flowrate measurement summaries included in Appendix A.

(G) For example, for EUADHESIVE1:

115 in^2 + 10.5 in^2 = 125.5 in^2
125.5 in^2/144 = 0.87

(H) For example, for EUADHESIVE1:

(232 ft^3/min)/(0.87 ft^2) = 266 ft/min

(I) For example, for EUADHESIVE1:

Enclosure Portion	Dimensions	Area (in2)
Top of Booth	67" x 50"	3,350
Floor of Booth	67" x 50"	3,350
Side Wall Left	50" x 21"	1,050
Side Wall Right	50" x 21"	1,050
Front Wall	67" x 21"	1,407
Back Wall	67" x 21"	1,407
Total Area		11,614

(J) For example, for EUADHESIVE1:

(0.87 ft^2)/(80.7 ft^2) x 100 = 1.1%

Table 2
Exhaust Gas Flowrate Measurements Summary
Hutchinson Antivibration Systems
Grand Rapids, Michigan

Enclosure	Flowrate Measurement 1 (scfm)	Flowrate Measurement 2 (scfm)	Flowrate Measurement 3 (scfm)	Average Flowrate (scfm)
RC1	251	237	208	232
RC2	600	601	577	593
RC3	355	353	340	349
RC4	551	555	561	556