1.0 INTRODUCTION

1.1 SUMMARY OF TEST PROGRAM

Denso Manufacturing Michigan, Inc. (Facility ID: N1192) contracted Montrose Air Quality Services, LLC (Montrose) to perform a compliance test program on the Evaporator Manufacturing Area (EU-EVAP2) at the Denso Manufacturing Michigan, Inc. facility located in Battle Creek, Michigan. Testing was performed on August 10, 2021, for the purpose of satisfying the emission testing requirements pursuant to Michigan Department of Environment, Great Lakes, and Energy (EGLE) Permit No. MI-PTI-N1192-2017c.

The specific objectives were to:

- Verify the volatile organic compound (VOC) destruction efficiency (DE) of the C884 Thermal Oxidizer (T-OX) serving EU-EVAP2
- Verify the emissions of VOC of the C884 T-OX serving EU-EVAP2
- Conduct the test program with a focus on safety

Montrose performed the tests to measure the emission parameters listed in Table 1-1.

TABLE 1-1
SUMMARY OF TEST PROGRAM

Test Date	Unit ID/ Source Name	Activity/ Parameters	Test Methods	No. of Runs	Duration (Minutes)
8/10/2021	C884 T-OX	Velocity/Volumetric Flow Rate	EPA 1, 2	3	5-8 (inlet) 6-8 (outlet)
8/10/2021	C884 T-OX	Moisture	EPA 4	3	30 (inlet) 30 (outlet)
8/10/2021	C884 T-OX	TGO	EPA 25A	3	60 (inlet) 60 (outlet)

To simplify this report, a list of Units and Abbreviations is included in Appendix C.1. Throughout this report, chemical nomenclature, acronyms, and reporting units are not defined. Please refer to the list for specific details.

This report presents the test results and supporting data, descriptions of the testing procedures, descriptions of the facility and sampling locations, and a summary of the quality assurance procedures used by Montrose. The average emission test results are summarized and compared to their respective permit limits in Table 1-2. Detailed results for individual test runs can be found in Section 4.0. All supporting data can be found in the appendices.

The testing was conducted by the Montrose personnel listed in Table 1-3 on August 10, 2021 The tests were conducted according to the test plan (protocol) dated June 18, 2021 that was submitted to EGLE on June 21, 2021.

TABLE 1-2
SUMMARY OF AVERAGE COMPLIANCE RESULTS -
C884 T-OX
AUGUST 10, 2021

Parameter/Units	Average Results	Allowable Limits*
VOC (TGO) Emissions, as propane lb/hr	0.0	≤ 0.37
VOC (TGO) Destruction Efficiency (DE) %	100	≥ 95

* The T-OX has to meet either the DE or the emission rate limit stated in EGLE Permit No. MI-ROP-N1192-2017c.

1.2 KEY PERSONNEL

A list of project participants is included below:

Facility Information

Source Location: Denso Manufacturing Michigan, Inc.
One Denso Road
Battle Creek, MI 49037

Project Contact: Jody Smith, P.E.
Role: Advanced Environmental Manager
Company: Denso Manufacturing Michigan, Inc.
Telephone: 269-565-8562
Email: Jody.smith@na.denso.com

Agency Information

Regulatory Agency: Michigan Department of EGLE
Contact: Karen Kajiya-Mills
Telephone: 517-284-6780
Email: Kajiya-millsk@michigan.gov

Testing Company Information

Testing Firm:	Montrose Air Quality Services, LLC	
Contact:	Matthew Young	Randal Tysar
Title:	District Manager	Sr. Environmental Engineer
Telephone:	248-548-8070	248-548-8070
Email:	myoung@montrose-env.com	rtysar@montrose-env.com

Test personnel and observers are summarized in Table 1-3.

TABLE 1-3
TEST PERSONNEL AND OBSERVERS

Name	Affiliation	Role/Responsibility
Steve Smith	Montrose	Client Project Manager, QI
Barry Boulianne	Montrose	Midwest Sales Manager
Benjamin Durham	Montrose	Field Technician
Scott Dater	Montrose	Field Technician
Jody Smith	Denso Manufacturing Michigan, Inc.	Observer/Client Liaison/Test Coordinator

2.0 PLANT AND SAMPLING LOCATION DESCRIPTIONS

2.1 PROCESS DESCRIPTION, OPERATION, AND CONTROL EQUIPMENT

Denso Manufacturing Michigan, Inc.'s operations includes an evaporator manufacturing area consisting of metal stamping, degreasing (C852), fluxing, and cutting of small parts; metal forming of fins and mechanical assembly of cores with components; core oven degreasing (C884); and brazing. Emissions from each oven degreaser are controlled by a separate thermal oxidizer. Only C884 was tested during this test event.

Oven degreasers are used to remove machining oils (containing VOCs) from evaporators. The cores consist of aluminum tubes, fins, and other small parts, which have been assembled to make the core. The machining oils are used to facilitate the formation of fins from strips of aluminum. The main raw material used in making the cores is aluminum.

2.2 FLUE GAS SAMPLING LOCATIONS

Information regarding the sampling locations is presented in Table 2-1.

TABLE 2-1
SAMPLING LOCATIONS

Sampling Location	Stack Inside Dimensions (in.)	Distance from Nearest Disturbance		Number of Traverse Points
		Downstream EPA "B" (in./dia.)	Upstream EPA "A" (in./dia.)	
C884 T-OX Inlet Duct	10	77/7.7	18/1.8	Flow: 16 (8/port); Moisture and Gaseous: 1
C884 T-OX Exhaust Duct	16.5	169/10.2	39/2.4	Flow: 16 (8/port); Moisture and Gaseous: 1

Sample locations were verified in the field to conform to EPA Method 1. See Section 4-1 for details. Acceptable cyclonic flow conditions were confirmed prior to testing using EPA Method 1, Section 11.4. See Appendices A.1 through A.3 for more information.

2.3 OPERATING CONDITIONS AND PROCESS DATA

Emission tests were performed while the source/units and air pollution control devices were operating at the conditions required by the permit. The units were tested when operating normally.

Plant personnel were responsible for establishing the test conditions and collecting all applicable unit-operating data. The process data that was provided is presented in Appendix B.

3.0 SAMPLING AND ANALYTICAL PROCEDURES

3.1 TEST METHODS

The test methods for this test program were presented previously in Table 1-1. Additional information regarding specific applications or modifications to standard procedures is presented below.

3.1.1 EPA Method 1, Sample and Velocity Traverses for Stationary Sources

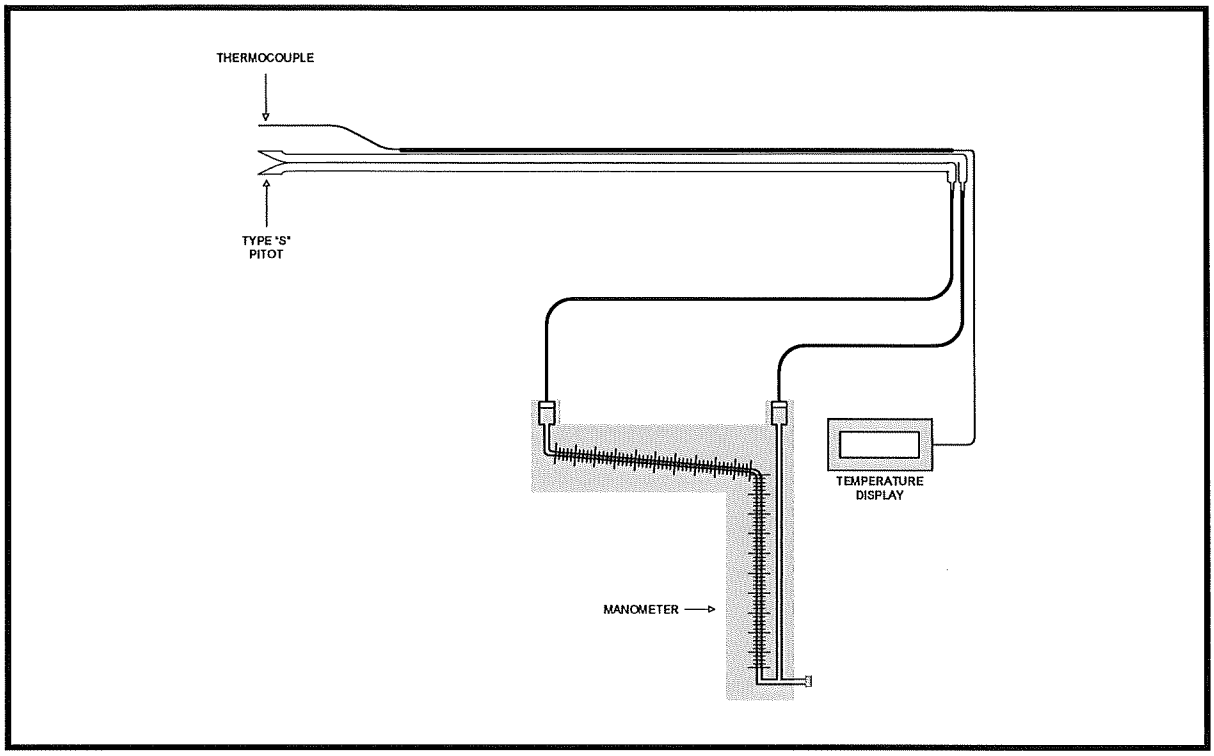
EPA Method 1 is used to assure that representative measurements of volumetric flow rate are obtained by dividing the cross-section of the stack or duct into equal areas, and then locating a traverse point within each of the equal areas. Acceptable sample locations must be located at least two stack or duct equivalent diameters downstream from a flow disturbance and one-half equivalent diameter upstream from a flow disturbance.

3.1.2 EPA Method 2, Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)

EPA Method 2 is used to measure the gas velocity using an S-type pitot tube connected to a pressure measurement device, and to measure the gas temperature using a calibrated thermocouple connected to a thermocouple indicator. Typically, Type S (Stausscheibe) pitot tubes conforming to the geometric specifications in the test method are used, along with an inclined manometer. The measurements are made at traverse points specified by EPA Method 1.

The sampling system is detailed in Figure 3-1.

FIGURE 3-1
EPA METHOD 2 SAMPLING SYSTEM

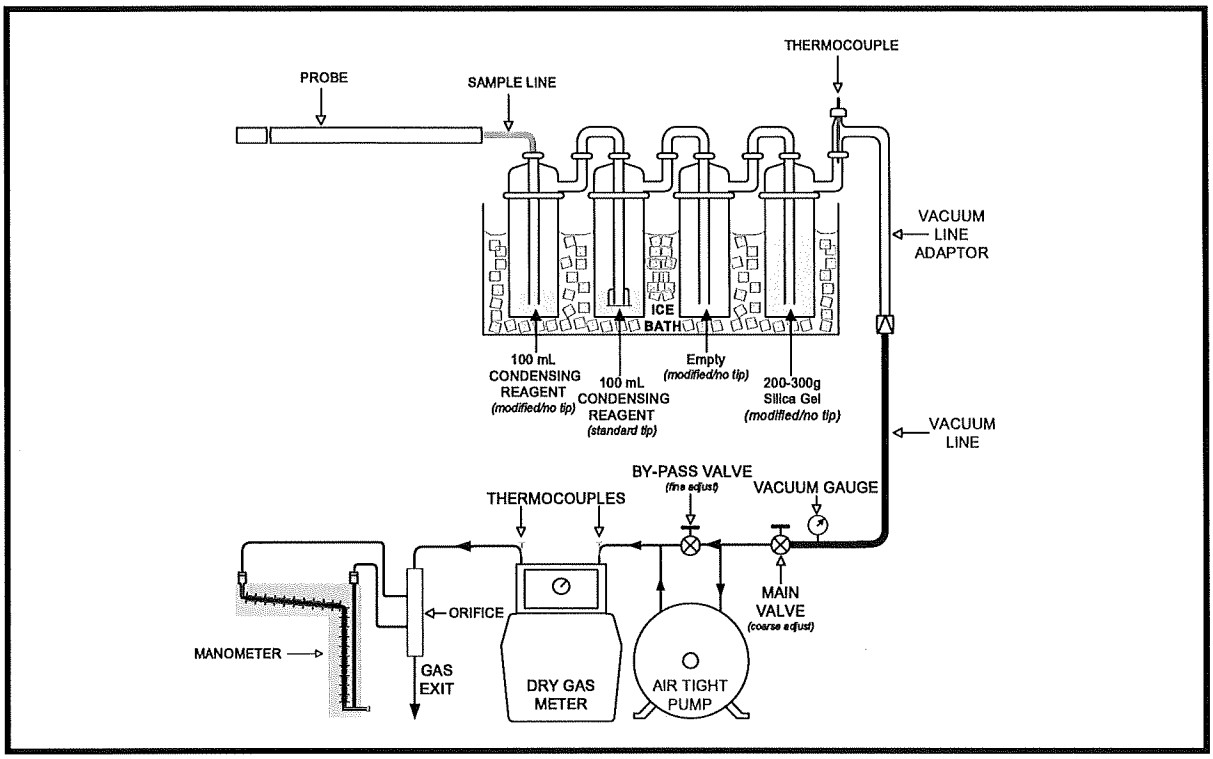


3.1.3 EPA Method 4, Determination of Moisture Content in Stack Gas

EPA Method 4 is a manual, non-isokinetic method used to measure the moisture content of gas streams. Gas is sampled at a constant sampling rate through a probe and impinger train. Moisture is removed using a series of pre-weighed impingers containing methodology-specific liquids and silica gel immersed in an ice water bath. The impingers are weighed after each run to determine the percent moisture.

The sampling system is detailed in Figure 3-2.

FIGURE 3-2
EPA METHOD 4(DETACHED) SAMPLING TRAIN

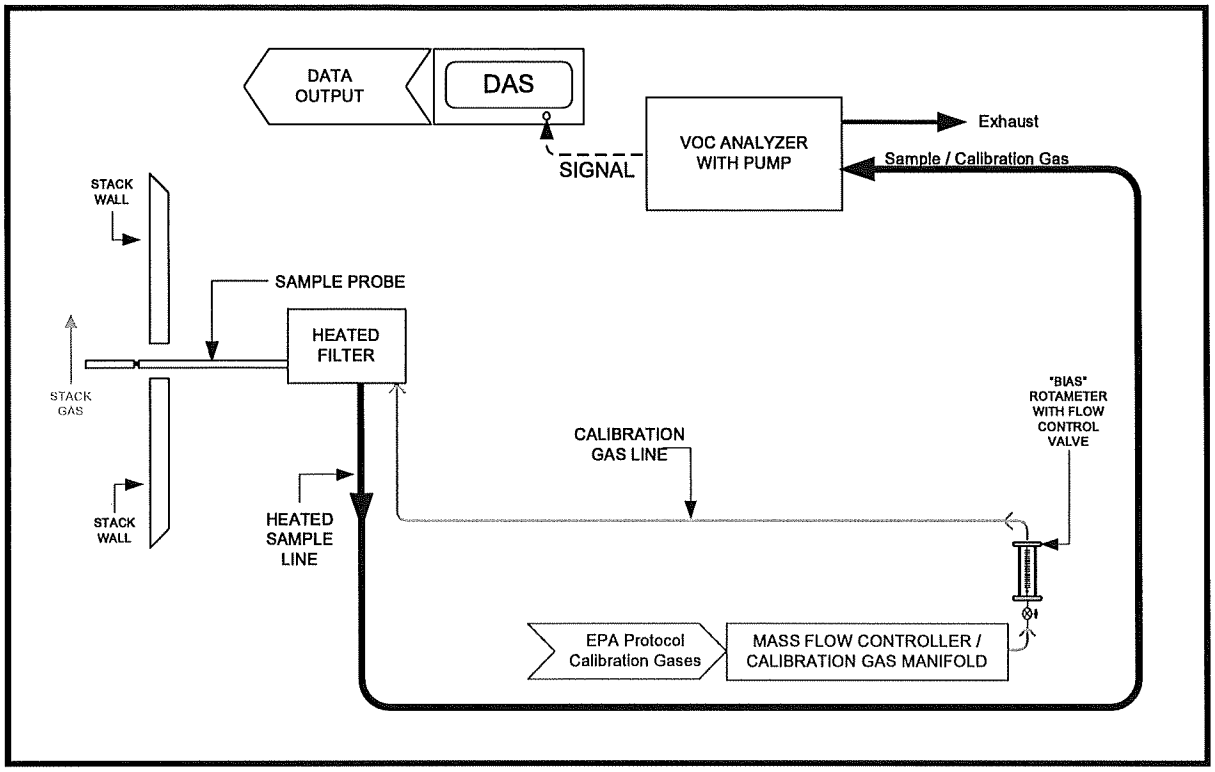


3.1.4 EPA Method 25A, Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer

EPA Method 25A is an instrumental test method used to measure the concentration of THC in stack gas. A gas sample is extracted from the source through a heated sample line and glass fiber filter to a flame ionization analyzer (FIA). Results are reported as volume concentration equivalents of the calibration gas or as carbon equivalents.

The sampling systems are detailed in Figure 3-3.

FIGURE 3-3
EPA METHOD 25A SAMPLING TRAIN



3.2 PROCESS TEST METHODS

The test plan did not require that process samples be collected during this test program; therefore, no process sample data are presented in this test report.

4.0 TEST DISCUSSION AND RESULTS

4.1 FIELD TEST DEVIATIONS AND EXCEPTIONS

The test plan called for grab samples of duct gas to be analyzed using EPA Method 3 for molecular weight determination. Instead, a dry molecular weight of 29.0 lb/lb-mole, as outlined in EPA Method 2 Section 8.6, was used.

4.2 PRESENTATION OF RESULTS

The average results are displayed in Table 1-2. The results of individual test runs performed are presented in Tables 4-1 and 4-2. Emissions are reported in units consistent with those in the applicable regulations or requirements. Additional information is included in the appendices as presented in the Table of Contents.

TABLE4-1
VOC EMISSIONS RESULTS -
C884 T-OX INLET

Run Number	1	2	3	Average
Date	8/10/2021	8/10/2021	8/10/2021	--
Time	8:30-9:30	10:05-12:00	12:20-13:20	--
Flue Gas Parameters				
flue gas temperature, °F	475.4	483.2	476.0	478.2
moisture content, % volume	6.76	6.90	6.52	6.73
volumetric flow rate, scfm	506.4	500.4	498.5	501.7
VOC (TGO), as Propane				
ppmvw	400.5	366.5	338.1	368.4
lb/hr	1.393	1.259	1.157	1.270

TABLE4-2
VOC EMISSIONS AND DE RESULTS -
C884 T-OX EXHAUST

Run Number	1	2	3	Average
Date	8/10/2021	8/10/2021	8/10/2021	--
Time	8:30-9:30	10:05-12:00	12:20-13:20	--
Process Data				
Cores processed	232	219	218	223
T-OX temperature, °F	1436	1436	1436	1436
Flue Gas Parameters				
flue gas temperature, °F	1375.3	1364.8	1372.1	1370.7
moisture content, % volume	11.08	10.09	10.06	10.41
volumetric flow rate, scfm	776.1	788.3	761.5	775.3
VOC (TGO), as Propane				
ppmvw	0.0	0.0	0.0	0.0
lb/hr	0.0	0.0	0.0	0.0
VOC Destruction Efficiency (DE)				
%	100	100	100	100

5.0 INTERNAL QA/QC ACTIVITIES

5.1 QA/QC AUDITS

The meter boxes and sampling trains used during sampling performed within the requirements of their respective methods. All post-test leak checks, and minimum metered volumes met the applicable QA/QC criteria.

EPA Method 25A FIA calibration audits were within the measurement system performance specifications for the calibration drift checks and calibration error checks.

An EPA Method 205 field evaluation of the calibration gas dilution system was conducted. The dilution accuracy and precision QA specifications were met.

5.2 QA/QC DISCUSSION

All QA/QC criteria were met during this test program.

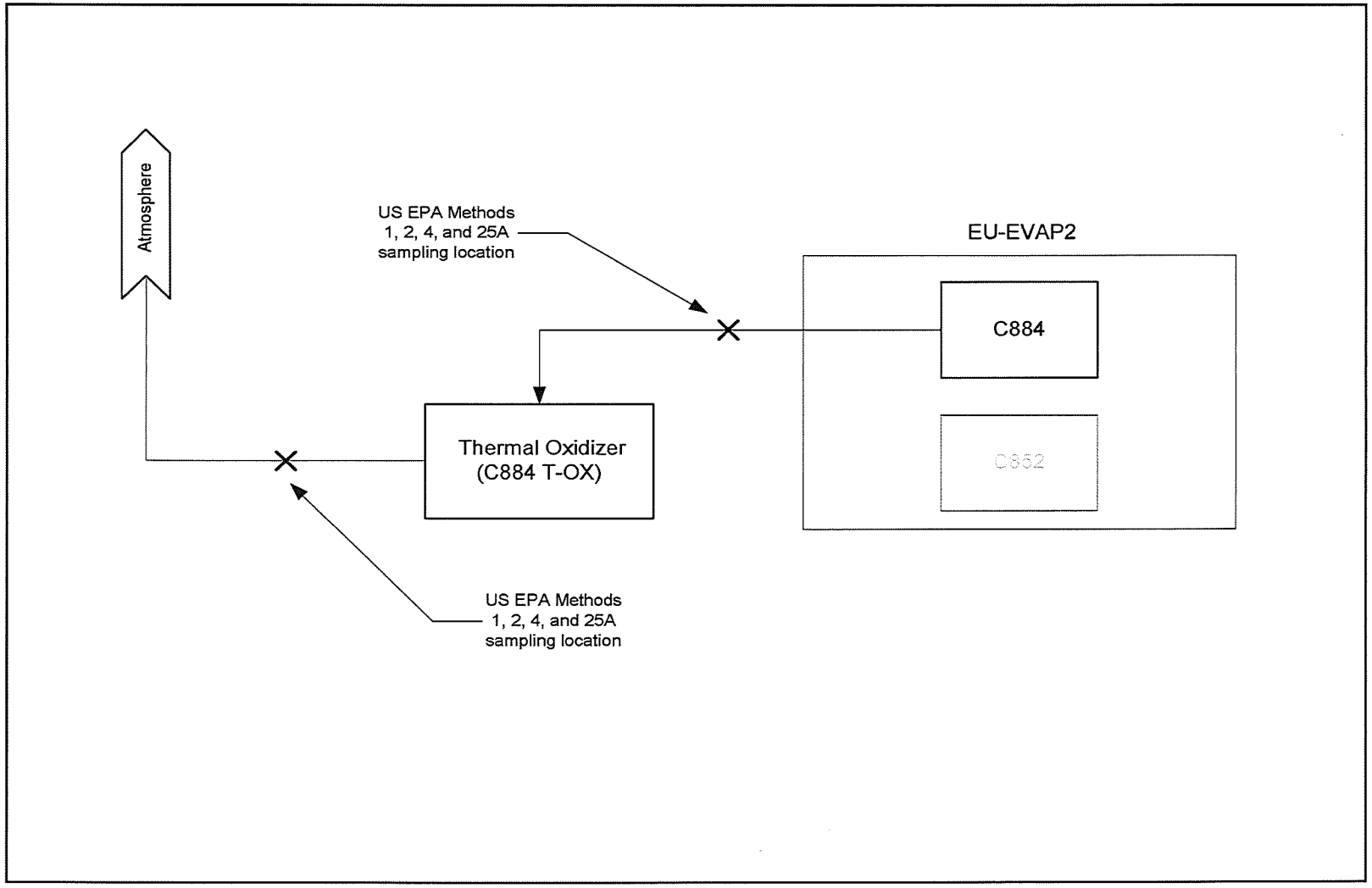
5.3 QUALITY STATEMENT

Montrose is qualified to conduct this test program and has established a quality management system that led to accreditation with ASTM Standard D7036-04 (Standard Practice for Competence of Air Emission Testing Bodies). Montrose participates in annual functional assessments for conformance with D7036-04, which are conducted by the American Association for Laboratory Accreditation (A2LA). All testing performed by Montrose is supervised on site by at least one Qualified Individual (QI) as defined in D7036-04 Section 8.3.2. Data quality objectives for estimating measurement uncertainty within the documented limits in the test methods are met by using approved test protocols for each project as defined in D7036-04 Sections 7.2.1 and 12.10. Additional quality assurance information is included in the report appendices. The content of this report is modeled after the EPA Emission Measurement Center Guideline Document (GD-043).

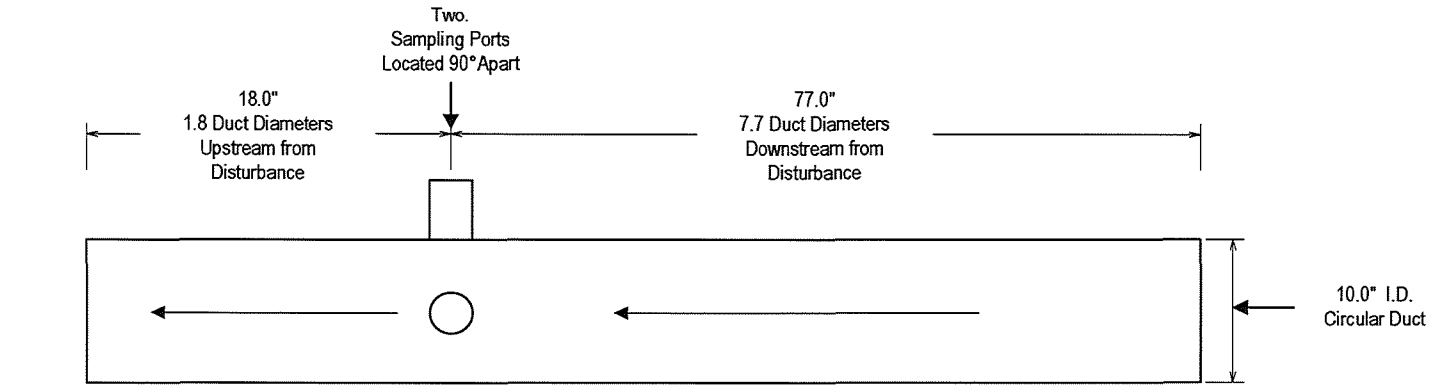
APPENDIX A
FIELD DATA AND CALCULATIONS

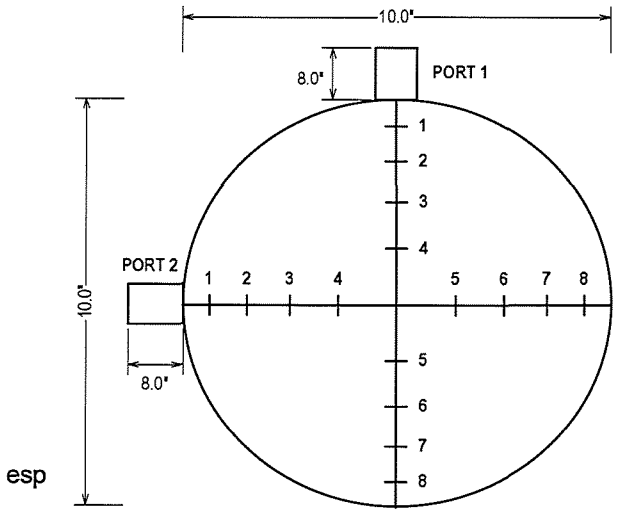
Appendix A.1
Sampling Locations

C884 T-OX SAMPLING LOCATION SCHEMATIC



C884 T-OX INLET DUCT TRAVERSE POINT LOCATION DRAWING





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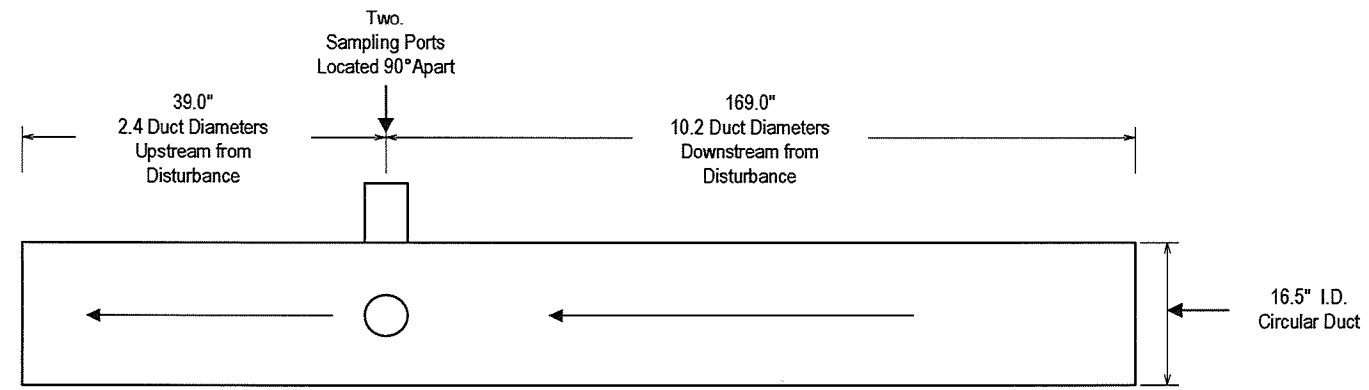
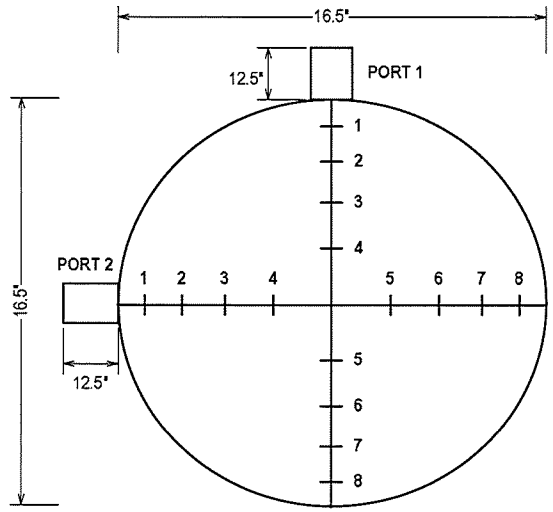
Point	% of Duct Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2
1*	3.2	0.5	0.5
2	10.5	1.1	1.1
3	19.4	1.9	1.9
4	32.3	3.2	3.2
5	67.7	6.8	6.8
6	80.6	8.1	8.1
7	89.5	9.0	9.0
8*	96.8	9.5	9.5

* Points adjusted per US EPA Method 1, Section 11.1.3.4

C884 T-OX EXHAUST DUCT TRAVERSE POINT LOCATION DRAWING





Point	% of Duct Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2
1	3.2	0.5	0.5
2	10.5	1.7	1.7
3	19.4	3.2	3.2
4	32.3	5.3	5.3
5	67.7	11.2	11.2
6	80.6	13.3	13.3
7	89.5	14.8	14.8
8	96.8	16.0	16.0

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