

EMISSIONS TEST REPORT

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for

AIR QUALITY DIV.

**OXIDES OF NITROGEN (NO_x) AND CARBON
MONOXIDE (CO)**

Z330 Engines 4 & 5

DTE-Gas

**Belle River Mills Compressor Station (SRN:B6478)
East China, Michigan**

August 6-7, 2014

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

DTE Energy[®]





MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

**RENEWABLE OPERATING PERMIT
REPORT CERTIFICATION**

Authorized by 1994 P.A. 451, as amended. Failure to provide this information may result in civil and/or criminal penalties.

Reports submitted pursuant to R 336.1213 (Rule 213), subrules (3)(c) and/or (4)(c), of Michigan's Renewable Operating Permit (ROP) program must be certified by a responsible official. Additional information regarding the reports and documentation listed below must be kept on file for at least 5 years, as specified in Rule 213(3)(b)(II), and be made available to the Department of Environmental Quality, Air Quality Division upon request.

Source Name DTE Gas Company - Belle River Mills Compressor Station County St. Clair

Source Address 5440 Puttygut Road City China Township

AQD Source ID (SRN) B6478 ROP No. MI-ROP-B6478-2010 ROP Section No. _____

Please check the appropriate box(es):

Annual Compliance Certification (Pursuant to Rule 213(4)(c))

Reporting period (provide inclusive dates): From _____ To _____

1. During the entire reporting period, this source was in compliance with ALL terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference. The method(s) used to determine compliance is/are the method(s) specified in the ROP.

2. During the entire reporting period this source was in compliance with all terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference, EXCEPT for the deviations identified on the enclosed deviation report(s). The method used to determine compliance for each term and condition is the method specified in the ROP, unless otherwise indicated and described on the enclosed deviation report(s).

Semi-Annual (or More Frequent) Report Certification (Pursuant to Rule 213(3)(c))

Reporting period (provide inclusive dates): From _____ To _____

1. During the entire reporting period, ALL monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred.

2. During the entire reporting period, all monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred, EXCEPT for the deviations identified on the enclosed deviation report(s).

Other Report Certification

Reporting period (provide inclusive dates): From 8/6/2014 To 8/7/2014

Additional monitoring reports or other applicable documents required by the ROP are attached as described:

Emissions Compliance Testing Report

I certify that, based on information and belief formed after reasonable inquiry, the statements and information in this report and the supporting enclosures are true, accurate and complete

<u>Michael S. Sklar</u>	<u>Manager - T&SO</u>	<u>313-256-6476</u>
Name of Responsible Official (print or type)	Title	Phone Number
<u>Michael S. Sklar</u>		<u>8/29/14</u>
Signature of Responsible Official		Date

* Photocopy this form as needed.



EXECUTIVE SUMMARY

DTE Energy's Environmental Management and Resources (EM&R) Field Services Group performed emissions testing at the DTE Gas Belle River Mills Compressor Station (SRN:B6478), located in East China, Michigan. The fieldwork was performed on August 6-7, 2014, to satisfy requirements of the Michigan Department of Environmental Quality (MDEQ) Renewable Operating Permit (ROP) No. B6478-2010. Emissions tests were performed on Z-330 Engines #4 and #5 for oxides of nitrogen (NO_x), and carbon monoxide (CO).

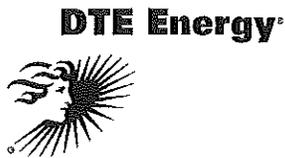
The results of the emissions testing are highlighted below:

Emissions Testing Summary
Belle River Mills Compressor Station
Engine #4 and #5 Z-330
August 6-7, 2014

	#4 Z-330 Emission Rate ⁽¹⁾	#5 Z-330 Emission Rate ⁽¹⁾	ROP Permit Limit ⁽¹⁾	40 cfr Part 60 JJJ Permit Limit ⁽¹⁾
Average Oxides of Nitrogen Concentration	1.3	2.0	3.0	2.0
Average Carbon Monoxide Concentration	1.3	2.3	3.0	4.0

(1) Emissions in grams per brake horsepower-hour (g/BHp-hr)

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1.0 INTRODUCTION

DTE Energy's Environmental Management and Resources (EM&R) Field Services Group performed emissions testing at the DTE Gas Belle River Mills Compressor Station (SRN:B6478), located in East China, Michigan. The fieldwork was performed on August 6-7, 2014, to satisfy requirements of the Michigan Department of Environmental Quality (MDEQ) Renewable Operating Permit (ROP) No. B6478-2010. Emissions tests were performed on Z-330 Engines #4 and #5 for oxides of nitrogen (NO_x), and carbon monoxide (CO).

Testing was performed pursuant to Title 40, *Code of Federal Regulations*, Part 60, Appendix A (40 CFR §60 App. A), Methods 3A, 7E, 10, and 19.

The fieldwork was performed in accordance with EPA Reference Methods and EM&R's Intent to Test¹, Test Plan Submittal, which was approved by the Michigan Department of Environmental Quality (MDEQ) on July 10, 2014². The following EM&R personnel participated in the testing program: Mr. Mark Grigereit, Senior Specialist, and Mr. Thomas Snyder, Senior Environmental Technician. Mr. Grigereit was the project leader. Mr. Tyler Gage, Environmental Engineer, with EM&R, provided process coordination for the testing program. Mr. David Patterson with the Air Quality Division of the Michigan Department of Environmental Quality (MDEQ) reviewed the test plan and Mr. Robert Elmouchi with the Air Quality Division of the MDEQ observed the testing activities.

2.0 SOURCE DESCRIPTION

The Belle River Mills Compressor Station located at 5440 Puttygut Road, East China, Michigan, employs the use of two (#4 and #5) natural gas-fired Cooper Z-330 2-stroke lean burn 10,000 Horse Power reciprocating engines. The Z-330 compressor engines generate line pressure assisting the transmission of natural gas into and out of the gas storage field as well as to and from the pipeline transmission system in south east Michigan.

The emissions from both Z-330 engines exhaust directly into the atmosphere through individual exhaust stacks. Engines #4 and #5 were operated at their maximum load during the testing. The composition of the emissions from the engine depends on both the speed of the engine and the torque delivered to the compressor. Ambient atmospheric conditions, as it affects the density of air, may limit the speed and torque at which the engine can effectively operate.

¹ MDEQ, Test Plan, sent July 7, 2014. (Attached-Appendix A)

² MDEQ, Approval Letter. (Attached-Appendix A)



A schematic representation of the engine exhaust and sampling location is presented in Figure 1.

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 7E	Oxides of Nitrogen	Chemiluminescent Instrumental Analyzer Method
USEPA Method 10	Carbon Monoxide	NDIR Instrumental Analyzer Method
USEPA Method 19	Emission Rate Calculations	Stoichiometric Calculations

3.1 OXYGEN (USEPA METHOD 3A)

3.1.1 Sampling Method

Oxygen (O₂) emissions were evaluated using USEPA Method 3A, "Gas Analysis for Carbon Dioxide, Oxygen, Excess Air, and Dry Molecular Weight (Instrumental Analyzer Method)". The analyzer utilizes a paramagnetic sensor. Triplicate 60-minute tests were performed on the engine exhaust.

3.1.2 O₂ Sampling Train

The EPA Method 3A sampling system (Figure 2) consisted of the following:

- (1) Single-point sampling probe (moved throughout the test according to Method 7E)
- (2) Heated Teflon™ sampling line
- (3) Universal® gas conditioner with particulate filter
- (4) Flexible unheated Teflon™ sampling line



- (5) Servomex 1400 O₂ gas analyzer
- (6) Appropriate USEPA Protocol 1 calibration gases
- (7) pDaqview[®] Data Acquisition System.

3.1.3 Sampling Train Calibration

The O₂ analyzer was calibrated according to procedures outlined in USEPA Method 7E. Zero, span, and mid range calibration gases were introduced directly into the analyzer to verify the instruments linearity. A zero and mid range span gas was then introduced through the entire sampling system to determine sampling system bias for the analyzer at the completion of each test.

3.1.4 Quality Control and Assurance

All sampling and analytical equipment was calibrated according to the guidelines referenced in Methods 3A and 7E. 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.

3.1.5 Data Reduction

Data collected during the emissions testing was recorded at 10-second intervals and averaged in 1-minute increments. The O₂ emissions were recorded in percent (%). The 1-minute readings collected can be found in Appendix B.

3.2 OXIDES OF NITROGEN AND CARBON MONOXIDE (USEPA METHODS 7E AND 10)

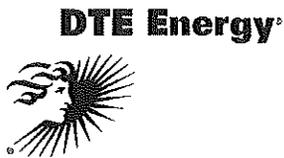
3.2.1 Sampling Method

Oxides of nitrogen (NO_x) emissions were evaluated using USEPA Method 7E, "Determination of Oxides of Nitrogen Emissions from Stationary Sources". The NO_x analyzer utilizes a Chemiluminescent detector. 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. Triplicate 60-minute tests were performed on each engine exhaust.

3.2.2 NO_x and CO Sampling Train

The EPA Methods 7E and 10 sampling system (Figure 2) consisted of the following:

- (1) Single-point sampling probe (moved throughout the test according to Method 7E)
- (2) Heated Teflon[™] sampling line
- (3) MAK[®] gas conditioner with particulate filter



- (4) Flexible unheated Teflon™ sampling line
- (5) TECO 42i Chemiluminescent NO/NO_x gas analyzer, and TECO 48i NDIR CO gas analyzer
- (6) Appropriate USEPA Protocol 1 calibration gases
- (7) pDaqview® Data Acquisition System.

3.2.3 Sampling Train Calibration

The NO_x / CO sampling train was calibrated according to procedures outlined in USEPA Method 7E. Zero, span, and mid range calibration gases were introduced directly into each analyzer to verify the instruments linearity. A zero and mid range span gas for each pollutant was then introduced through the entire sampling system to determine sampling system bias for each analyzer at the completion of each test.

3.1.4 Quality Control and Assurance

All sampling and analytical equipment was calibrated according to the guidelines referenced in Methods 7E 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.

DTE performed NO_x converter efficiency testing by directly challenging the NO_x analyzer with a nitrogen dioxide (NO₂) calibration gas of 50.9 ppm. Results from the converter efficiency test demonstrated that the analyzer met the requirements of Method 7E (Eq-1).

$$\text{Eq. 1} \quad \text{Eff}_{\text{NO}_2} = \frac{C_{\text{Dir}}}{C_v} = \frac{46.2}{50.9} = 90.7\%$$

3.1.5 Data Reduction

Data collected during the emissions testing was recorded at 10-second intervals and averaged in 1-minute increments. The NO_x and CO emissions were recorded in parts per million (ppm). The 1-minute readings collected can be found in Appendix B.

Emissions calculations are based on calculations located in USEPA Methods 7E, 10, and 19 (Appendix D).



4.0 OPERATING PARAMETERS

The test program included the collection of engine operating data during each test run. Parameters recorded included Brake horsepower, gross dry BTU, fuel feed rate, spark timing, fuel pressure, air manifold pressure & temperature, and suction and discharge pressure.

Operational data and results of the fuel analysis can be found in Appendix E.

5.0 DISCUSSION OF RESULTS

The results of the NO_x and CO emission testing on Engines #4 and #5 are presented in Tables No. 1 and No. 2. The NO_x and CO emissions are presented in parts per million, dry (ppm_{dry}), pounds per hour (lbs/hr), pounds per million British Thermal Unit (lbs/MMBtu), and grams per brake horsepower – hour (grams/BHp-hr). Process data presented includes engine load in percent (%), engine brake-horsepower (Brake-Hp), and heat input in million British Thermal unit per hour (MMBtu/Hr).

For Engine #4 the average NO_x emissions of 1.3 grams/BHp-Hr are in compliance with the permit limit of 3.0 grams/BHp-Hr. The average CO emissions of 2.0 grams/BHp-Hr are in compliance with the permit limit of 3.0 grams/BHp-Hr.

For Engine #5 the average NO_x emissions of 1.3 grams/BHp-Hr are in compliance with the permit limit of 3.0 grams/BHp-Hr. The average CO emissions of 2.3 grams/BHp-Hr are in compliance with the permit limit of 3.0 grams/BHp-Hr.



6.0 CERTIFICATION STATEMENT

"I certify that I believe the information provided in this document is true, accurate, and complete. Results of testing are based on the good faith application of sound professional judgment, using techniques, factors, or standards approved by the Local, State, or Federal Governing body, or generally accepted in the trade."

A handwritten signature in cursive script that reads "Thomas Snyder".

Thomas Snyder, Senior Environmental Technician

This report prepared by:

A handwritten signature in cursive script that reads "Thomas Snyder".

Mr. Thomas Snyder, QSTI
Senior Environmental Technician, Field Services
Environmental Management and Resources
DTE Energy Corporate Services, LLC (DECS)

This report reviewed by:

A handwritten signature in cursive script that reads "Tom Durham".

Mr. Tom Durham
Manager, Field Services
Environmental Management and Resources
DTE Energy Corporate Services, LLC (DECS)



TABLE NO. 1
NO_x and CO EMISSION TESTING RESULTS
Engine #4 Z330 - Belle River Mills Compressor Station
August 6, 2014

Test	Test Date	Test Time	Load (%)	Brake-Hp	Heat Input (MMBtu/hr)	NO _x Emissions ⁽¹⁾				CO Emissions ⁽¹⁾			
						(ppm _{dry})	(lb/hr)	(lb/MMBtu)	(gram/BHp-Hr) ⁽²⁾	(ppm _{dry})	(lb/hr)	(lb/MMBtu)	(gram/BHp-Hr) ⁽²⁾
1	8/6/14	8:20-9:20	92	8,114	64.2	87.3	23.04	0.36	1.3	237.8	37.50	0.58	2.1
2		10:20-11:20	87	7,616	59.9	94.2	22.23	0.37	1.3	222.0	31.68	0.53	1.9
3		13:30-14:30	<u>87</u>	<u>7,628</u>	<u>60.5</u>	<u>89.6</u>	<u>21.22</u>	<u>0.35</u>	<u>1.3</u>	<u>238.3</u>	<u>34.08</u>	<u>0.56</u>	<u>2.0</u>
		<i>Average:</i>	<i>89</i>	<i>7,786</i>	<i>61.5</i>	<i>90.4</i>	<i>22.16</i>	<i>0.36</i>	<i>1.3</i>	<i>232.7</i>	<i>34.42</i>	<i>0.56</i>	<i>2.0</i>

ND = Non Detect

(1) Emissions were corrected for analyzer drift per USEPA Method 7E

(2) ROP Permit Limit:

NO_x - 3.0 gram/BHp-Hr

CO - 3.0 gram/BHp-Hr

(3) 40 CFR, Part 60, Subpart JJJ Limit:

NO_x - 2.0 gram/BHp-Hr

CO - 4.0 gram/BHp-Hr

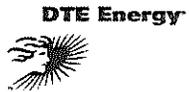


TABLE NO. 2
NO_x and CO EMISSION TESTING RESULTS
Engine #5 Z330 - Belle River Mills Compressor Station
August 7, 2014

Test	Test Date	Test Time	Load (%)	Brake-Hp	Heat Input (MMBtu/hr)	NO _x Emissions ⁽²⁾				CO Emissions ⁽¹⁾			
						(ppm _{dry})	(lb/hr)	(lb/MMBtu)	(gram/BHp-Hr) ⁽²⁾	(ppm _{dry})	(lb/hr)	(lb/MMBtu)	(gram/BHp-Hr) ⁽²⁾
1	8/7/14	8:06-9:06	92	8,086	66.7	84.1	23.32	0.35	1.3	249.8	40.89	0.61	2.3
2		9:20-10:20	92	8,046	66.6	81.4	22.42	0.34	1.3	253.1	41.58	0.62	2.3
3		10:36-11:36	92	8,056	66.7	83.2	23.04	0.35	1.3	253.1	41.66	0.63	2.4
		<i>Average:</i>	92	8,063	66.7	82.9	22.93	0.34	1.3	252.0	41.38	0.62	2.3

ND = Non Detect

(1) Emissions were corrected for analyzer drift per USEPA Method 7E

(2) ROP Permit Limit:

NO_x - 3.0 gram/BHp-Hr

CO - 3.0 gram/BHp-Hr

(3) 40 CFR, Part 60, Subpart JJJ Limit:

NO_x - 2.0 gram/BHp-Hr

CO - 4.0 gram/BHp-Hr



Figure 1 – Sampling Locations
Z330 Engines #4 and #5
Belle River Mills Compressor Station
August, 2014

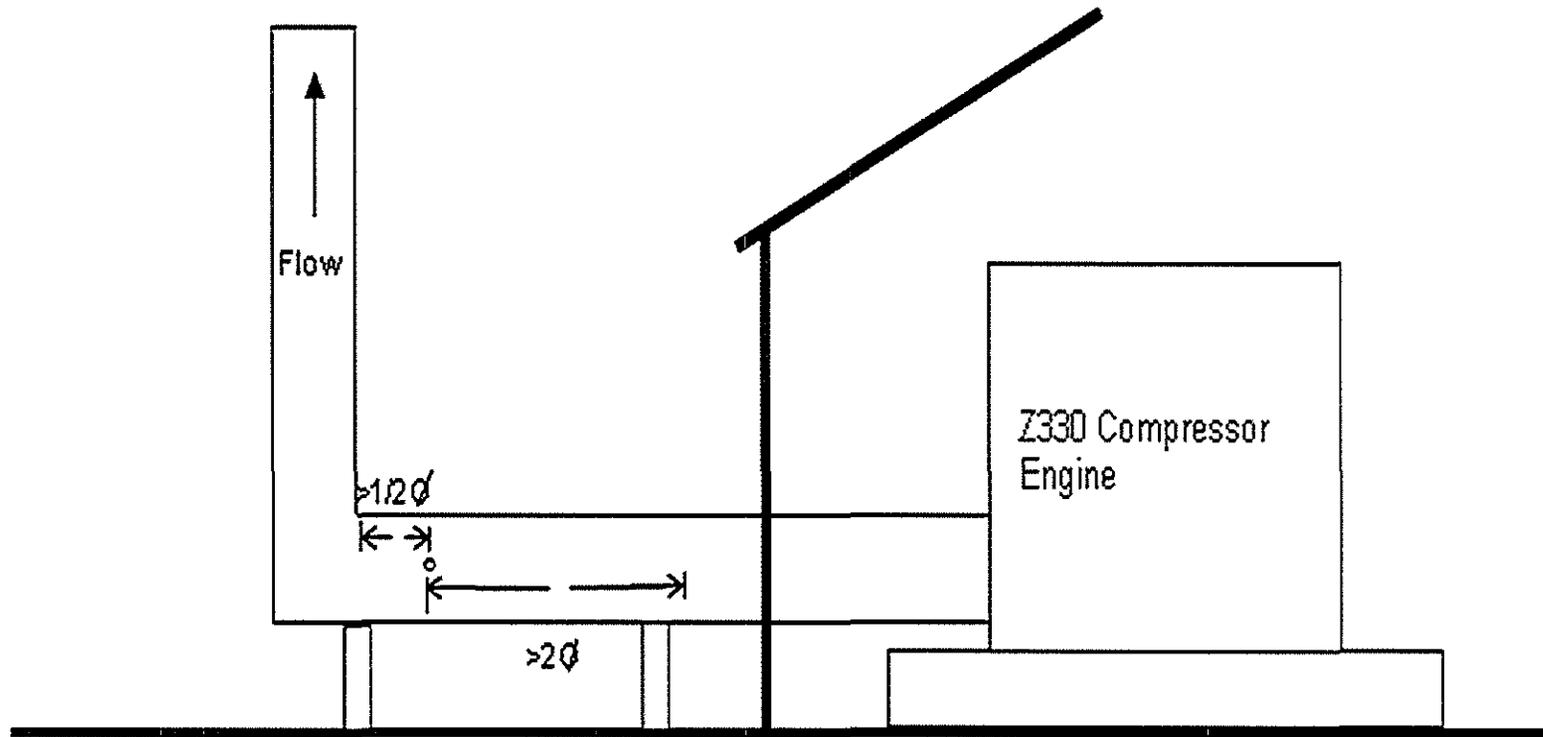




Figure 2 – EPA Method 3A, 7E and 10
Z330 Engines #4 and #5
Belle River Mills Compressor Station
August, 2014

