COMPLIANCE TEST REPORT

for

CARBON MONOXIDE EMISSIONS (CO)

UNITS 11-1 to 11-5

SRN: B2802

Oliver Substation
Pigeon, Michigan

RECEIVED
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AIR QUALITY DIV.

October 5-7, 2015

Prepared By
Environmental Management & Resources
Environmental Field Services Group
DTE Corporate Services, LLC
7940 Livernois H-136
Detroit, MI 48210

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EXECUTIVE SUMMARY

DTE Energy's Environmental Management and Resources (EM&R) Field Services Group, performed emissions testing on five (5) 3,600 Brake-HP diesel engines located at the Oliver Substation in Mayville, Michigan. The fieldwork, performed on October 5-7, 2015 was conducted to satisfy requirements of 40CFR Part 63 Subpart ZZZZ. Emission tests were performed on Units 11-1 to 11-5 for carbon monoxide (CO) destruction efficiency.

The results of the emissions testing are highlighted below:

CO Emissions Test Results
Oliver Substation
October, 2015

Date	Unit	Average CO Destruction Efficiency (%)
10-5-15	11-5	76.8
10-6-15	11-4	84.1
10-6-15	11-3	79.8
10-7-15	11-2	84.7
10-7-15	11-1	77.8

Subpart ZZZZ Limit: Limit the concentration of CO in the stationary RICE exhaust to 23 ppmvd or less at 15% O2; or Reduce CO emissions by 70% or more

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1.0 INTRODUCTION

DTE Energy's Environmental Management and Resources (EM&R) Field Services Group, performed emissions testing on five (5) 3,600 Brake-HP diesel engines located at the Oliver Substation in Mayville, Michigan. The fieldwork, performed on October 5-7, 2015 was conducted to satisfy requirements of 40CFR Part 63 Subpart ZZZZ. Emission tests were performed on Units 11-1 to 11-5 for carbon monoxide (CO) destruction efficiency.

Testing was performed pursuant to Title 40, *Code of Federal Regulations*, Part 60, Appendix A (40 CFR §60 App. A), Methods 3A and 10.

The fieldwork was performed in accordance with EPA Reference Methods, the requirements outlined in 40CFR Part 63 Subpart ZZZZ, and EM&R's Intent to Test[1], Test Plan Submittal, which was approved in a letter by Mr. Tom Gasloli from the Michigan Department of Environmental Quality (MDEQ), dated June 8, 2015. The following EM&R personnel participated in the testing program: Mr. Thomas Snyder, Senior Technician, and Mr. Mark Grigereit, Principal Engineer. Mr. Brad McIntyre, Operator with DTE - Electric, and Mr. Rahn Ledesma, Reliability Supervisor with DTE Electric, provided process coordination for the testing program.

2.0 SOURCE DESCRIPTION

The Oliver Substation located at 346 S. Gagetown Rd, Pigeon, Michigan, employs the use of five EM&D, MP45, 20 cylinder, 3,600 Horse Power diesel engines (Units 11-1 to 11-5). The engines generate supplemental electrical power during peak electrical demand periods or when required for load stability. On site diesel generators produce the electrical power supply which is sent to the electrical grid. Each unit is capable of producing approximately 2.5 GMW at full load conditions.

The emissions from the engines are exhausted through individual catalyst beds and to the atmosphere through individual exhaust stacks.

During the emissions testing the engines were operated at 100% load conditions (2.5 MW).

A schematic representation of the engines exhausts and sampling locations are presented in Figure 1. Sampling was performed in the duct prior to and downstream of the catalyst bed.

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[1] MDEQ, Test Plan, Submitted May 6, 2015. (Attached-Appendix A)
[2] MDEQ, Approval Letter (Attached-Appendix A)

3.0 SAMPLING AND ANALYTICAL PROCEDURES

DTE Energy obtained emissions measurements in accordance with procedures specified in the USEPA *Standards of Performance for New Stationary Sources*. The sampling and analytical methods used in the testing program are indicated in the table below:

Sampling Method	Parameter	Analysis
USEPA Method 3A	Oxygen	Instrumental Analyzer Method
USEPA Method 10	Carbon Monoxide	NDIR Instrumental Analyzer Method

3.1 OXYGEN AND CARBON MONOXIDE (USEPA METHODS 3A AND 10)

3.1.1 Sampling Method

Oxygen (O_2) emissions were evaluated using USEPA Method 3A, "Gas Analysis for Carbon Dioxide, Oxygen, Excess Air, and Dry Molecular Weight (Instrumental Analyzer Method)". The O_2 analyzer utilizes a paramagnetic sensor.

Carbon monoxide (CO) emissions were evaluated using USEPA Method 10, "Determination of Carbon Monoxide Emissions from Stationary Sources". The CO analyzer utilizes a NDIR detector.

3.1.2 O_2 and CO Sampling Train

The EPA Methods 3A and 10 sampling systems at the inlet and outlet (Figure 2) consisted of the following components:

(1) Single-point stainless steel sampling probe with a cintered filter.
(2) Heated Teflon™ sampling line.
(3) Universal® and MAK® gas conditioners with a particulate filter.
(4) Flexible unheated Teflon™ sampling line.
(5) Servomex 1400 O_2/CO_2 gas analyzer and TECO 48i NDIR CO gas analyzer.
(6) USEPA Protocol 1 calibration gases.
(7) Data Acquisition System.

3.1.3 *Sampling Train Calibration*

The O_2 / CO sampling trains were calibrated according to procedures outlined in USEPA Methods 3A & 10. Zero, span, and mid range calibration gases were introduced directly into the CO and O_2 analyzers to determine the instruments linearity. A zero and mid range span gas was then introduced through the entire sampling system to determine sampling system bias for each analyzer. Additional system calibrations were performed at the completion of each test.

3.1.4 *Sampling Duration & Frequency*

The emissions testing of each engine consisted of triplicate 60-minute samples at the inlet and exhaust of the catalyst. Stratification testing was conducted at three points across the diameter of the exhaust duct during the first run on each engine. Emissions testing of the first run demonstrated an absence of stratification (<1%), therefore a single centroid sampling point was selected. Sampling was performed simultaneously for O_2 and CO. Data was recorded as 1-minute averages.

3.1.5 *Quality Control and Assurance (O_2 and CO)*

All sampling and analytical equipment was calibrated according to the guidelines referenced in Methods 3A and 10. Calibration gases were EPA Protocol 1 gases and the concentrations were within the acceptable ranges (40-60% mid range and span) specified in Method 7E. Calibration gas certification sheets are located in Appendix C.

3.1.6 *Data Reduction*

The O_2 and CO emission readings in percent (%) and parts per million (ppm) were recorded at 4-second intervals and averaged to 1-minute increments. The CO emissions were normalized to 15% O_2, and that number was used to determine CO % Destruction Efficiency (DE) as required by 40CFR Part 63 Subpart ZZZZ. Emission calculations are based upon calculations found in USEPA Methods 3A, 7E, 10 and 19. Example calculations can be found in Appendix D.

The 1-minute O_2 and CO readings collected can be found in Appendix B.

4.0 OPERATING PARAMETERS

The test program included the collection of catalyst inlet temperature (°F), catalyst pressure drop ("H_2O), and crank case vacuum ("H_2O). Ambient temperature (°F), Relative Humidity (%), and Barometric Pressure (in) were also recorded during each test. Operational and atmospheric data collected during the testing is located in Appendix E.

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5.0 RESULTS

Tables 1-5 present the CO emissions @ 15% O_2 results from Units 11-2 to 11-4. The CO emissions are presented in parts per million (ppm) for the inlet and outlet and the destruction efficiency in percent (%). Also presented are the Oxygen inlet and outlet in percent (%), the catalyst inlet temperature in degrees Fahrenheit (°F), and pressure drop across the catalyst in inches of water ("H_2O). The results of the testing indicate that Units 11-1 to 11-5 are in compliance with 40CFR Part 63 Subpart ZZZZ requirements of reducing CO emissions by 70% or more.

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TABLE NO. 1
CARBON MONOXIDE (CO) EMISSION TESTING RESULTS
Unit 11-5 Oliver Substation
October 5, 2015

Test	Time	Load (MW)	Catalyst Inlet Temperature (°F)	Catalyst Pressure Drop ("H_2O)	Oxygen [1] Inlet (%)	Oxygen [1] Outlet (%)	CO Emissions @ 15% O_2 [1] Inlet (ppm)	CO Emissions @ 15% O_2 [1] Outlet (ppm)	Destruction Efficiency (%)
Run - 1	10:25-11:25	2.6	575	0.003	12.4	12.4	94.0	24.6	74.1
Run - 2	11:37-12:37	2.6	658	0.003	12.4	12.3	92.8	21.2	77.4
Run - 3	12:54-13:54	2.6	662	0.003	12.4	12.3	94.3	20.0	79.0
	Avg:	*2.6*	*632*	*0.003*	*12.4*	*12.3*	*93.7*	*21.9*	*76.8*

[1] Corrected for analyzer drift per USEPA method 7E

40CFR Part 63 Subpart ZZZZ Limit: 70% DE

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TABLE NO. 2
CARBON MONOXIDE (CO) EMISSION TESTING RESULTS
Unit 11-4 Oliver Substation
October 6, 2015

Test	Time	Load (MW)	Catalyst Inlet Temperature (°F)	Catalyst Pressure Drop ("H_2O)	Oxygen [1] Inlet (%)	Oxygen [1] Outlet (%)	CO Emissions @ 15% O_2 [1] Inlet (ppm)	CO Emissions @ 15% O_2 [1] Outlet (ppm)	Destruction Efficiency (%)
Run - 1	9:20-10:20	2.6	702	0.004	11.8	11.7	198.7	34.2	83.0
Run - 2	10:32-11:32	2.6	710	0.004	11.8	11.7	204.3	31.9	84.6
Run - 3	11:44-12:44	2.6	709	0.004	11.8	11.7	196.0	30.6	84.6
	Avg:	***2.6***	***707***	***0.004***	***11.8***	***11.7***	***199.7***	***32.2***	***84.1***

[1] Corrected for analyzer drift per USEPA method 7E

40CFR Part 63 Subpart ZZZZ Limit: 70% DE

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TABLE NO. 3
CARBON MONOXIDE (CO) EMISSION TESTING RESULTS
Unit 11-3 Oliver Substation
October 6, 2015

Test	Time	Load (MW)	Catalyst Inlet Temperature (°F)	Catalyst Pressure Drop ("H_2O)	Oxygen [1] Inlet (%)	Oxygen [1] Outlet (%)	CO Emissions @ 15% O_2 [1] Inlet (ppm)	CO Emissions @ 15% O_2 [1] Outlet (ppm)	Destruction Efficiency (%)
Run - 1	12:57-13:57	2.6	657	0.001	12.6	12.5	174.9	36.6	79.3
Run - 2	14:09-15:09	2.6	667	0.002	12.5	12.5	176.5	35.8	79.9
Run - 3	15:19-16:19	2.6	673	0.003	12.5	12.4	182.2	36.2	80.3
	Avg:	***2.6***	***666***	***0.002***	***12.5***	***12.5***	***177.9***	***36.2***	***79.8***

[1] Corrected for analyzer drift per USEPA method 7E

40CFR Part 63 Subpart ZZZZ Limit: 70% DE

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TABLE NO. 4
CARBON MONOXIDE (CO) EMISSION TESTING RESULTS
Unit 11-2 Oliver Substation
October 7, 2015

Test	Time	Load (MW)	Catalyst Inlet Temperature (°F)	Catalyst Pressure Drop ("H_2O)	Oxygen [1] Inlet (%)	Oxygen [1] Outlet (%)	CO Emissions @ 15% O_2 [1] Inlet (ppm)	CO Emissions @ 15% O_2 [1] Outlet (ppm)	Destruction Efficiency (%)
Run - 1	9:14-10:14	2.6	676	0.004	12.1	12.0	151.6	24.2	84.2
Run - 2	10:24-11:24	2.6	686	0.006	12.1	12.0	155.3	23.7	84.9
Run - 3	11:35-12:35	2.6	695	0.006	12.1	12.0	158.0	24.0	85.0
	Avg:	***2.6***	***686***	***0.005***	***12.1***	***12.0***	***155.0***	***24.0***	***84.7***

[1] Corrected for analyzer drift per USEPA method 7E

40CFR Part 63 Subpart ZZZZ Limit: 70% DE

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TABLE NO. 5
CARBON MONOXIDE (CO) EMISSION TESTING RESULTS
Unit 11-1 Oliver Substation
October 7, 2015

Test	Time	Load (MW)	Catalyst Inlet Temperature (°F)	Catalyst Pressure Drop ("H_2O)	Oxygen [1] Inlet (%)	Oxygen [1] Outlet (%)	CO Emissions @ 15% O_2 [1] Inlet (ppm)	CO Emissions @ 15% O_2 [1] Outlet (ppm)	Destruction Efficiency (%)
Run - 1	12:48-13:48	2.5	636	0.006	12.2	12.1	49.5	11.5	77.0
Run - 2	13:57-14:57	2.5	657	0.005	12.2	12.1	51.0	11.4	77.8
Run - 3	15:10-16:10	2.5	653	0.004	12.2	12.0	51.3	11.3	78.5
	Avg:	***2.5***	***649***	***0.005***	***12.2***	***12.1***	***50.6***	***11.4***	***77.8***

[1] Corrected for analyzer drift per USEPA method 7E

40CFR Part 63 Subpart ZZZZ Limit: 70% DE

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Figure 1 – Sampling Location
Oliver Substation Diesel Generators
October, 2015

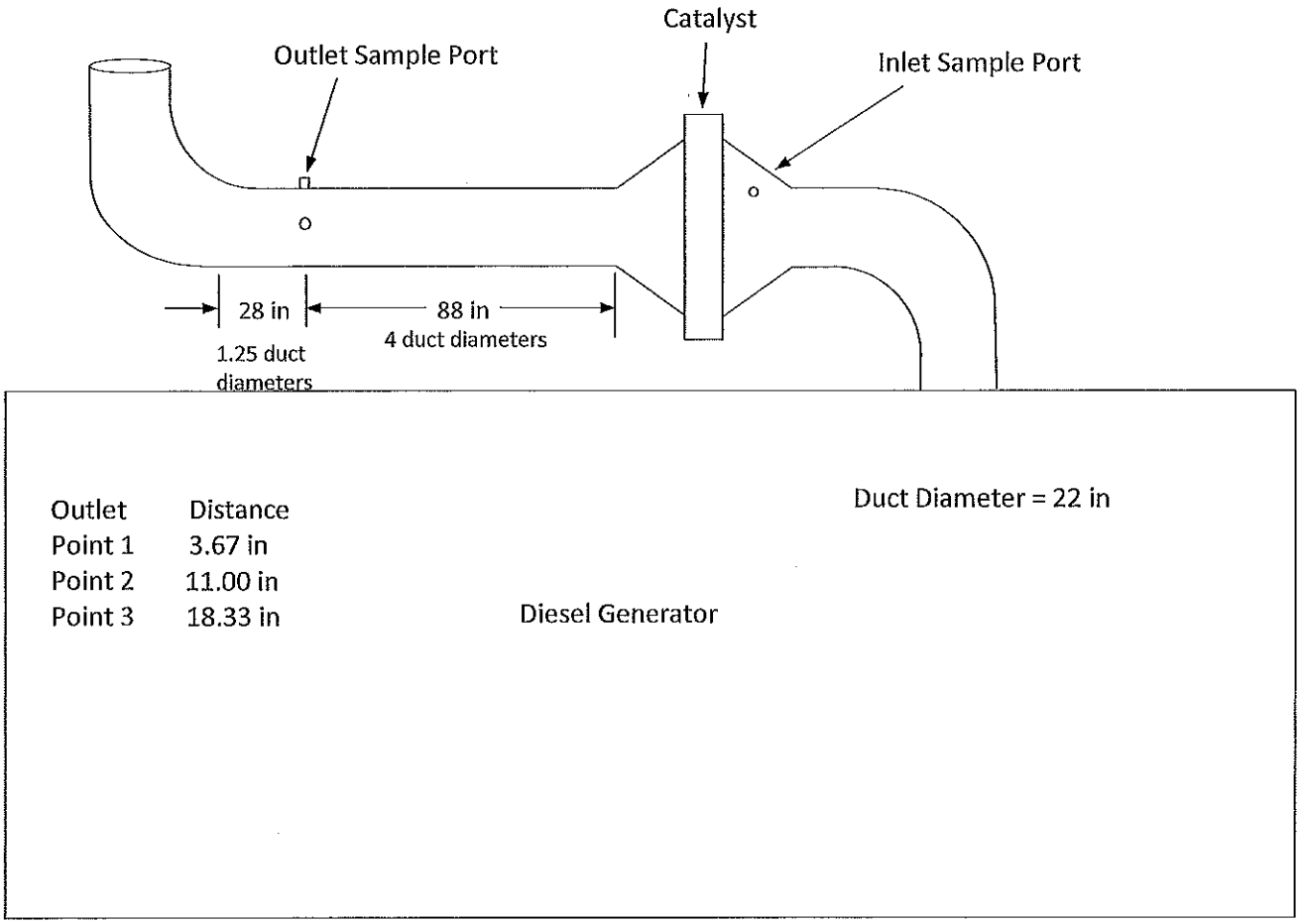

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Figure 2 – EPA Methods 3A/10
Oliver Substation Diesel Generator
October, 2015