

1.0 INTRODUCTION

1.1 SUMMARY OF TEST PROGRAM

DTE Gas Company-Belle River Mills Compressor Station (State Registration No.: B6478) contracted Montrose Air Quality Services, LLC (Montrose) to perform a compliance test program on the Z-330 Compressor Engines No. 4 (EU017) and No. 5 (EU018) (FGRULE818ENGINES) at the Belle River Mills Compressor Station facility located in East China Township, Michigan. Testing was performed on August 17 and 19, 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-B6478-2016 and 40 CFR Part 60, Subpart JJJJ.

The specific objectives were to:

- Verify the emissions of nitrogen oxides (NO_x), carbon monoxide (CO), and non-methane non-ethane organic compounds (NMEOC) at the exhaust stacks serving EU017 and EU018
- 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(s)	Unit ID/ Source Name	Activity/ Parameters	Test Methods	No. of Runs	Duration (Minutes)
8/19/2021	EU017	O ₂	EPA 3A	3	60
8/19/2021	EU017	THC	EPA 25A	3	60
8/19/2021	EU017	Moisture, NO _x , CO, CH ₄ , C ₂ H ₆	EPA 320	3	60
8/17/2021	EU018	O ₂	EPA 3A	4	60
8/17/2021	EU018	THC	EPA 25A	4	60
8/17/2021	EU018	Moisture, NO _x , CO, CH ₄ , C ₂ H ₆	EPA 320	4	60

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

DTE Gas Company-Belle River Mills Compressor Station
2021 Compliance Source Test Report

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 1-2 and 1-3. 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 1-4. The tests were conducted according to the Test Plan dated March 5, 2021, that was submitted to the EGLE.

**TABLE 1-2
SUMMARY OF AVERAGE COMPLIANCE RESULTS -
EU017
AUGUST 19, 2021**

Parameter/Units	Average Results	40 CFR Part 60, Subpart JJJJ Emission Limits	MI-ROP-B6478-2016 Emission Limits
Nitrogen Oxides (NO_x) g/bhp-hr	1.76	2.0	3.0
Carbon Monoxide (CO) g/bhp-hr	1.75	4.0	3.0
Non-Methane Non-Ethane Organic Compounds (NMEOC) g/bhp-hr	0.0	1.0	1.0

**TABLE 1-3
SUMMARY OF AVERAGE COMPLIANCE RESULTS -
EU018
AUGUST 17, 2021**

Parameter/Units	Average Results	40 CFR Part 60, Subpart JJJJ Emission Limits	MI-ROP-B6478-2016 Emission Limits
Nitrogen Oxides (NO_x) g/bhp-hr	1.92	2.0	3.0
Carbon Monoxide (CO) g/bhp-hr	2.20	4.0	3.0
Non-Methane Non-Ethane Organic Compounds (NMEOC) g/bhp-hr	0.0	1.0	1.0

RECEIVED

OCT 15 2021

DTE Gas Company-Belle River Mills Compressor Station
2021 Compliance Source Test Report

Test personnel and observers are summarized in Table 1-4.

**TABLE 1-4
TEST PERSONNEL AND OBSERVERS**

Name	Affiliation	Role/Responsibility
Matthew Young	Montrose	District Manager
Scott Dater	Montrose	Field Technician
Cody Shifflet	Prism	FTIR Analyst
Amanda Nilles	Prism	FTIR Analyst
Mark Grigereit	DTE Energy	Observer/Client Liaison/Test Coordinator
Matthew Karl	EGLE	Observer

2.0 PLANT AND SAMPLING LOCATION DESCRIPTIONS

2.1 PROCESS DESCRIPTION, OPERATION, AND CONTROL EQUIPMENT

The DTE Gas Company-Belle River Mills Compressor Station operates two Cooper model Z330 10,000 HP natural gas-fired, 2-cycle lean-burn reciprocating internal combustion engines (RICE) (derated to 9,000 HP). Engine No. 4 (EU017) and Engine No. 5 (EU018) are each used to power a natural gas pipeline compressor. Both engines were in operation for this test event.

2.2 FLUE GAS SAMPLING LOCATIONS

See Appendix A.1 for a sampling location drawing.

2.3 OPERATING CONDITIONS AND PROCESS DATA

Emission tests were performed while EU017 and EU018 were operating at greater than 90% of maximum load.

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:

- Gross Caloric Value, BTU
- Load, %
- Speed, RPM
- Brake-HP, BHP-hr (dry)
- Fuel Flow, 100/sdf/hr
- Heat Input Rate, MMBtu/hr

RECEIVED

OCT 15 2021

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 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 O₂ and CO₂ in stack gas. The effluent gas is continuously or intermittently sampled and conveyed to analyzers that measure the concentration of O₂ and CO₂. The performance requirements of the method must be met to validate data.

The typical sampling system is detailed in Figure 3-1.

3.1.2 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.

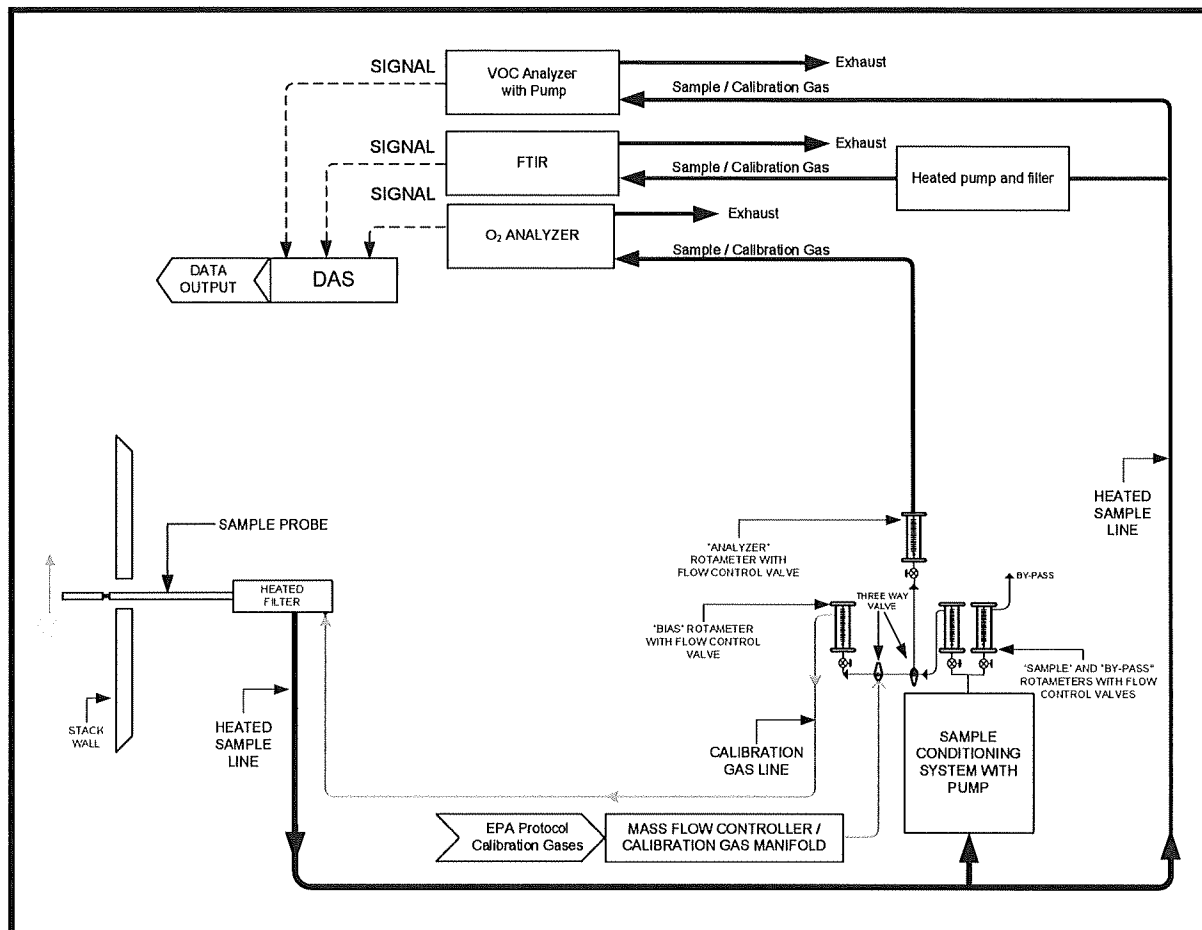
The typical sampling system is detailed in Figure 3-1.

3.1.3 EPA Method 320, Measurement of Vapor Phase Organic and Inorganic Emissions by Extractive FTIR Spectroscopy

EPA Method 320 is an instrumental test method used to measure specific analyte concentrations for which EPA reference spectra have been developed or prepared. Extractive emission measurements are performed using FTIR spectroscopy. The FTIR analyzer is composed of a spectrometer and detector, a high optical throughput sampling cell, analysis software, and a quantitative spectral library. The analyzer collects high resolution spectra in the mid infrared spectral region (400 to 4,000 cm⁻¹), which are analyzed using the quantitative spectral library. This provides an accurate, highly sensitive measurement of gases and vapors.

The typical sampling system is detailed in Figure 3-1.

**FIGURE 3-1
 EPA METHODS 3A (O₂), 25A, 320 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

As a result of an equipment malfunction, the calibration line for the FTIR was damaged during Run 1 at the EU018 Exhaust Stack. The run was voided, and an additional run (Run 4) was performed. Run 1 data is included in this report for informational purposes only.

4.2 PRESENTATION OF RESULTS

The average results are compared to the permit limits in Tables 1-2 and 1-3. The results of individual compliance 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.

The $\text{CH}_4/\text{C}_2\text{H}_6$ correction of THC concentration values measured at the EU017 Exhaust Stack and EU018 Exhaust Stack resulted in negative values. As a result, the $\text{CH}_4/\text{C}_2\text{H}_6$ -corrected THC (NMEOC) displayed in Tables 4-2 and 4-4 have been assigned values of zero.

DTE Gas Company-Belle River Mills Compressor Station
2021 Compliance Source Test Report

TABLE 4-1
NO_x, CO EMISSIONS RESULTS -
EU017

Run Number	1	2	3	Average
Date	8/19/2021	8/19/2021	8/19/2021	--
Time	10:56-11:56	12:05-13:05	13:15-14:15	--
Process Data *				
Gross Caloric Value, BTU/cf	1045.5	1045.5	1045.5	1045.5
Load, %	92.4	91.8	91.6	91.9
Speed, RPM	295.3	294.7	295.0	295.0
Brake-HP, BHP-hr	8249.3	8191.7	8185.3	8208.8
Fuel Flow, cfh	625.7	624.9	625.2	625.3
Heat Input Rate, MMBtu/hr	65.4	65.3	65.4	65.4
Flue Gas Parameters				
O ₂ , % volume dry	15.31	15.27	15.24	15.27
moisture content, % volume	7.60	7.70	7.70	7.67
Nitrogen Oxides (NO_x)				
ppmvd	124.7	125.7	127.5	126.0
lb/MMBtu	0.48	0.49	0.49	0.49
lb/hr	31.7	31.7	32.0	31.8
lb/MMscf fuel	506.9	507.3	512.1	508.7
g/BHP-hr	1.74	1.76	1.77	1.76
Carbon Monoxide (CO)				
ppmvd	205.2	207.3	207.0	206.5
lb/MMBtu	0.49	0.49	0.48	0.49
lb/hr	31.8	31.8	31.7	31.8
lb/MMscf fuel	507.9	509.3	506.2	507.8
g/BHP-hr	1.75	1.76	1.75	1.75

* Process data was provided by DTE Energy personnel.

DTE Gas Company-Belle River Mills Compressor Station
2021 Compliance Source Test Report

**TABLE 4-2
NMEOC EMISSIONS RESULTS -
EU017**

Run Number	1	2	3	Average
Date	8/19/2021	8/19/2021	8/19/2021	--
Time	10:56-11:56	12:05-13:05	13:15-14:15	--
Process Data *				
Gross Caloric Value, BTU/cf	1045.5	1045.5	1045.5	1045.5
Load, %	92.4	91.8	91.6	91.9
Speed, RPM	295.3	294.7	295.0	295.0
Brake-HP, BHP-hr	8249.3	8191.7	8185.3	8208.8
Fuel Flow, cfh	625.7	624.9	625.2	625.3
Heat Input Rate, MMBtu/hr	65.4	65.3	65.4	65.4
Flue Gas Parameters				
O ₂ , % volume dry	15.31	15.27	15.24	15.27
moisture content, % volume	7.60	7.70	7.70	7.67
Total Hydrocarbon (THC), as propane				
ppmvd	489.5	492.6	491.9	453.7
Methane (CH₄)				
ppmvd	1148	1164	1169	1161
Methane:Propane RF	2.40	2.40	2.40	2.40
ppmvd, as propane	478.4	485.2	487.0	483.6
Ethane (C₂H₆)				
ppmvd	56.7	56.3	55.9	56.3
Ethane:Propane RF	1.50	1.50	1.50	1.50
ppmvd, as propane	37.8	37.6	37.3	37.5
Non-Methane Non-Ethane Organic Compounds (NMEOC), as propane †				
ppmvd	0.0	0.0	0.0	0.0
lb/MMBtu	0.0	0.0	0.0	0.0
lb/hr	0.0	0.0	0.0	0.0
lb/MMscf fuel	0.0	0.0	0.0	0.0
g/BHP-hr	0.0	0.0	0.0	0.0

* Process data was provided by DTE Energy personnel.

† Negative CH₄/C₂H₆-corrected THC (NMEOC) results were assigned a value of zero.

DTE Gas Company-Belle River Mills Compressor Station
2021 Compliance Source Test Report

**TABLE 4-3
NO_x, CO EMISSIONS RESULTS -
EU018**

Run Number	1	2	3	Average
Date	8/17/2021	8/17/2021	8/17/2021	--
Time	14:45-15:45	16:00-17:00	17:15-18:15	--
Process Data *				
Gross Caloric Value, BTU/cf	1047.6	1047.6	1047.6	1047.6
Load, %	91.9	92.2	92.1	92.0
Speed, RPM	295.0	295.3	295.0	295.1
Brake-HP, BHP-hr	8208.3	8250.3	8230.0	8229.6
Fuel Flow, cfh	640.3	638.8	637.7	638.9
Heat Input Rate, MMBtu/hr	67.1	66.9	66.8	66.9
Flue Gas Parameters				
O ₂ , % volume dry	15.26	15.26	15.25	15.25
moisture content, % volume	7.7	7.8	7.7	7.73
Nitrogen Oxides (NO_x)				
ppmvd	132.4	135.8	136.8	135.0
lb/MMBtu	0.51	0.52	0.53	0.52
lb/hr	34.2	35.0	35.2	34.8
lb/MMscf fuel	534.1	547.9	551.2	544.4
g/BHP-hr, dry	1.89	1.92	1.94	1.92
Carbon Monoxide (CO)				
ppmvd	258.2	253.6	252.9	254.9
lb/MMBtu	0.61	0.59	0.59	0.60
lb/hr	40.6	39.8	39.5	40.0
lb/MMscf fuel	634.2	622.9	620.2	625.8
g/BHP-hr	2.24	2.19	2.18	2.20

* Process data was provided by DTE Energy personnel.

DTE Gas Company-Belle River Mills Compressor Station
2021 Compliance Source Test Report

**TABLE 4-4
NMEOC EMISSIONS RESULTS -
EU018**

Run Number	1	2	3	Average
Date	8/17/2021	8/17/2021	8/17/2021	--
Time	14:45-15:45	16:00-17:00	17:15-18:15	--
Process Data *				
Gross Caloric Value, BTU/cf	1047.6	1047.6	1047.6	1047.6
Load, %	91.9	92.2	92.1	92.0
Speed, RPM	295.0	295.3	295.0	295.1
Brake-HP, BHP-hr	8208.3	8250.3	8230.0	8229.6
Fuel Flow, cfh	640.3	638.8	637.7	638.9
Heat Input Rate, MMBtu/hr	67.1	66.9	66.8	66.9
Flue Gas Parameters				
O ₂ , % volume dry	15.26	15.26	15.25	15.25
moisture content, % volume	7.70	7.80	7.70	7.73
Total Hydrocarbon (THC), as propane				
ppmvd	603.8	611.5	596.3	557.1
Methane (CH₄)				
ppmvd	1379	1389	1384	1384
Methane:Propane RF	2.40	2.40	2.40	2.40
ppmvd, as propane	574.6	578.6	576.7	576.6
Ethane (C₂H₆)				
ppmvd	57.7	58.7	58.4	58.3
Ethane:Propane RF	1.50	1.50	1.50	1.50
ppmvd, as propane	38.5	39.1	38.9	38.8
Non-Methane Non-Ethane Organic Compounds (NMEOC), as propane †				
ppmvd	0.0	0.0	0.0	0.0
lb/MMBtu	0.0	0.0	0.0	0.0
lb/hr	0.0	0.0	0.0	0.0
lb/MMscf fuel	0.0	0.0	0.0	0.0
g/BHP-hr	0.0	0.0	0.0	0.0

* Process data was provided by DTE Energy personnel.

† Negative CH₄/C₂H₆-corrected THC (NMEOC) results were assigned a value of zero.

RECEIVED

OCT 15 2021

AIR QUALITY DIVISION

5.0 INTERNAL QA/QC ACTIVITIES

5.1 QA/QC AUDITS

EPA Method 3A 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.

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

The EPA Method 320 performance parameters measured included signal to noise tests, noise equivalent absorbance (NEA), detector linearity, background spectra, potential interferents, and cell and system leakage. Quality assurance procedures included baseline measurement with ultra-high purity nitrogen, measurement of a calibration transfer standard (~100 ppm ethylene), direct analyte calibration measurements, and measurements to determine baseline shift. SF₆ was also used as a tracer gas in the calibration gases to evaluate dilution ratios and verify the sample delivery system integrity. A dynamic matrix spike was performed using SF₆ as a tracer gas. The method QA/QC criteria were met.

5.2 QA/QC DISCUSSION

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

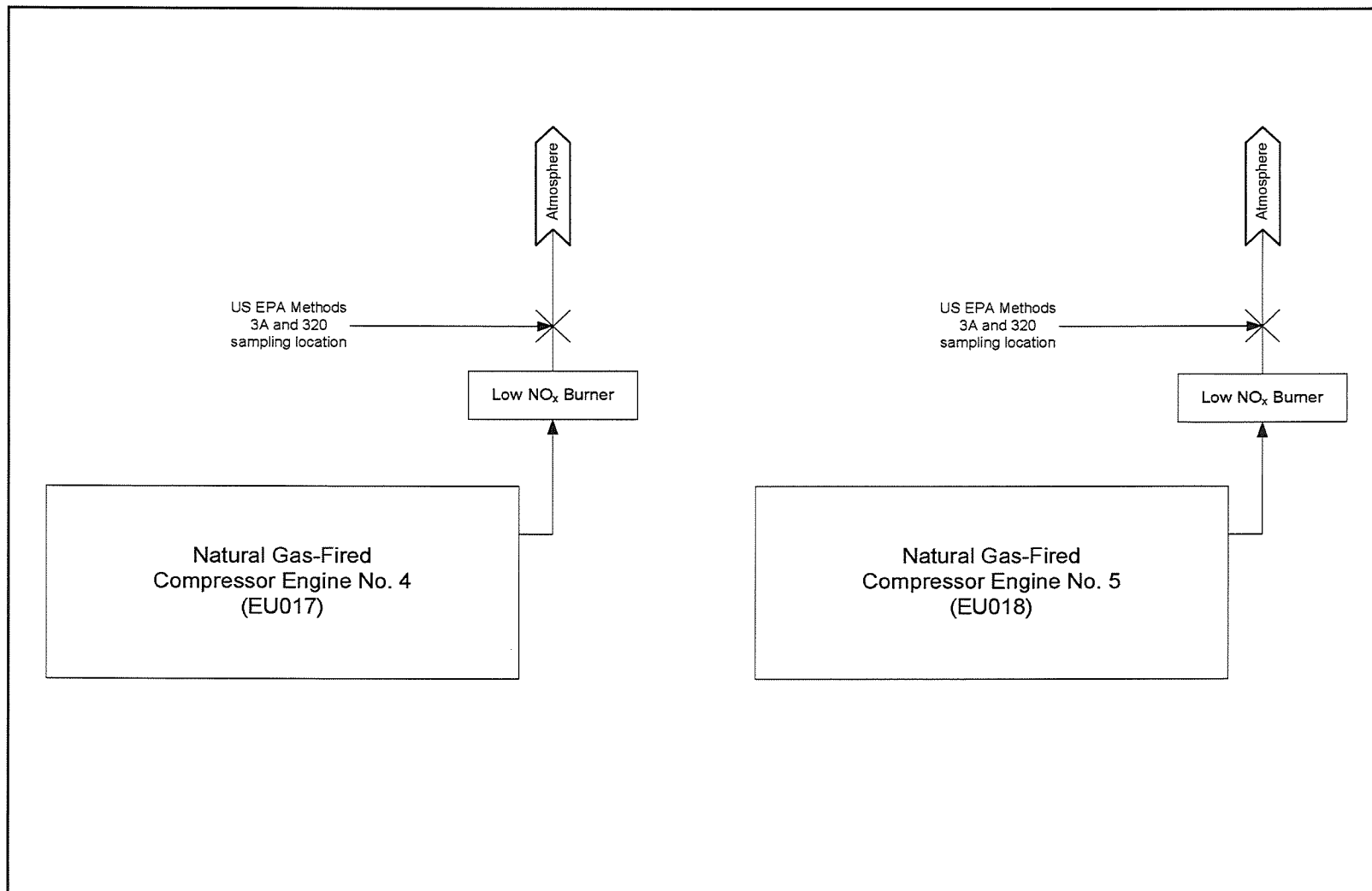
5.3 QUALITY STATEMENT

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

EU017 AND EU018 SAMPLING LOCATION SCHEMATIC



THIS PAGE LEFT INTENTIONALLY BLANK.