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EMISSION TEST REPORT
For
CO Reduction Efficiency
Catalyst on Generator Unit 3, Unit 5, and Unit 6
City of Marshall
Marshall, MI
April 18 - 19, 2017

Comprehensive Emission Services, Inc
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Project No. 3617

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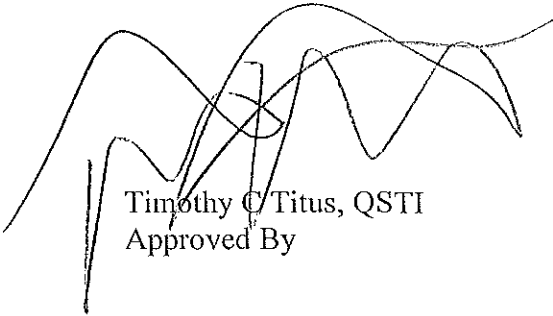
PREFACE

This report was prepared by Comprehensive Emission Services, Inc. in response to emission testing that was conducted at the City of Marshall. The testing was conducted on Generator Units: 3, 5, and 6 at the facility in Marshall, MI on April 18 - 19, 2017. Any questions concerning this report should be directed to Mr. Matt Milligan or Mr. Tim Titus.

Comprehensive Emission Services, Inc.



Matt Milligan
Test Leader



Timothy C. Titus, QSTI
Approved By

Date: April 28, 2017

SECTION 1

INTRODUCTION

Emission testing was conducted by Comprehensive Emission Services, Inc. on Generator Units: 3, 5, and 6 at the City of Marshall Generation facility located in Marshall, MI on April 18 - 19, 2017.

Coordinating the field test:

Tim Titus - Comprehensive Emission Services, Inc.
Edward Rice - City of Marshall

Conducting the field test:

Matt Milligan - Comprehensive Emission Services, Inc.
Ted Webb - Comprehensive Emission Services, Inc.

Observing the Field test:

Rex I. Lane - Michigan Dept. of Environmental Quality
Amanda Chapel - Michigan Dept. of Environmental Quality

The results were used to evaluate the Generator with regards to the following:

CO Emission reduction efficiency

The appendices contain the following:

Appendix A: Analyzer Data
Appendix B: Plant Process Data
Appendix C: Monitor Calibration Data
Appendix D: Protocol 1 Certification Sheets
Appendix E: Certificates of Accreditation

SECTION 2

SUMMARY OF RESULTS

Table 1 summarizes the test results for testing at the City of Marshall located in Marshall, MI. The CO results are presented in ppm corrected to 15 percent O₂. The catalyst on the Generators were tested to demonstrate compliance with the outlet concentration limit of ≤ 23 ppm corrected to 15 percent O₂, or a 70% or greater reduction of CO emissions as required in NESHAP ZZZZ, 40 CFR, Part 63.

SUMMARY OF TEST RESULTS

Parameters	CO (ppm @ 15% O ₂)	CO (ppm @ 15% O ₂)	%
	Inlet	Outlet	CO Reduction (%)
Generator Unit 3	196.02	13.12	93.36
Generator Unit 5	283.72	60.98	78.55
Generator Unit 6	266.7	65.5	75.42

SECTION 3

SAMPLING AND ANALYTICAL PROCEDURES

Carbon Monoxide

Carbon Monoxide (CO) and Oxygen (O₂) were measured by EPA Methods 10 and 3A. The Generators were sampled with each test run lasting approximately one hour. A Teflon heated line was used to transfer the sample from the probe to the sampling trailer. At the sampling trailer, the sample was conditioned by a series of refrigeration dryers to remove the moisture from the gas stream. After the refrigeration dryers, the sample was transported through a Teflon line to the analyzers. The flow of the stack gas sample was regulated at a constant rate to minimize drift.

3.3 Calibration Procedure

At the start of the day, the each monitor was checked for calibration error by introducing zero, low, mid, and high-range EPA Protocol 1 gases to the measurement system at a point upstream of the analyzers. Comprehensive Emission Services, Inc. refers to the calibration error test as the instrument calibration. The gas was injected into the sampling valve located at the inlet of the sampling probe. The bias test was conducted before and after each consecutive test condition by introducing zero and upscale calibration gases for each monitor. The upscale calibration gases used for the each monitors bias tests were the calibration gases which most closely approximates the effluent concentration monitored during the test runs.

SECTION 4
TEST RESULTS

Table 2 summarizes the CO emissions and other parameters for Generator Unit 3. The raw data is presented in appendix B.

Table 2 Test Results April 18, 2017 Unit 3 Fairbanks-Morse 38TDD8 Rating: 2070 kW and 2880 hp			
Parameters	Run 1	Run 2	Run 3
Start time	08:29 AM	09:35 AM	10:41 AM
Stop time	09:29 AM	10:35 AM	11:41 AM
O2(%) Inlet	10.7	11.2	11.6
O2(%) Outlet	10.5	11.1	11.6
CO(ppm) Inlet	364.2	310.9	296.2
CO(ppm @ 15% O2) Inlet	211.15	188.71	188.18
CO(ppm) CO(ppm) Outlet	30.1	18.3	17.7
CO(ppm @ 15% O2) Outlet	17.10	11.06	11.20
CO Reduction (%)	91.90	94.14	94.05
Average Electric Output (%)		97.6	
Electrical Output(KW)		2020	
Catalyst Pressure Differential		1.4	
Catalyst Inlet Temp		681.0	

Table 3 summarizes the CO emissions and other parameters for Generator Unit 5. The raw data is presented in appendix B.

Table 3 Test Results April 18, 2017 Unit 5 Nordberg TSGl 216 Rating: 1875 kW and 2400 hp			
Parameters	Run 1	Run 2	Run 3
Start time	12:34 PM	01:43 PM	02:49 PM
Stop time	01:34 PM	02:43 PM	03:49 PM
O2(%) Inlet	16.1	16.1	16.0
O2(%) Outlet	16.1	15.9	15.8
CO(ppm) Inlet	246.0	227.6	223.4
CO(ppm @ 15% O2) Inlet	301.80	279.52	269.83
CO(ppm) CO(ppm) Outlet	55.3	50.5	47.5
CO(ppm @ 15% O2) Outlet	68.08	59.66	55.19
CO Reduction (%)	77.44	78.65	79.54
Average Electric Output (%)		82.7	
Electrical Output(KW)		1550	
Catalyst Pressure Differential		-0.6	
Catalyst Inlet Temp		546.0	

Table 4 summarizes the CO emissions and other parameters for Generator Unit 6. The raw data is presented in appendix B.

Table 4 Test Results April 19, 2017 Unit 6 Colt-Pielstick PC-2.3V Rating: 5400 kW and 8000 hp			
Parameters	Run 1	Run 2	Run 3
Start time	08:45 AM	09:53 AM	10:59 AM
Stop time	09:45 AM	10:53 AM	11:59 AM
O2(%) Inlet	11.7	11.8	11.8
O2(%) Outlet	11.7	11.8	11.8
CO(ppm) Inlet	392.2	408.2	435.5
CO(ppm @ 15% O2) Inlet	252.39	263.89	283.83
CO(ppm) CO(ppm) Outlet	100.3	100.3	103.6
CO(ppm @ 15% O2) Outlet	64.40	64.99	67.01
CO Reduction (%)	74.48	75.37	76.39
Average Electric Output (KW %)		98.2	
Electrical Output(KW)		5304	
Catalyst Pressure Differential		2.1	
Catalyst Inlet Temp		815.2	