SOURCE TEST REPORT
2021 COMPLIANCE EMISSIONS TESTING

WESTERN MICHIGAN UNIVERSITY
ROBERT M. BEAM POWER PLANT
KALAMAZOO, MICHIGAN

RECIPROCATING INTERNAL COMBUSTION ENGINES (FGENGINES)

Prepared For:

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For Submittal To:

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ACCREDITED
TO ASTM D3518 ONLY
CERT #3925.01

MONTROSE
AIR QUALITY SERVICES

K2131-test-20210624

EXECUTIVE SUMMARY

Montrose Air Quality Services, LLC (Montrose) was retained by Western Michigan University (WMU) to measure carbon monoxide (CO), nitrogen oxides (NO_x), oxygen (O_2), and total volatile organic compounds (VOC) emissions at the exhausts of two natural gas-fired reciprocating internal combustion engines (RICE) (EU-ENGINE9 and EU-ENGINE10) located at WMU's Robert M. Beam Power Plant in Kalamazoo, Michigan. The facility operates under Michigan Department of Environment, Great Lakes, and Energy (EGLE) Renewable Operating Permit No. MI-ROP-K2131-2021.

The emissions testing is required by 40 CFR Part 60, Subpart JJJJ (Standards of Performance for Stationary Spark Ignition Internal Combustion Engines). Subpart JJJJ requires the following:

- CO emissions be ≤ 2.0 g/hp-hr or CO concentrations be ≤ 270 ppmvd corrected to 15% O_2
- NO_x emissions (as NO_2) be ≤ 1.0 g/hp-hr or NO_x concentrations be ≤ 82 ppmvd corrected to 15% O_2
- VOC (without formaldehyde (CH_2O)) emissions be ≤ 0.7 g/hp-hr or VOC (without CH_2O) concentrations be ≤ 60 ppmvd corrected to 15% O_2

The emissions test program was conducted on June 24, 2021. The results of the emissions test program are summarized in the following tables.

SUMMARY OF AVERAGE COMPLIANCE RESULTS -
EU-ENGINE9
JUNE 24, 2021

Parameter/Units	Average Results	Emission Limits
Nitrogen Oxides (NO_x as NO_2)		
ppmvd @ 15% O_2	67	82
g/hp-hr	0.7	1.0
Carbon Monoxide (CO)		
ppmvd @ 15% O_2	7	270
g/hp-hr	0.1	2.0
Volatile Organic Compounds, as Propane (VOC)*		
ppmvd @ 15% O_2	0	60
g/hp-hr	0.0	0.7

* Per MI-ROP-K2131-2021 and 40 CFR Part 60, Subpart JJJJ, this compliance demonstration of VOC must exclude CH_2O.

SUMMARY OF AVERAGE COMPLIANCE RESULTS - EU-ENGINE10 JUNE 24, 2021

Parameter/Units	Average Results	Emission Limits
Nitrogen Oxides (NO_x as NO_2)		
ppmvd @ 15% O_2	68	82
g/hp-hr	0.8	1.0
Carbon Monoxide (CO)		
ppmvd @ 15% O_2	7	270
g/hp-hr	0.1	2.0
Volatile Organic Compounds, as Propane (VOC)*		
ppmvd @ 15% O_2	0	60
g/hp-hr	0.0	0.7

* Per MI-ROP-K2131-2021 and 40 CFR Part 60, Subpart JJJJ, this compliance demonstration of VOC must exclude CH_2O.

REVIEW AND CERTIFICATION

All work, calculations, and other activities and tasks performed and presented in this document were carried out by me or under my direction and supervision. I hereby certify that, to the best of my knowledge, Montrose operated in conformance with the requirements of the Montrose Quality Management System and ASTM D7036-04 during this test project.

Signature: _____ Date: _____

Name: Todd Wessel Title: Client Project Manager

I have reviewed, technically and editorially, details, calculations, results, conclusions, and other appropriate written materials contained herein. I hereby certify that, to the best of my knowledge, the presented material is authentic, accurate, and conforms to the requirements of the Montrose Quality Management System and ASTM D7036-04.

Signature: _____ Date: _____

Name: Matthew Young Title: District Manager

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1.0 INTRODUCTION

1.1 SUMMARY OF TEST PROGRAM

Western Michigan University (State Registration No.: K2131) contracted Montrose Air Quality Services, LLC (Montrose) to perform a compliance test program on two natural gas-fired RICE Engines 1 (EU-ENGINE9) and 2 (EU-ENGINE10) at the Western Michigan University-Robert M. Beam Power Plant facility located in Kalamazoo, Michigan. Testing was performed on June 24, 2021, for the purpose of satisfying the emission testing requirements pursuant to Michigan Department of Environment, Great Lakes, and Energy (EGLE) Renewable Operation Permit No. MI-ROP-K2131-2021 and 40 CFR Part 60, Subpart JJJJ.

The specific objectives were to:

- Verify the emissions of nitrogen oxides (NO_x) (as NO_2), carbon monoxide (CO), and volatile organic compounds (VOC) (excluding formaldehyde (CH_2O)) at the exhaust stacks serving EU-ENGINE9 and EU-ENGINE10 in accordance with 40 CFR Part 60, Subpart JJJJ
- Conduct the test program with a focus on safety

Montrose performed the tests to measure the emission parameters listed in Tables 1-1 and 1-2.

TABLE 1-1
SUMMARY OF TEST PROGRAM - EU-ENGINE9

Test Date(s)	Unit ID/ Source Name	Activity/ Parameters	Test Methods	No. of Runs	Duration (Minutes)
6/24/2021	EU-ENGINE9	Velocity/Volumetric Flow Rate	EPA 1 & 2	3	5-6
6/24/2021	EU-ENGINE9	O_2, CO_2	EPA 3A	3	60
6/24/2021	EU-ENGINE9	Moisture	EPA 4	3	30
6/24/2021	EU-ENGINE9	NO_x	EPA 7E	3	60
6/24/2021	EU-ENGINE9	CO	EPA 10	3	60
6/24/2021	EU-ENGINE9	TGO, CH_4	40 CFR § 1065.260 and § 1065.265	3	60

TABLE 1-2
SUMMARY OF TEST PROGRAM - EU-ENGINE10

Test Date(s)	Unit ID/ Source Name	Activity/ Parameters	Test Methods	No. of Runs	Duration (Minutes)
6/24/2021	EU-ENGINE10	Velocity/Volumetric Flow Rate	EPA 1 & 2	3	4-7
6/24/2021	EU-ENGINE10	O_2, CO_2	EPA 3A	3	60
6/24/2021	EU-ENGINE10	Moisture	EPA 4	3	30
6/24/2021	EU-ENGINE10	NO_x	EPA 7E	3	60
6/24/2021	EU-ENGINE10	CO	EPA 10	3	60
6/24/2021	EU-ENGINE10	TGO, CH_4	40 CFR § 1065.260 and § 1065.265	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 Tables 1-3 and 1-4. 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 1-5. The tests were conducted according to the Intent-to-Test notification dated May 21, 2021, that was submitted to the EGLE.

TABLE 1-3
SUMMARY OF AVERAGE COMPLIANCE RESULTS -
EU-ENGINE9
JUNE 24, 2021

Parameter/Units	Average Results	Emission Limits
Nitrogen Oxides (NO_x as NO_2)		
ppmvd @ 15% O_2	67	82
g/hp-hr	0.7	1.0
Carbon Monoxide (CO)		
ppmvd @ 15% O_2	7	270
g/hp-hr	0.1	2.0
Volatile Organic Compounds, as Propane (VOC)*		
ppmvd @ 15% O_2	0	60
g/hp-hr	0.0	0.7

* Per MI-ROP-K2131-2021 and 40 CFR Part 60, Subpart JJJJ, this compliance demonstration of VOC must exclude CH_2O.

TABLE 1-4
SUMMARY OF AVERAGE COMPLIANCE RESULTS -
EU-ENGINE10
JUNE 24, 2021

Parameter/Units	Average Results	Emission Limits
Nitrogen Oxides (NO_x as NO_2)		
ppmvd @ 15% O_2	68	82
g/hp-hr	0.8	1.0
Carbon Monoxide (CO)		
ppmvd @ 15% O_2	7	270
g/hp-hr	0.1	2.0
Volatile Organic Compounds, as Propane (VOC)*		
ppmvd @ 15% O_2	0	60
g/hp-hr	0.0	0.7

* Per MI-ROP-K2131-2021 and 40 CFR Part 60, Subpart JJJJ, this compliance demonstration of VOC must exclude CH_2O.

1.2 KEY PERSONNEL

A list of project participants is included below:

Facility Information

Source Location:	Western Michigan University Robert M. Beam Power Plant 1903 West Michigan Avenue Kalamazoo, MI 49008	
Project Contact:	George Jarvis	Mark Weiss
Role:	Power Plant Director	Director of EHS
Company:	Western Michigan University	Western Michigan University
Telephone:	269-387-8548	269-387-5588
Email:	george.jarvis@wmich.edu	mark.weiss@wmich.edu

Agency Information

Regulatory Agency:	EGLE
Agency Contact:	Karen Kajiya-Mills
Telephone:	517-335-3122
Email:	kajiya-millk@michigan.gov

Testing Company Information

Testing Firm:	Montrose Air Quality Services, LLC	
Contact:	Matthew Young	Todd Wessel
Title:	District Manager	Client Project Manager
Telephone:	248-548-8070	248-548-8070
Email:	myoung@montrose-env.com	twessell@montrose-env.com

Subcontractor (or Consultant) Information

Company:	NTH Consultants, Ltd.
Contact:	Abbie Welch
Telephone:	616-450-6436
Email:	awelch@nthconsultants.com

Test personnel and observers are summarized in Table 1-5.

TABLE 1-5
TEST PERSONNEL AND OBSERVERS

Name	Affiliation	Role/Responsibility
Todd Wessel	Montrose	Client Project Manager, QI
Richard Collen Oakes	Montrose	Field Technician
George Jarvis	Western Michigan University	Observer/Client Liaison/Test Coordinator
Monica Brothers	EGLE	Observer
Trevon Drost	EGLE	Observer

2.0 PLANT AND SAMPLING LOCATION DESCRIPTIONS

2.1 PROCESS DESCRIPTION, OPERATION, AND CONTROL EQUIPMENT

Western Michigan University's Robert M. Beam Power Plant operates two 3,500 HP natural gas-fired reciprocating internal combustion engines (RICE) manufactured by Caterpillar. Each RICE is rated at 3,448 brake horsepower (HP) (2.5 megawatts (MW)) with a maximum heat input of 22 MMBtu/hr. Engine 1 (EU-ENGINE9) and Engine 2 (EU-ENGINE10) use lean-burn technology and are each equipped with oxidation catalysts for control of CO and VOC emissions. EU-ENGINE9 and EU-ENGINE10 were commissioned to provide electricity during on-peak hours to the WMU Kalamazoo campus. Both engines were in operation for the June 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 Diameter (in.)	Distance from Nearest Disturbance		Number of Traverse Points
		Downstream EPA "B" (in./dia.)	Upstream EPA "A" (in./dia.)	
EU-ENGINE9 Exhaust Stack	19.5	72.0 / 3.7	36.0 / 1.9	Flow: 16 (8/port); Gaseous: 3
EU-ENGINE10 Exhaust Stack	19.5	72.0 / 3.7	36.0 / 1.9	Flow: 16 (8/port); Gaseous: 3

Sampling locations were verified in the field to conform to EPA Method 1. Acceptable cyclonic flow conditions were confirmed prior to testing using EPA Method 1, Section 11.4. See Appendix A.1 for more information.

2.3 OPERATING CONDITIONS AND PROCESS DATA

Emission tests were performed while the engines were operating at greater than 90% capacity.

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. Data collected includes the following parameters:

- Engine output (KW) during testing
- Natural gas use
- Oxidation catalyst inlet temperature at least every 15-minutes
- Pressure drop across the oxidation catalyst once per run

3.0 SAMPLING AND ANALYTICAL PROCEDURES

3.1 TEST METHODS

The test methods for this test program were presented previously in Tables 1-1 and 1-2. 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.

The sample port and traverse point locations are detailed in Appendix A.

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 typical sampling system is detailed in Figure 3-1.

3.1.3 EPA Method 3A, Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)

EPA Method 3A is an instrumental test method used to measure the concentration of O_2 and CO_2 in stack gas. The effluent gas is continuously or intermittently sampled and conveyed to analyzers that measure the concentration of O_2 and CO_2. The performance requirements of the method must be met to validate data.

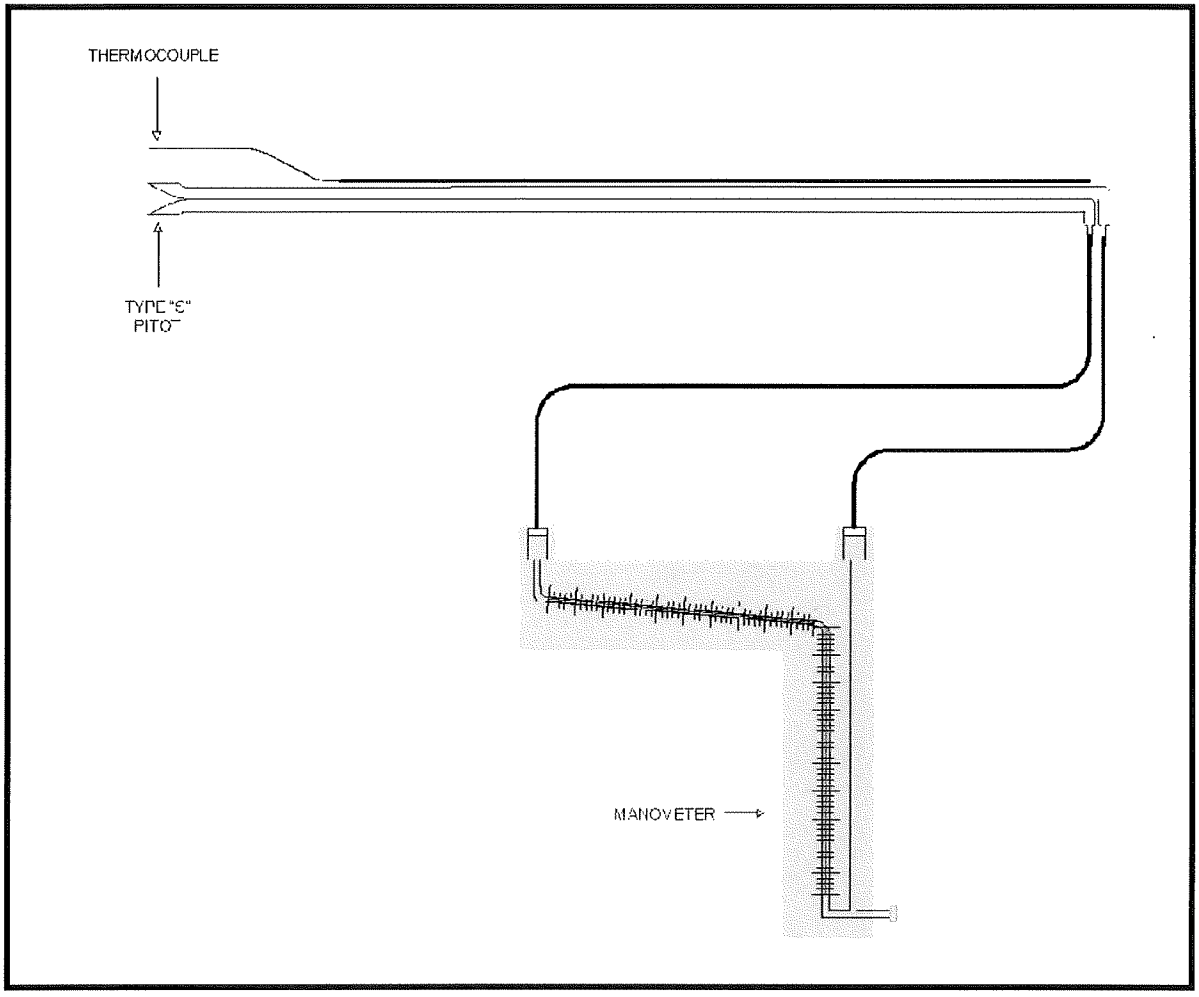
The typical sampling system is detailed in Figures 3-3 and 3-4.

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 typical sampling system is detailed in Figure 3-2.

FIGURE 3-1
EPA METHOD 2 SAMPLING TRAIN

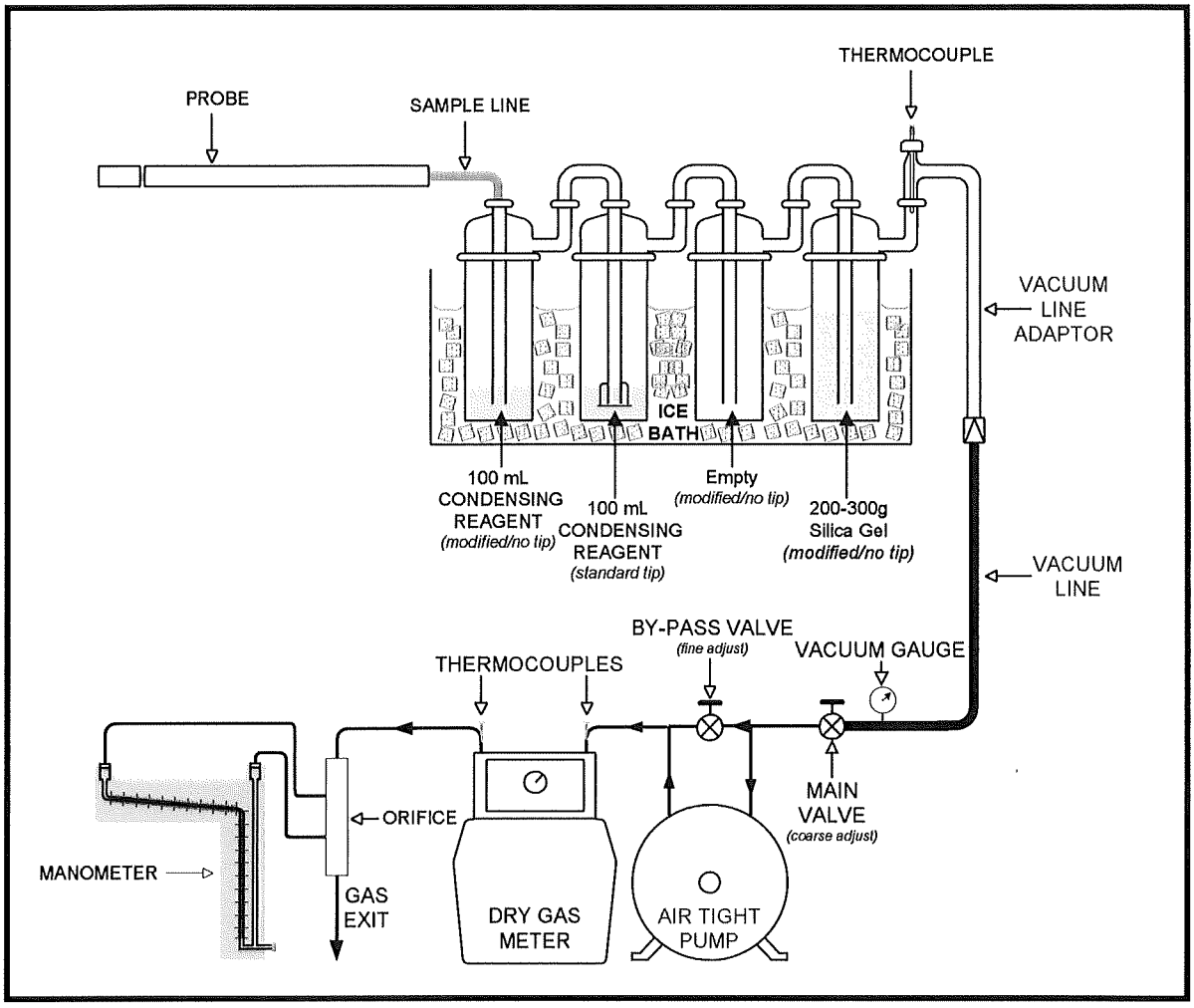


3.1.5 EPA Method 7E, Determination of Nitrogen Oxides Emissions from Stationary Source (Instrumental Analyzer Procedure)

EPA Method 7E is an instrumental test method used to continuously measure emissions of NO_x as NO_2. Conditioned gas is sent to an analyzer to measure the concentration of NO_x. NO and NO_2 can be measured separately or simultaneously together but, for the purposes of this method, NO_x is the sum of NO and NO_2. The performance requirements of the method must be met to validate the data.

The typical sampling system is detailed in Figure 3-3.

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

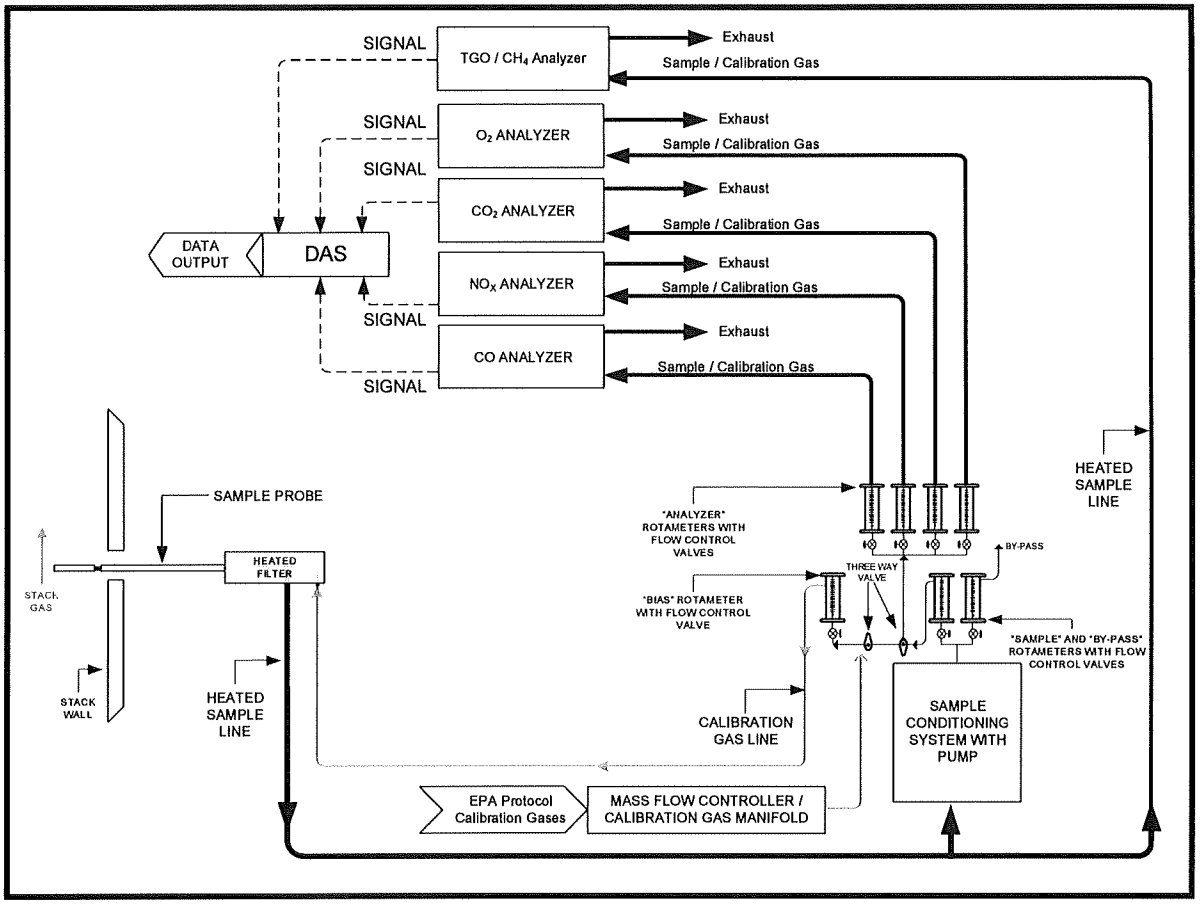


3.1.6 EPA Method 10, Determination of Carbon Monoxide Emissions from Stationary Sources (Instrumental Analyzer Procedure)

EPA Method 10 is an instrumental test method used to continuously measure emissions of CO. Conditioned gas is sent to an analyzer to measure the concentration of CO. The performance requirements of the method must be met to validate the data.

The typical sampling system is detailed in Figure 3-3.

FIGURE 3-3
EPA METHOD 3A, 7E, 10, 25A SAMPLING TRAIN



3.1.7 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.

For the purpose of this test, dual FIAs were utilized to measure THC (as propane) and CH_4 (as methane).

The typical sampling system is detailed in Figure 3-3.

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 compared to the permit limits in Tables 1-3 through 1-4. The results of individual compliance test runs performed are presented in Tables 4-1 through 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.

For EPA Method 25A, the reported total hydrocarbon (THC) concentrations were CH_4-corrected and reported as VOC (as propane). In instances where the CH_4-corrected THC (VOC) concentration was calculated to be negative, it was assigned a value of zero.

TABLE 4-1
NO_X, CO, AND VOC EMISSIONS RESULTS - EU-ENGINE9

Run Number	1	2	3	Average
Date	6/24/2021	6/24/2021	6/24/2021	--
Time	9:40-10:40	11:14-12:14	12:36-13:36	--
Process Data *				
Engine Load, KW	2,500	2,493	2,494	2,496
Engine Load, bhp	3,352	3,344	3,344	3,347
Flue Gas Parameters				
O_2, % volume dry	9.50	9.48	9.45	9.48
CO_2, % volume dry	6.43	6.42	6.43	6.43
flue gas temperature, °F	713.3	718.8	718.4	716.9
moisture content, % volume	11.97	12.35	11.98	12.10
volumetric flow rate, scfm	6,769	6,973	6,114	6,619
volumetric flow rate, dscfm	5,959	6,112	5,382	5,817
Nitrogen Oxides (NO_x as NO_2)				
ppmvd	129.5	127.5	130.8	129.3
ppmvd @ 15% O_2	67.1	65.9	67.4	66.8
lb/hr	5.53	5.58	5.04	5.38
g/hp-hr	0.75	0.76	0.68	0.73
Carbon Monoxide (CO)				
ppmvd	12.4	12.6	12.7	12.6
ppmvd @ 15% O_2	6.39	6.49	6.56	6.48
lb/hr	0.32	0.34	0.30	0.32
g/hp-hr	0.043	0.045	0.041	0.043
Total Hydrocarbons (THC), as Propane				
ppmvw	270.9	270.1	277.9	273.0
Methane (CH_4), as Propane				
ppmvw	281.8	306.3	294.5	294.2
Volatile Organic Compounds, as Propane (VOC) †				
ppmvd	0.00	0.00	0.00	0.00
ppmvd @ 15% O_2	0.00	0.00	0.00	0.00
lb/hr	0.00	0.00	0.00	0.00
g/hp-hr	0.00	0.00	0.00	0.00

* Process data for engine load (KW) was provided by WMU personnel, as shown in Appendix B of this report.

† Per MI-ROP-K2131-2021 and 40 CFR Part 60, Subpart JJJJ, this compliance demonstration of VOC must exclude CH_2O. Displayed concentrations and emissions were assigned a zero value. See Section 4.2 for details.

TABLE 4-2
NO_X, CO, AND VOC EMISSIONS RESULTS - EU-ENGINE10

Run Number	1	2	3	Average
Date	6/24/2021	6/24/2021	6/24/2021	--
Time	14:32-15:32	15:52-16:52	17:11-18:11	--
Process Data *				
Engine Load, KW	2,490	2,489	2,491	2,491
Engine Load, bhp	3,339	3,337	3,341	3,339
Flue Gas Parameters				
O_2, % volume dry	9.43	9.45	9.41	9.43
CO_2, % volume dry	6.41	6.45	6.45	6.44
flue gas temperature, °F	717.8	717.4	718.4	717.9
moisture content, % volume	12.94	12.34	13.73	13.00
volumetric flow rate, scfm	7,152	7,203	7,142	7,165
volumetric flow rate, dscfm	6,226	6,314	6,161	6,234
Nitrogen Oxides (NO_x as NO_2)				
ppmvd	129.9	131.6	133.1	131.5
ppmvd @ 15% O_2	66.8	67.8	68.3	67.7
lb/hr	5.80	5.95	5.87	5.87
g/hp-hr	0.79	0.81	0.80	0.80
Carbon Monoxide (CO)				
ppmvd	14.3	14.2	14.3	14.3
ppmvd @ 15% O_2	7.35	7.31	7.36	7.34
lb/hr	0.39	0.39	0.39	0.39
g/hp-hr	0.053	0.053	0.052	0.053
Total Gaseous Organic Compounds (TGO), as Propane				
ppmvw	284.9	315.2	288.5	296.2
Methane (CH_4), as Propane				
ppmvw	336.3	330.4	333.5	333.4
Volatile Organic Compounds, as Propane (VOC) †				
ppmvd	0.00	0.00	0.00	0.00
ppmvd @ 15% O_2	0.00	0.00	0.00	0.00
lb/hr	0.00	0.00	0.00	0.00
g/hp-hr	0.00	0.00	0.00	0.00

* Process data for engine load (KW) was provided by WMU personnel, as shown in Appendix B of this report.

† Per MI-ROP-K2131-2021 and 40 CFR Part 60, Subpart JJJJ, this compliance demonstration of VOC must exclude CH_2O. Displayed concentrations and emissions were assigned a zero value. See Section 4.2 for details.

5.0 INTERNAL QA/QC ACTIVITIES

5.1 QA/QC AUDITS

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

EPA Method 3A, 7E, and 10 calibration audits were all within the measurement system performance specifications for the calibration drift checks, system calibration bias checks, and calibration error checks.

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

The NO_2 to NO converter efficiency check of the analyzer was conducted per the procedures in EPA Method 7E, Section 8.2.4. The conversion efficiency met the criteria.

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.

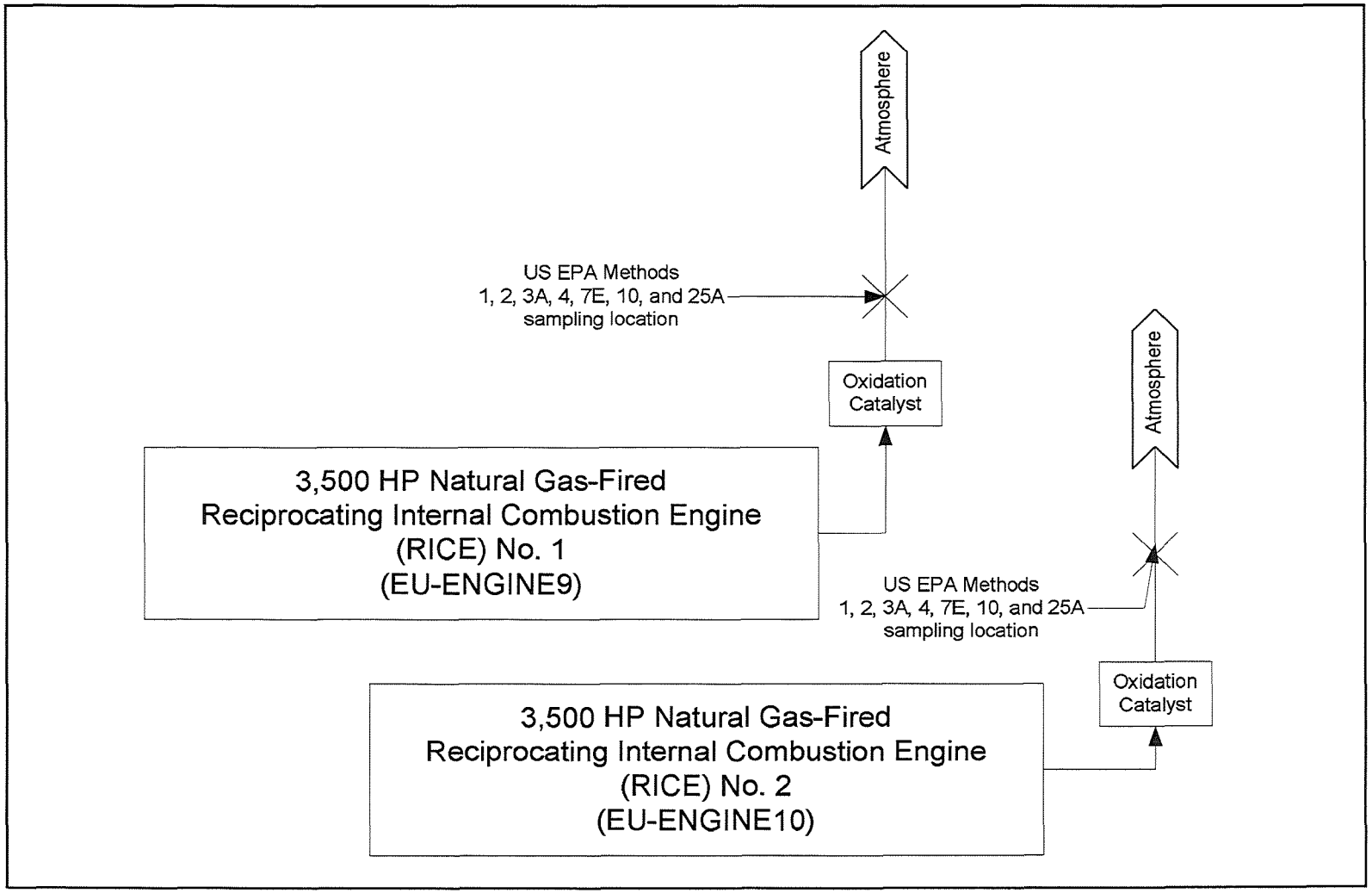
5.3 QUALITY STATEMENT

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).

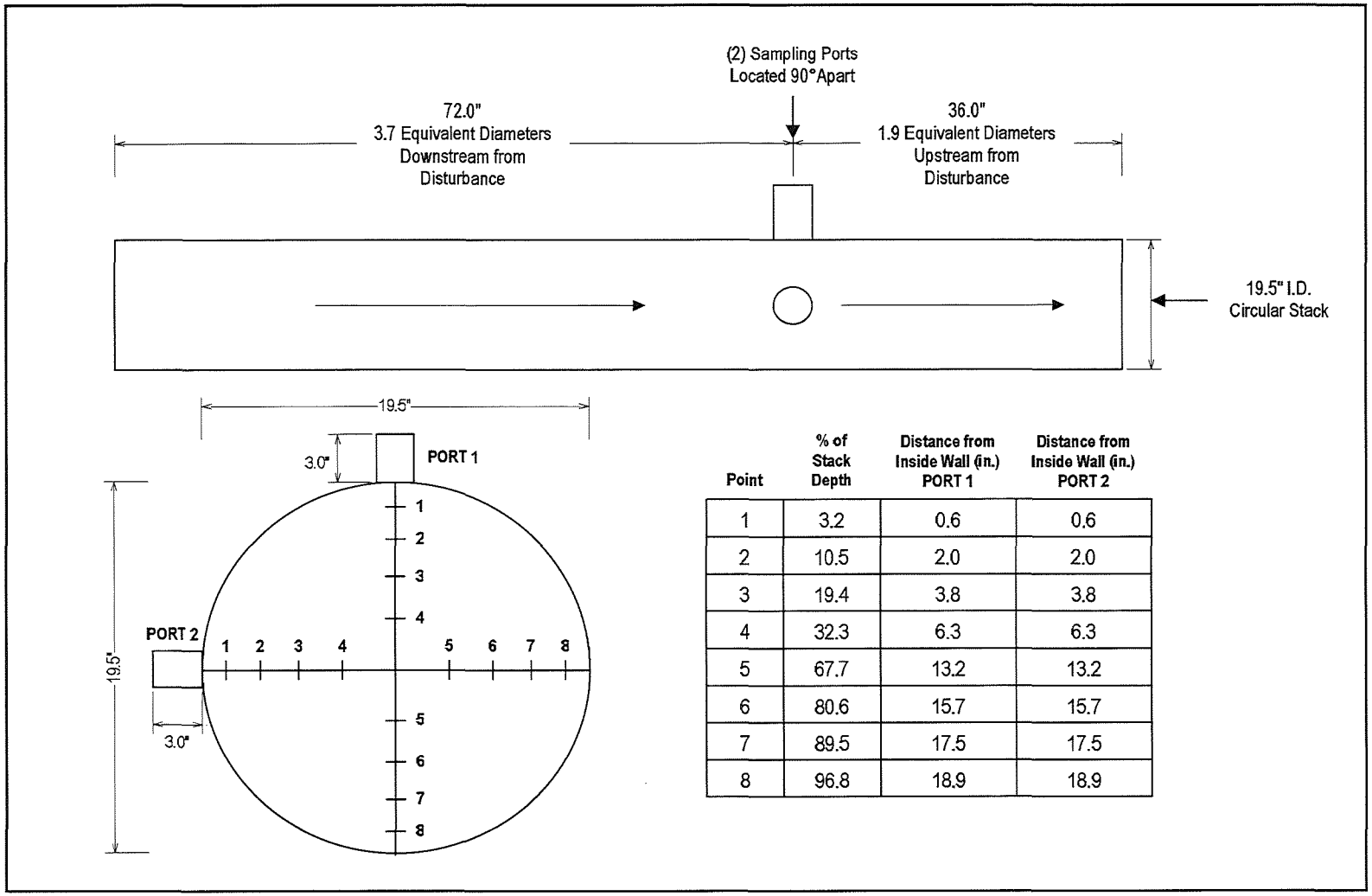
APPENDIX A
FIELD DATA AND CALCULATIONS

Appendix A.1
Sampling Locations

EU-ENGINE9 AND EU-ENGINE10 (6/24/2021) SAMPLING LOCATION SCHEMATIC

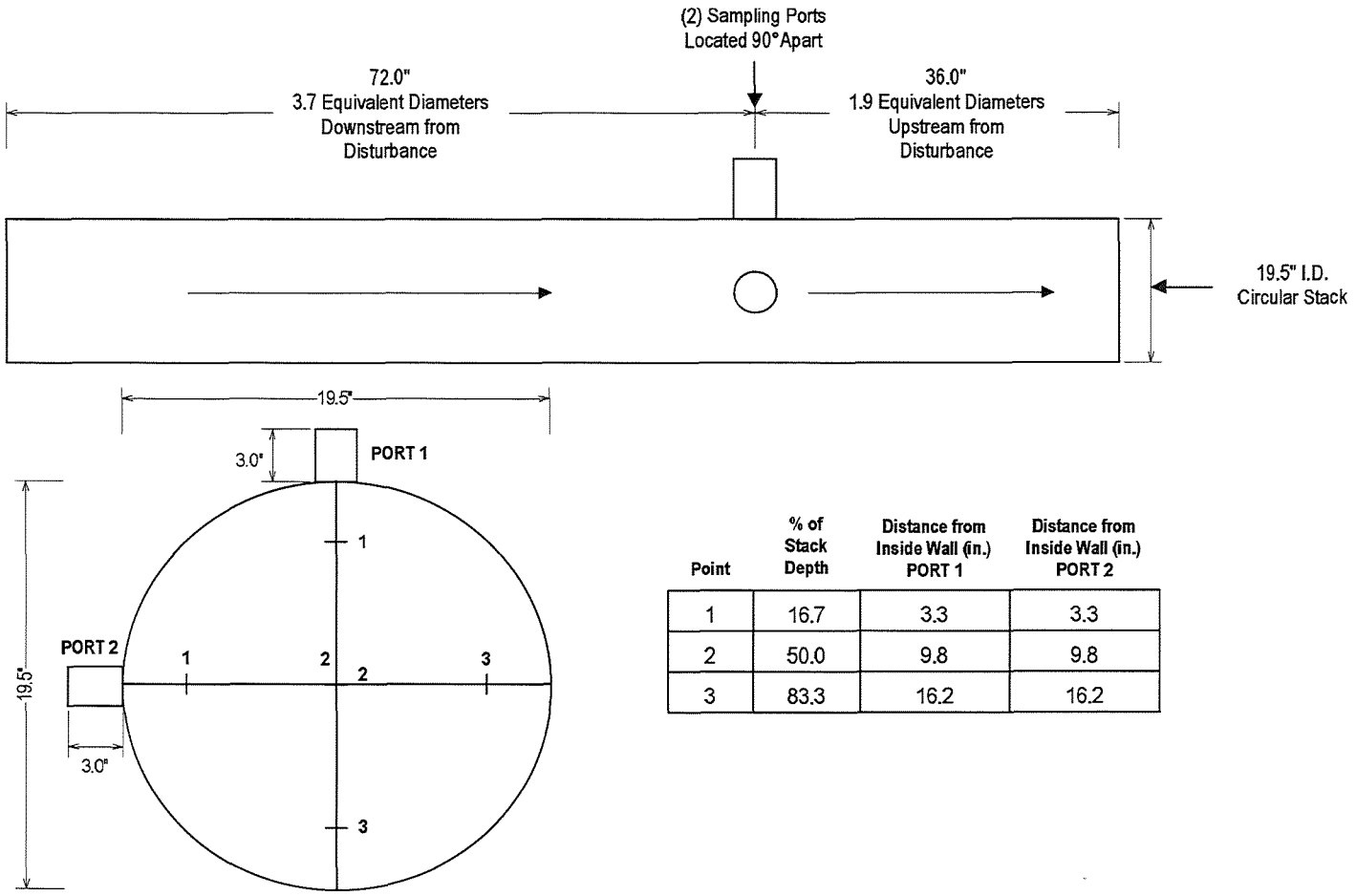


EU-ENGINE9 EXHAUST STACK FLOW TRAVERSE POINT LOCATION DRAWING



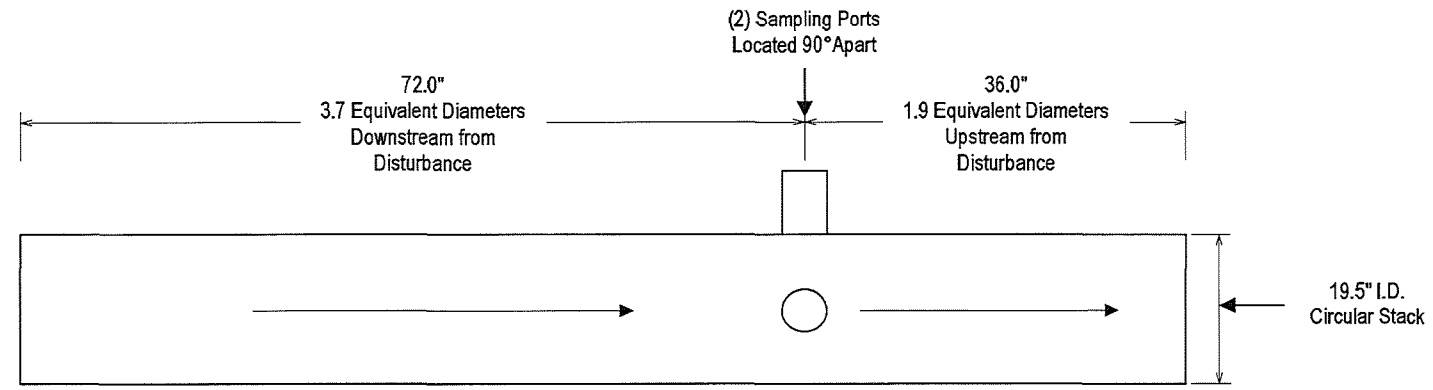
Point	% of Stack Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2
1	3.2	0.6	0.6
2	10.5	2.0	2.0
3	19.4	3.8	3.8
4	32.3	6.3	6.3
5	67.7	13.2	13.2
6	80.6	15.7	15.7
7	89.5	17.5	17.5
8	96.8	18.9	18.9

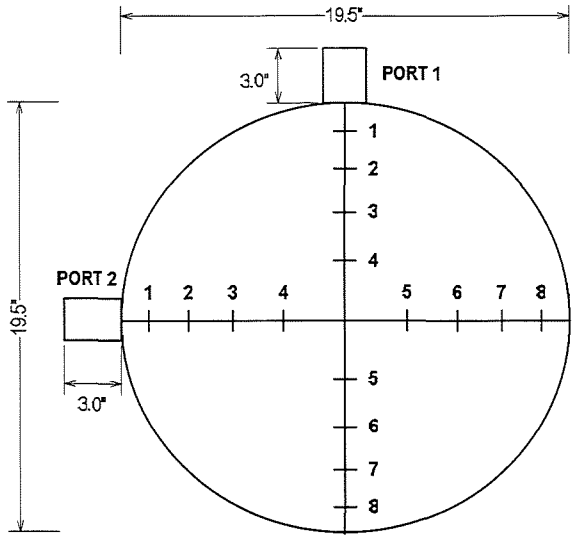
EU-ENGINE9 EXHAUST STACK CEMS TRAVERSE POINT LOCATION DRAWING



Point	% of Stack Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2
1	16.7	3.3	3.3
2	50.0	9.8	9.8
3	83.3	16.2	16.2

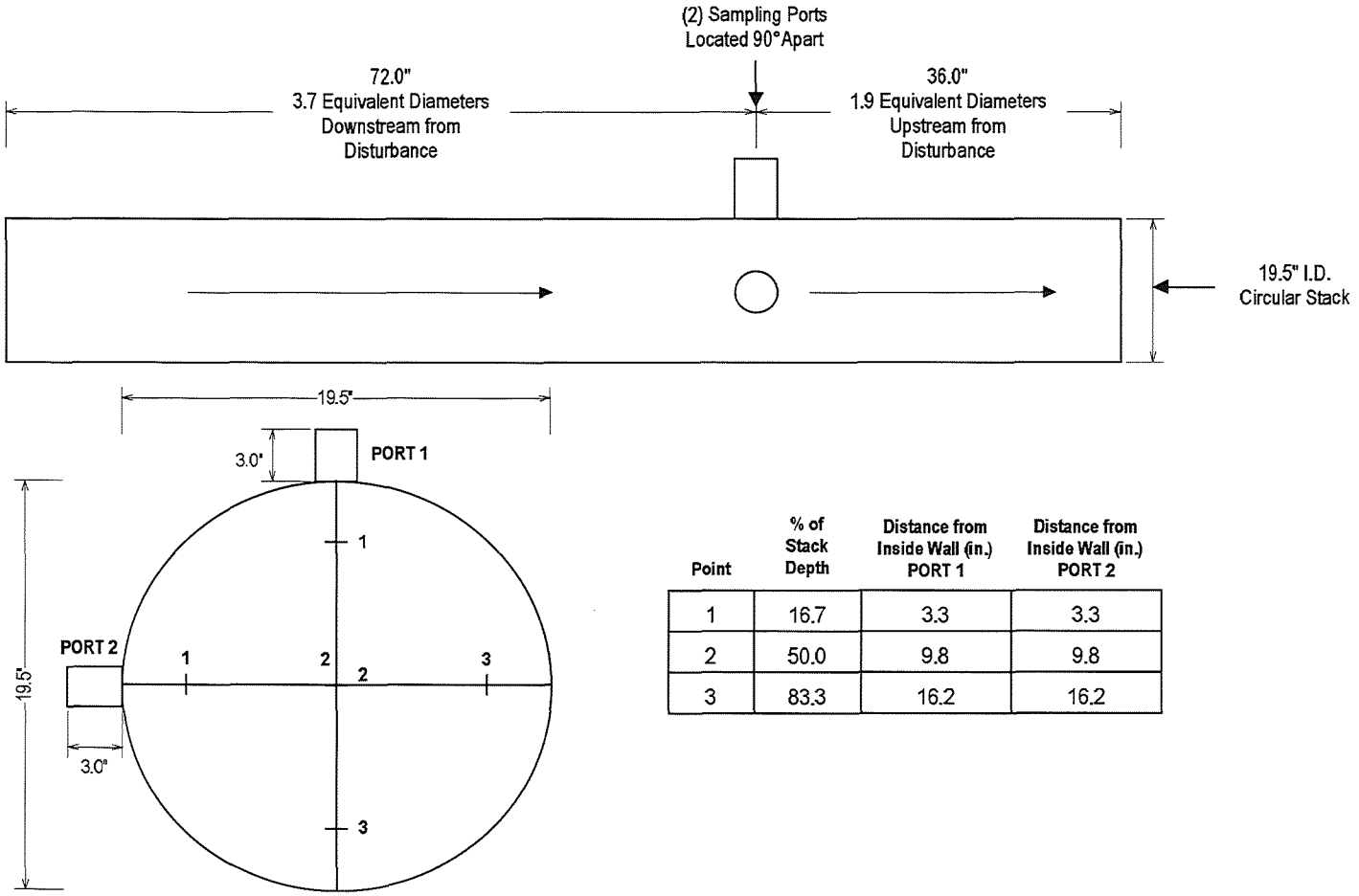
EU-ENGINE10 EXHAUST STACK FLOW TRAVERSE POINT LOCATION DRAWING





Point	% of Stack Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2
1	3.2	0.6	0.6
2	10.5	2.0	2.0
3	19.4	3.8	3.8
4	32.3	6.3	6.3
5	67.7	13.2	13.2
6	80.6	15.7	15.7
7	89.5	17.5	17.5
8	96.8	18.9	18.9

EU-ENGINE10 EXHAUST STACK CEMS TRAVERSE POINT LOCATION DRAWING



Point	% of Stack Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2
1	16.7	3.3	3.3
2	50.0	9.8	9.8
3	83.3	16.2	16.2

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