1.0 INTRODUCTION

1.1 SUMMARY OF TEST PROGRAM

Denso Manufacturing Michigan, Inc. contracted Montrose Air Quality Services, LLC (Montrose) to perform a compliance emissions test program on a condenser manufacturing area consisting of metal stamping presses, metal cutting, welding and degreasing of small parts; metal forming of fins and mechanical assembly of cores with components; core oven degreasing (C452A); and brazing (EU-CONDMF3) at the Denso Manufacturing Michigan, Inc. facility located in Battle Creek, Michigan. The tests were conducted to satisfy the emissions testing requirements pursuant to Michigan Department of Environment Great Lakes and Energy (EGLE) Permit No. MI-ROP-N1192-2017c.

The specific objectives were to:

- Verify the total gaseous organic (TGO)/total gaseous nonmethane organic (TGNMO) removal efficiency (RE) of the thermal oxidizer (TO C452A) serving EU-CONDMF3
- 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)
10/01/2020	TO C452A Inlets	Velocity/Volumetric Flow Rate	EPA 1 & 2	3	~10 (Inlet_1) ~10 (Inlet_2)
10/01/2020	TO C452A Combined Inlet	O_2, CO_2	EPA 3	3	~3
10/01/2020	TO C452A Combined Inlet	Moisture	EPA 4	3	35
10/01/2020	TO C452A Combined Inlet	TGO	EPA 25A	3	60
10/01/2020	TO C452A Exhaust	Velocity/Volumetric Flow Rate	EPA 1 & 2	3	~10
10/01/2020	TO C452A Exhaust	O_2, CO_2	EPA 3	3	~3
10/01/2020	TO C452A Exhaust	Moisture	EPA 4	3	35
10/01/2020	TO C452A Exhaust	TGO and Methane	EPA 25A	3	60

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 October 1, 2020 The tests were conducted according to the test plan (protocol) dated August 7, 2020 that was submitted to and approved by EGLE on August 26, 2020.

TABLE 1-2
SUMMARY OF AVERAGE COMPLIANCE RESULTS -
TO 452A*
OCTOBER 1, 2020

Parameter/Units	Average Results	Allowable Limits*
TGNMO Emissions, as propane		
lb/hr	0.09	≤ 0.37
TGO/TGNMO Destruction Efficiency (DE)		
%	89	≥ 94

* The TO 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 Engineering
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	Steve Smith
Title:	District Manager	Client Project Manager
Telephone:	248-548-8070	248-548-8070
Email:	myoung@montrose-env.com	ssmith@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
Scott Dater	Montrose	Field Technician
Austin Goracke	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 include a condenser manufacturing area (consisting of metal stamping presses, metal cutting, welding and degreasing of small parts; metal forming of fins and mechanical assembly of cores with components; core oven degreasing and brazing (EU-CONDMF3).

The oven degreasers are used to remove machining oils (containing VOCs) from condensers. 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.

Emissions from EU-CONDMF3 were controlled by a thermal oxidizer (TO C452A).

EU-CONDMF3 and TO C452A were in operation during this test event.

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.)	
TO C452A Inlet_1	12X12 Rectangular	60/5	60/5	Flow: 18 (6/port)
TO C452A Inlet_2	12X12 Rectangular	60/5	60/5	Flow: 18 (6/port)
TO C452A Combined Inlet	--	--	--	Moisture and Gaseous: 1
TO C452A Exhaust	23.5	180/7.7	120/5.1	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

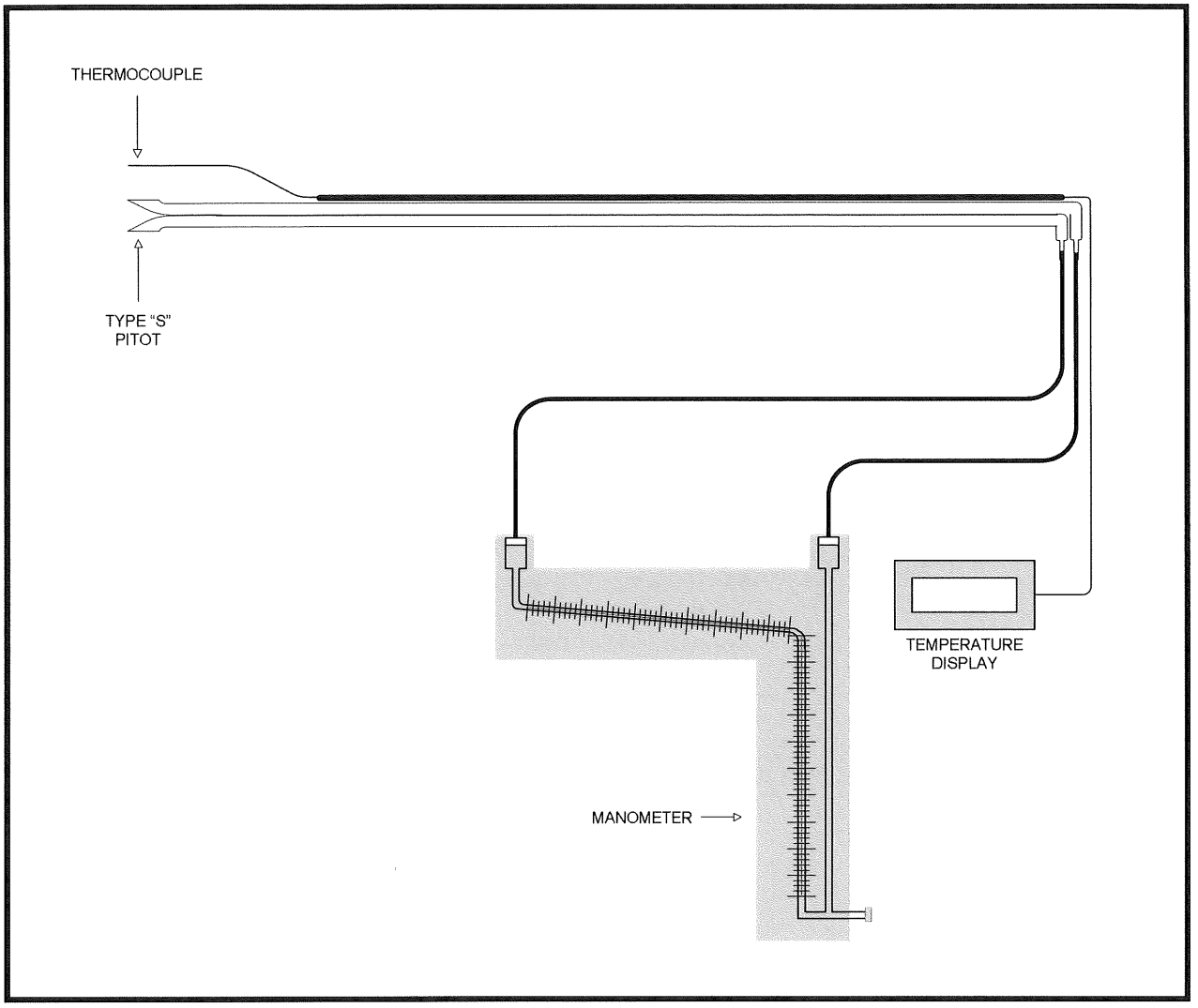
EPA Method 1 is used to assure that representative measurements of volumetric flow rate are obtained by dividing the cross-section of the stack or duct into equal areas, and then locating a traverse point within each of the equal areas. Acceptable sample locations must be located at least two stack or 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 3, Gas Analysis for the Determination of Dry Molecular Weight

EPA Method 3 is used to calculate the dry molecular weight of the stack gas using one of three methods. The first choice is to measure the percent O_2 and CO_2 in the gas stream. A gas sample is extracted from a stack by one of the following methods: (1) single-point, grab sampling; (2) single-point, integrated sampling; or (3) multi-point, integrated sampling. The gas sample is analyzed for percent CO_2 and percent O_2 using either an Orsat or a Fyrite analyzer.

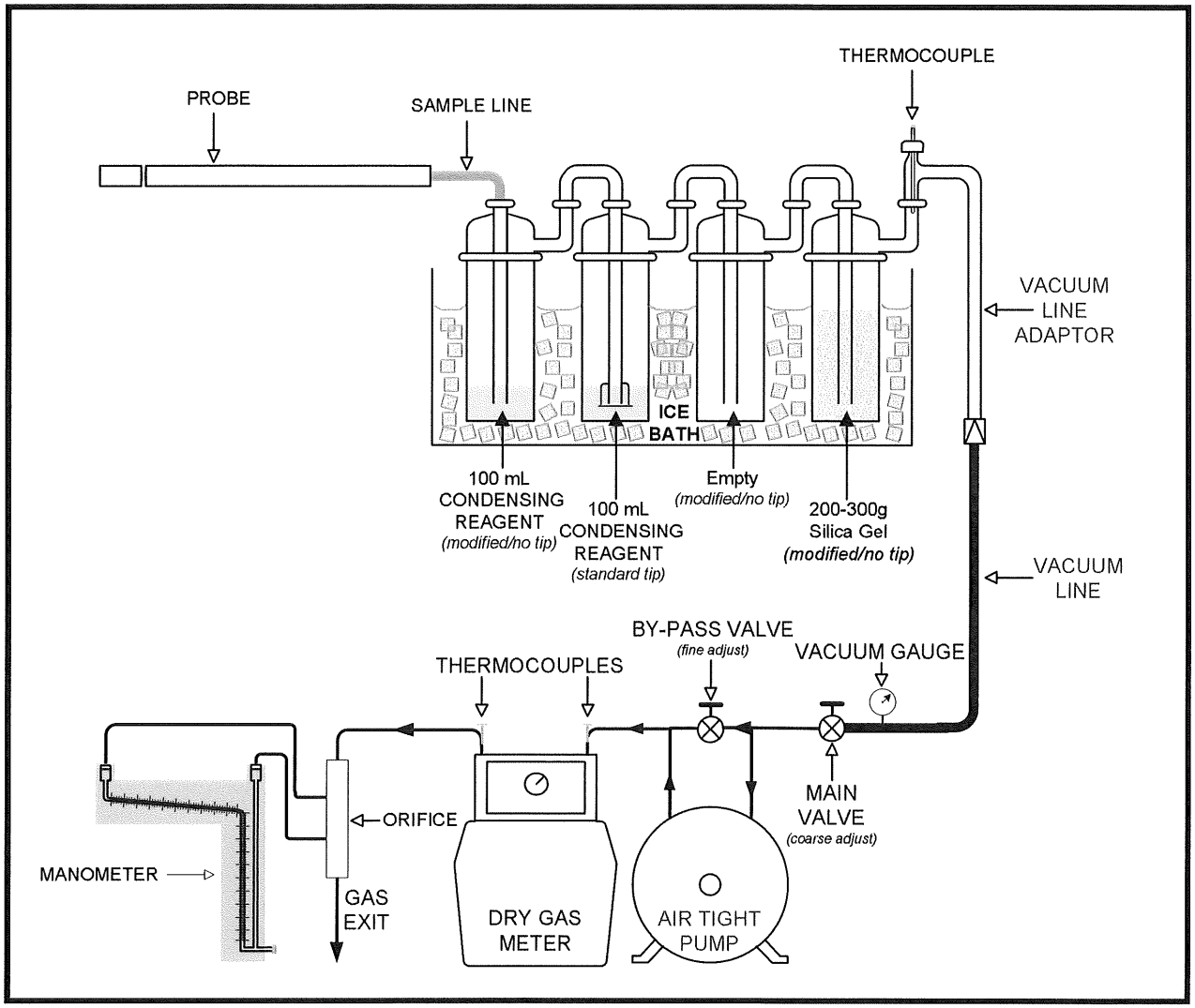
3.1.4 EPA Method 4, Determination of Moisture Content in Stack Gas

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



3.1.5 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 (TO C452A Inlet) and Figure 3-4 (TO C452A Exhaust).

FIGURE 3-3
EPA METHOD 25A SAMPLING TRAIN

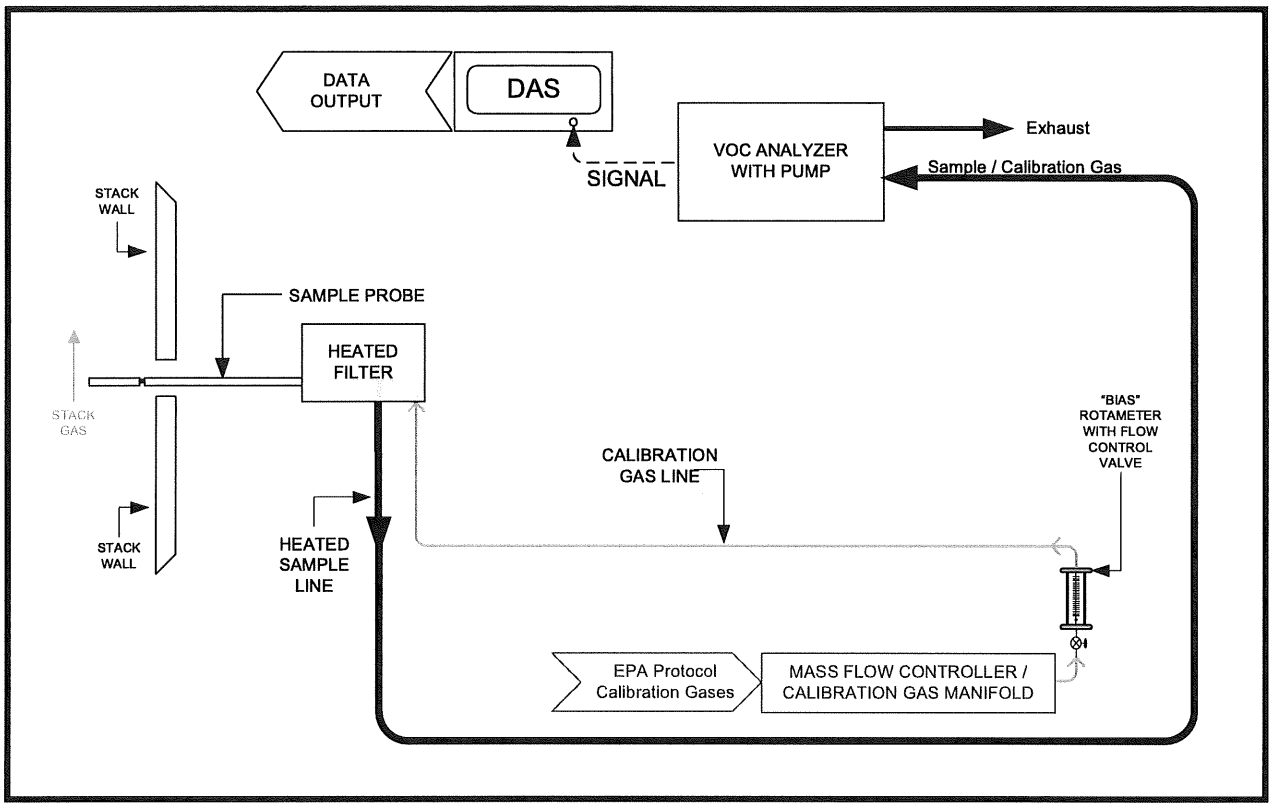
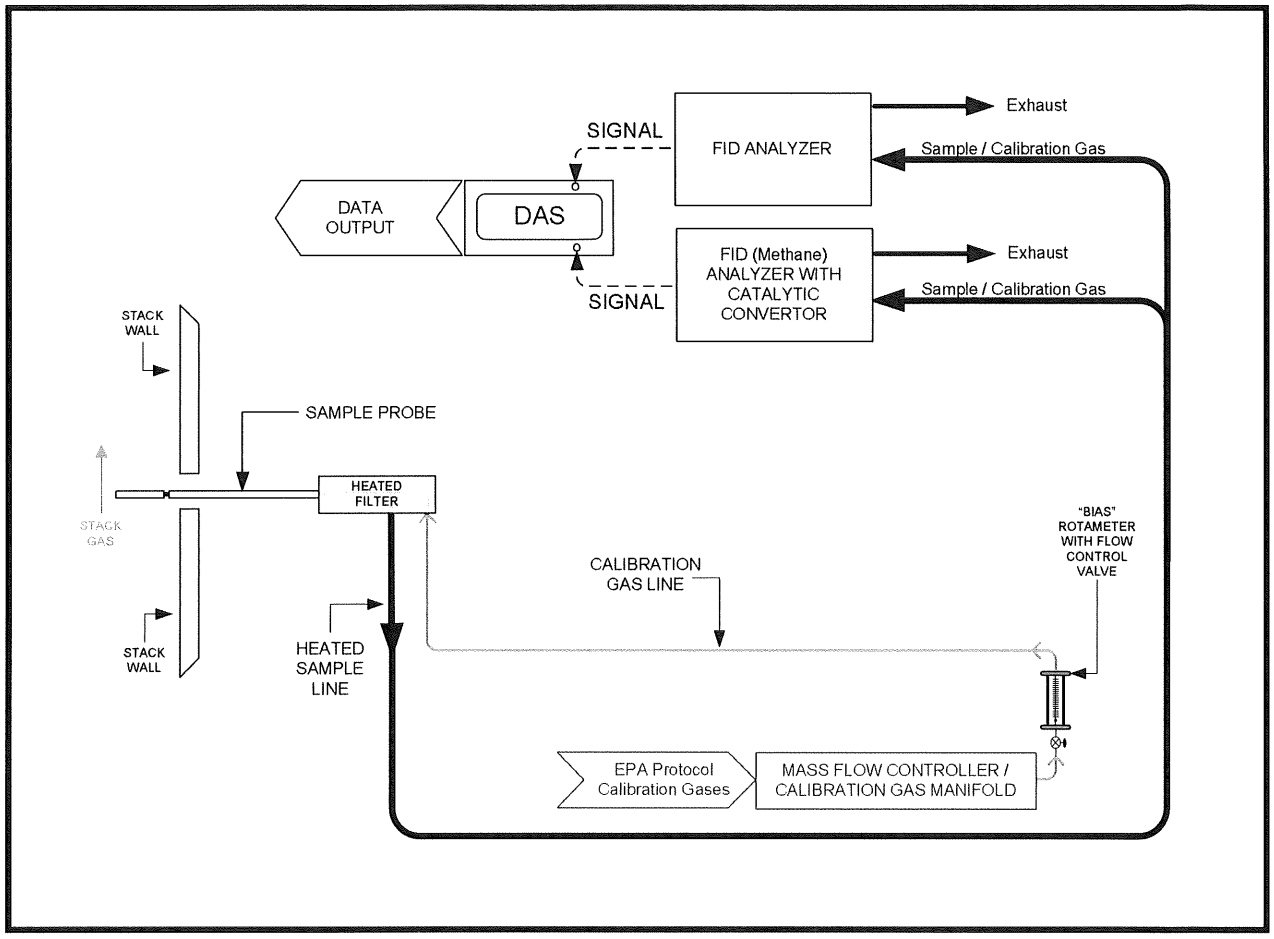


FIGURE 3-4
EPA METHOD 25A (TGO AND METHANE) SAMPLING TRAIN



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

No field deviations or exceptions from the test plan or test methods occurred during this test program

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 through 4-4. 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.

TABLE 4-1
TGO EMISSIONS RESULTS -
TO C452A INLET 1

Run Number	1	2	3	Average
Date	10/01/2020	10/01/2020	10/01/2020	--
Time	09:00-09:10	10:21-10:25	12:25-12:30	--
Flue Gas Parameters				
flue gas temperature, °F	422	432	456	437
volumetric flow rate, scfm	277	283	283	281

TABLE 4-2
TGO EMISSIONS RESULTS -
TO C452A INLET 2

Run Number	1	2	3	Average
Date	10/01/2020	10/01/2020	10/01/2020	--
Time	08:50-09:00	10:15-09:00	12:31-12:36	--
Flue Gas Parameters				
flue gas temperature, °F	487	492	497	492
volumetric flow rate, scfm	965	1,058	985	1,003

TABLE4-3
TGO EMISSIONS AND DE RESULTS -
TO C452A COMBINED INLET

Run Number	1	2	3	Average
Date	10/01/2020	10/01/2020	10/01/2020	--
Time	08:20-09:20	10:10-11:10	12:15-13:15	--
Flue Gas Parameters				
O_2, % volume dry	21	21	21	21
CO_2, % volume dry	0	0	0	0
moisture content, % volume	5.10	8.35	4.50	5.98
volumetric flow rate, scfm*	1,242	1,333	1,269	1,281
TGO as Propane				
ppmvw	68.4	117.0	105.1	96.9
lb/hr	0.58	1.07	0.92	0.86

* Combined flows measured at TO C425A Inlet 1 and TO C425A Inlet 2 . See Tables 4-1 and 4-2 for details.

TABLE4-4
TGO EMISSIONS AND DE RESULTS -
TO C452A EXHAUST

Run Number	1	2	3	Average
Date	10/01/2020	10/01/2020	10/01/2020	--
Time	08:20-09:20	10:10-11:10	12:15-13:15	--
Process Data				
TO chamber temperature, °C		703 - 727		--
Cores produced	108	132	132	124
Flue Gas Parameters				
O_2, % volume dry	21	21	21	21
CO_2, % volume dry	0	0	0	0
flue gas temperature, °F	610	601	598	603
moisture content, % volume	7.09	7.08	7.82	7.33
volumetric flow rate, scfm	2,554	2,705	2,858	2,706
TGO as Propane				
ppmvw	4.80	6.11	5.44	5.45
Methane as Propane				
ppmvw	0.69	0.60	0.69	0.66
TGNMO as Propane				
ppmvw	4.11	5.52	4.75	4.79
lb/hr	0.072	0.10	0.093	0.089
TGO/TGNMO DE				
%	87.6	90.4	89.8	89.3

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.

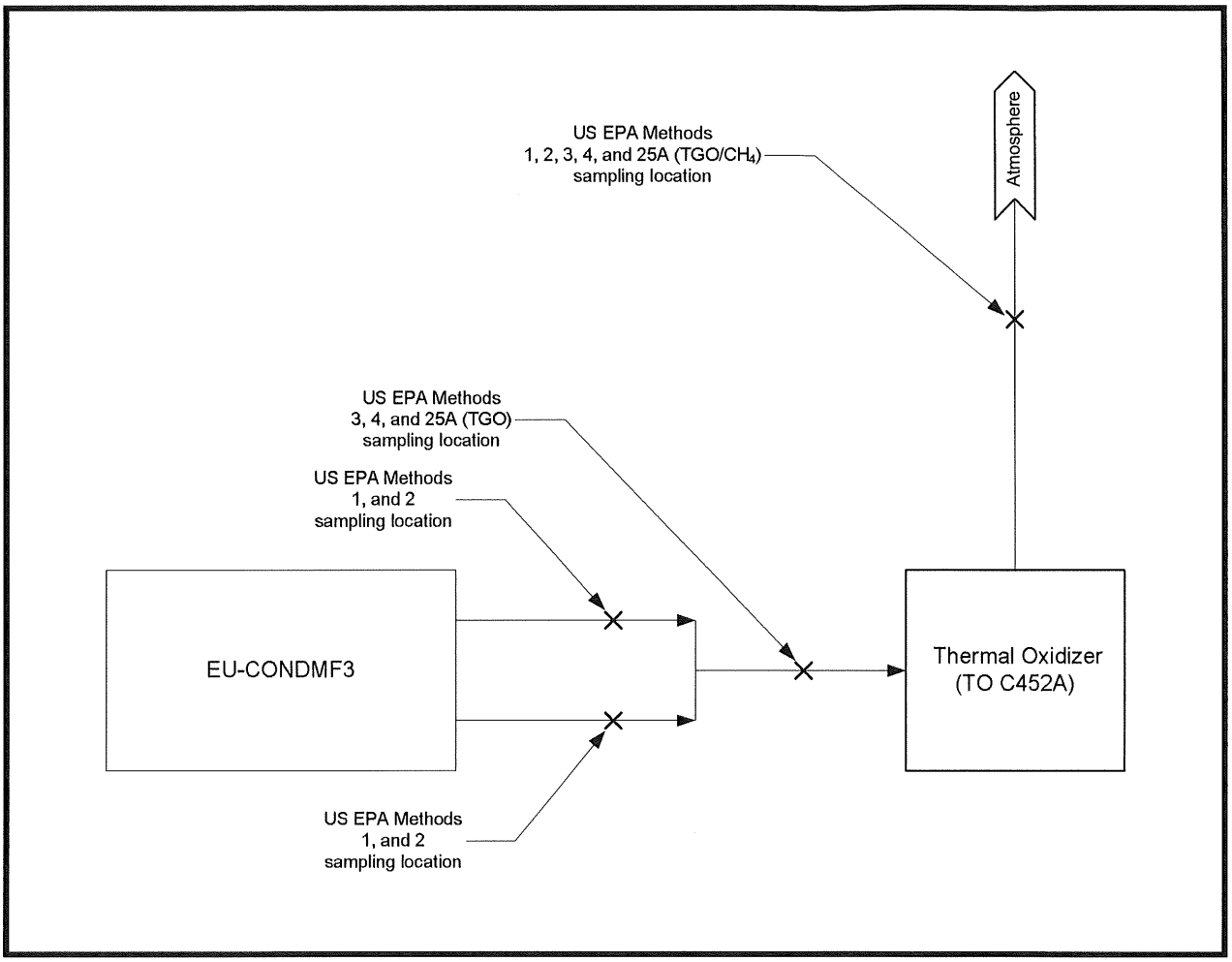
5.3 QUALITY STATEMENT

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).

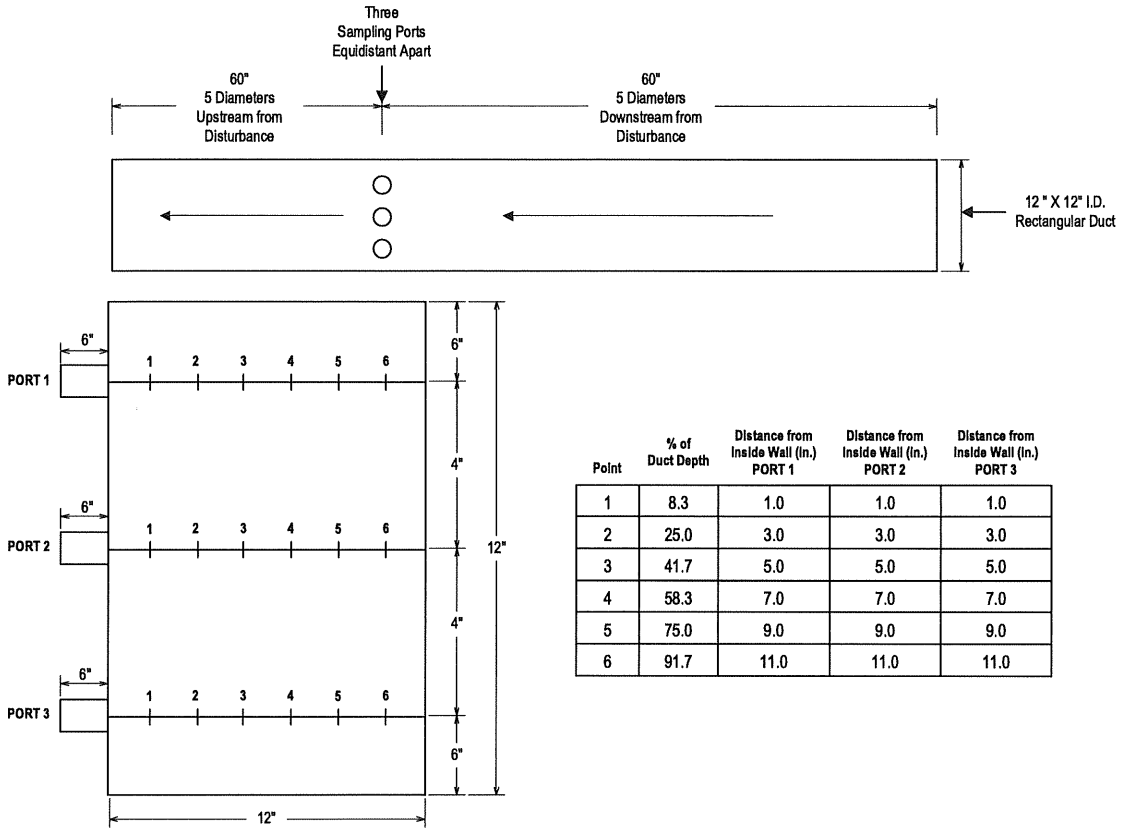
APPENDIX A
FIELD DATA AND CALCULATIONS

Appendix A.1
Sampling Locations

TO C452A SAMPLING LOCATION SCHEMATIC

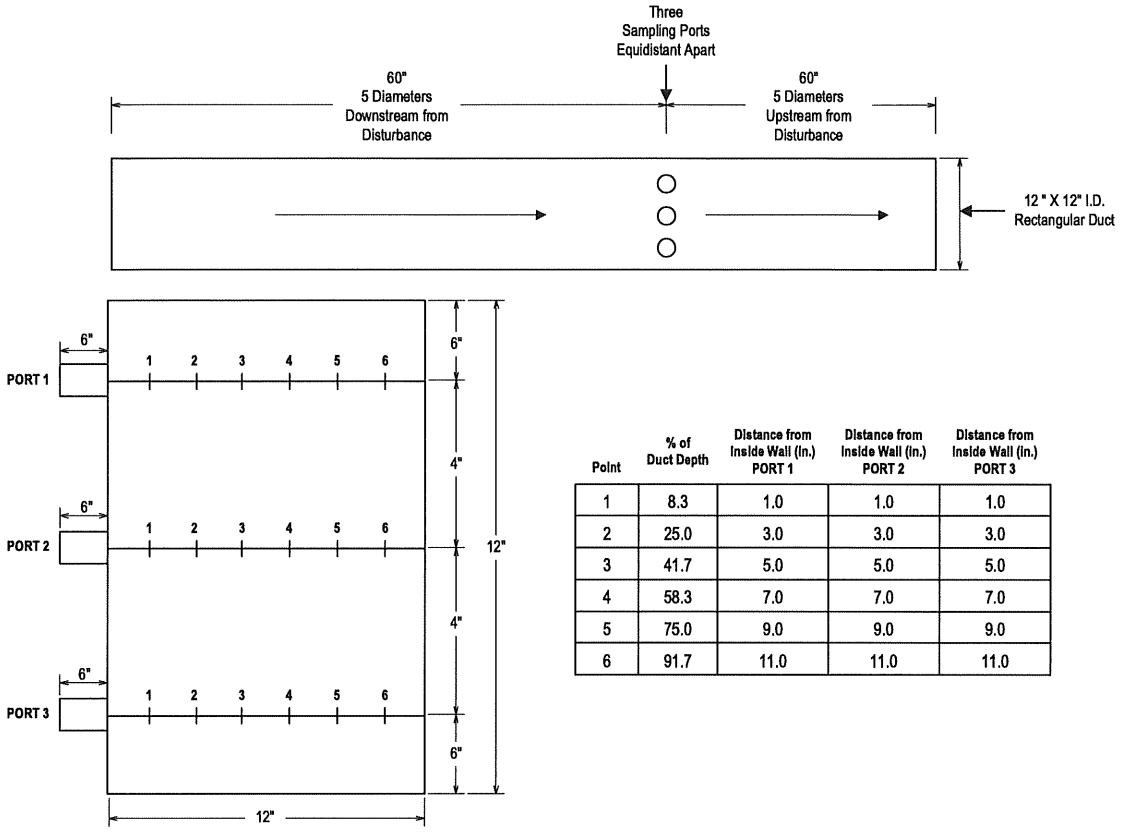


TO C452A INLET 1 FLOW TRAVERSE POINT SCHEMATIC



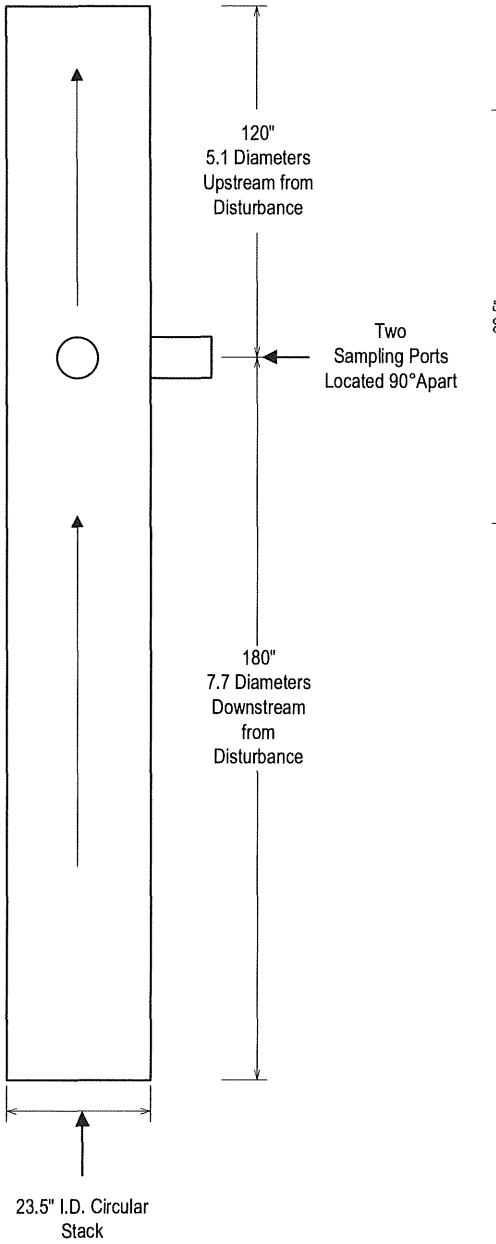
Point	% of Duct Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2	Distance from Inside Wall (in.) PORT 3
1	8.3	1.0	1.0	1.0
2	25.0	3.0	3.0	3.0
3	41.7	5.0	5.0	5.0
4	58.3	7.0	7.0	7.0
5	75.0	9.0	9.0	9.0
6	91.7	11.0	11.0	11.0

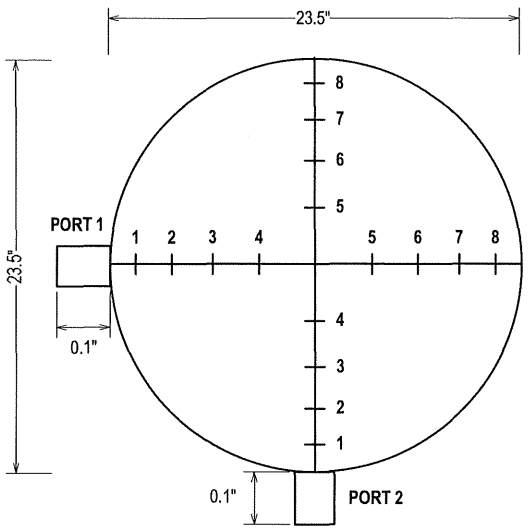
TO C452A INLET 2 FLOW TRAVERSE POINT SCHEMATIC



Point	% of Duct Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2	Distance from Inside Wall (in.) PORT 3
1	8.3	1.0	1.0	1.0
2	25.0	3.0	3.0	3.0
3	41.7	5.0	5.0	5.0
4	58.3	7.0	7.0	7.0
5	75.0	9.0	9.0	9.0
6	91.7	11.0	11.0	11.0

TO C452A EXHAUST FLOW TRAVERSE POINT SCHEMATIC





Point	% of Stack Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2
1	3.2	0.8	0.8
2	10.5	2.5	2.5
3	19.4	4.6	4.6
4	32.3	7.6	7.6
5	67.7	15.9	15.9
6	80.6	18.9	18.9
7	89.5	21.0	21.0
8	96.8	22.7	22.7