FINAL REPORT

FCA US LLC

AUBURN HILLS, MICHIGAN

CHRYSLER TECHNOLOGY CENTER:
C-WING AND D-WING POWERTRAIN

RWDI #1700987

April 25, 2017

SUBMITTED TO

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MAY 01 2017

AIR QUALITY DIVISION

DEQ

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 FCA US LLC - Chrysler Technology Center County Oakland

Source Address 800 Chrysler Drive City Auburn Hills

AQD Source ID (SRN) N1436 ROP No. N1436-2013 ROP Section No. 2

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 NA To NA

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

Air emissions test 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

Mark Cerny	Director of Powertrain	248-944-2555
Name of Responsible Official (print or type)	Title	Phone Number

Mark A. Cerny 4-27-17

Signature of Responsible Official Date

* Photocopy this form as needed.

EQP 5736 (Rev 11-04)

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AIR QUALITY DIV.

EXECUTIVE SUMMARY

RWDI AIR Inc. (RWDI) was retained by FCA US LLC (FCA) to complete an air sampling program on their C-Wing Oxidizer (4.01) and D-Wing Oxidizer (4.01) at their Chrysler Technology Center (CTC) located in Auburn Hills, Michigan. The C-Wing and D-Wing oxidizers control the emissions of dynamometer test cells under FG-CNTRLDCELLS-S2 for the C and D wings. The test program was conducted to evaluate the Carbon Monoxide (CO) and Nitrogen Oxides (NOx) concentrations and emission rates as well as several other parameters as discussed below.

In addition Oxygen, Carbon Dioxide and stack gas Velocity and Flow Rate were measured in order to determine stack gas composition and emission rates. Carbon monoxide sampling also occurred at the inlet of the C-Wing and D-Wing 4.01 oxidizers to determine the CO Destruction Efficiency (DE) of the oxidizers. The Intent-To-Test Plan (ITTP) was submitted to the MDEQ on February 15th, 2017 and a correspondence document was issued by the MDEQ on February 27th, 2017. The ITTP and MDEQ correspondence document may be found in Appendix A of this report.

Testing consisted of three (3) 60-minute test runs on each oxidizer. The sampling was conducted on March 22nd and 23rd, 2017.

Results of the sampling program are outlined in the tables below. Oxidizer DE is also presented below for both the C and D wings. Results of individual tests are presented in the Appendices.

Table 1: C-Wing Oxidizer 4.01 Nitrogen Oxides Results

Test #	NOx (ppm)	NOx (lb/hr)	lb of NOx/gal Fuel
T1	229.3	5.42	0.0836
T2	248.3	5.95	0.0780
T3	284.4	6.79	0.0900
Average	**254.0**	**6.05**	**0.0838**

Table 2: C-Wing Oxidizer 4.01 Carbon Monoxide Results

Test #	CO (ppm)	CO (lb/hr)	lb of CO/gal fuel
T1	9.76	0.14	0.0022
T2	13.6	0.20	0.0026
T3	13.3	0.19	0.0026
Average	**12.2**	**0.18**	**0.0024**

Table 3: C-Wing Oxidizer 4.01Carbon Monoxide Destruction Efficiency Results

Test #	CO (ppm)	CO Inlet (ppm)	DE %
T1	9.76	11,874	99.92%
T2	13.6	14,657	99.91%
T3	13.3	13,141	99.90%
Average	**12.2**	**13,224**	**99.91%**

Table 4: D-Wing Oxidizer 4.01 Nitrogen Oxides Results

Test #	NOx (ppm)	NOx (lb/hr)	lb of NOx/gal fuel
T1	232.4	5.47	0.0570
T2	234.2	5.40	0.0584
T3	246.3	5.58	0.0587
Average	**237.6**	**5.48**	**0.0580**

Table 5: D-Wing Oxidizer 4.01 Carbon Monoxide Results

Test #	CO *(ppm)*	CO *(lb/hr)*	lb of CO/gal fuel
T1	4.8	0.069	0.0007
T2	4.7	0.067	0.0007
T3	4.8	0.066	0.0007
Average	**4.8**	**0.067**	**0.0007**

Table 6: D-Wing Oxidizer 4.01Carbon Monoxide Destruction Efficiency Results

Test #	CO (ppm)	CO Inlet (ppm)	DE %
T1	4.8	33,923	99.99%
T2	4.7	31,656	99.99%
T3	4.8	30,314	99.98%
Average	**4.8**	**31,964**	**99.99%**

1 INTRODUCTION

RWDI AIR Inc. (RWDI) was retained by FCA US LLC (FCA) to complete an air sampling program on their C-Wing Oxidizer (4.01) and D-Wing Oxidizer (4.01) at their Chrysler Technology Center (CTC) located in Auburn Hills, Michigan. The C-Wing and D-Wing oxidizers control the emissions of dynamometer test cells under FG-CNTRLDCELLS-S2 for the C and D wings. The test program was conducted to evaluate the Carbon Monoxide (CO) and Nitrogen Oxides (NOx) concentrations and emission rates as well as several other parameters as discussed below.

In addition, Oxygen, Carbon Dioxide and stack gas Velocity and Flow Rate were measured in order to determine stack gas composition and emission rates. Carbon monoxide sampling also occurred at the inlet of the C-Wing and D-Wing 4.01 oxidizers to determine the CO Destruction Efficiency (DE) of the oxidizers. The Intent-To-Test Plan (ITTP) was submitted to the MDEQ on February 15th, 2017 and a correspondence document was issued by the MDEQ on February 27th, 2017. The ITTP and MDEQ correspondence document may be found in Appendix A of this report.

Testing consisted of three (3) 60-minute test runs on each oxidizer. The sampling was conducted on March 22nd and 23rd, 2017. Mr. Tom Gasloli and Mr. Samuel Liveson from the MDEQ were on-site to witness the testing. Mr Stuart Weiss and Mr Rohitkumar Patel from FCA were on-site to ensure the process was operating at normal standard operating conditions.

Table 7: Source, Parameter and Test Date

Source	Parameter	Test Date
C-Wing 4.01 Oxidizer	Carbon Monoxide, Oxides of Nitrogen, Oxygen, Carbon Dioxide Velocity and Flow Rate	March 23, 2017
D-Wing 4.01 Oxidizer	Carbon Monoxide, Oxides of Nitrogen, Oxygen, Carbon Dioxide Velocity and Flow Rate	March 22,2017

2 SOURCE DESCRIPTION

2.1 Facility Description

CTC is used as a research and development center for automobiles and light-duty trucks. Operations and equipment at CTC include dynamometer test cells used for engines and engine component testing. Test cells are in operation in five (5) wings of the Powertrain division (A-Wing, B-Wing, C-Wing, D-Wing and E-Wing). Engine dynamometer test cells located in C-Wing and D-Wing that are utilized for durability, transmission and catalyst testing are controlled by thermal oxidzers.

Table 8: Emission Unit Description

Units	Capacity
FG-CNTROLDCELLS-S2	50 engine dynamometer test cells located in C-Wing, D-Wing and E-Wing (durability, transmission, and catalyst test cells). Emissions from test cells are controlled using Thermal Oxidizers

3 SAMPLE LOCATION

The outlet sampling location for the Thermal Oxidizer on C-Wing (Unit 4.01) and D-Wing (Unit 4.01) stacks are identical and located on roof level.. Concurrently with the outlet measurements; sampling for CO was also completed on the inlet to the oxidizers to determine the destruction efficiency of CO. Each exhaust stack has an inside diameter of 24.5 inches. Each exhaust stack has two sampling ports, 90 degrees apart and 3 inches in diameter. The sampling ports are located more than ½ duct diameters upstream and more than 2 duct diameters downstream of any flow disturbances.

A stratification test was performed and the flue gas was determined to be uniform or un-stratified. Below is a photo of the roof sampling location for each Oxidizer.

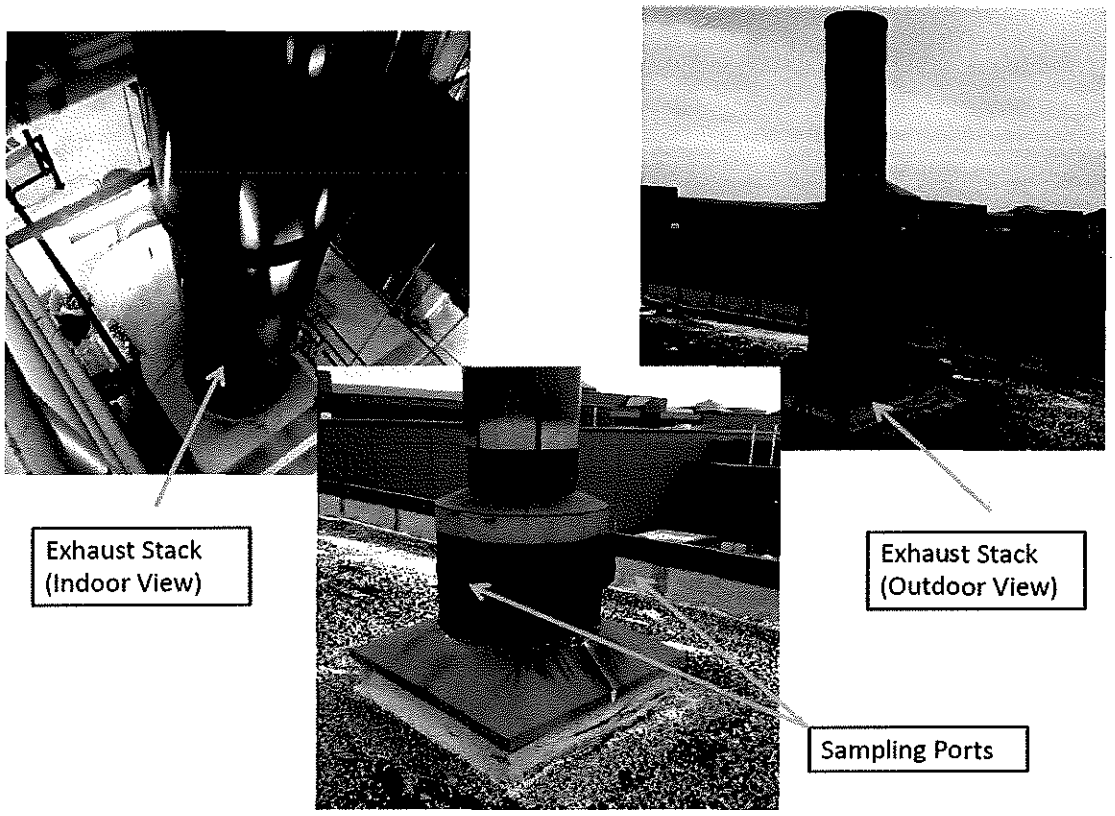

Figure 1: C-Wing Oxidizer 4.01 Sampling Location

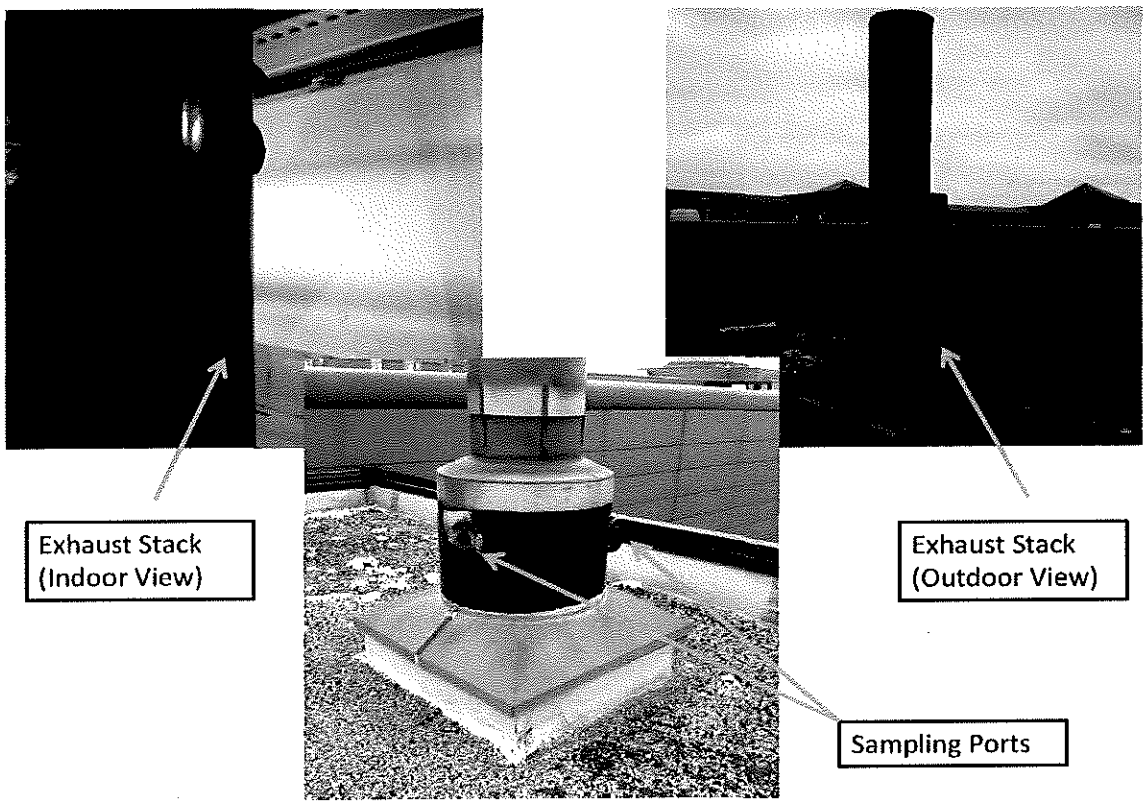

Figure 2: D-Wing Oxidizer 4.01 Sampling Location

4 SAMPLING METHODOLOGY

4.1 Testing Methodology

The following table summarizes the test methodologies that were followed during this program.

Table 9: Summary of Test Methodology

Parameter	Proposed Method
Temperature, Flow Rate and Moisture	USEPA[1] Method 1-4
Oxides of Nitrogen (NOx)	USEPA[1] Method 7E (CEM)
Carbon Monoxide	USEPA[1] Method 10 (CEM)

Notes: [1] USEPA = United States Environmental Protection Agency

4.2 Description of Testing Methodology

The following section provides brief descriptions of the sampling methods.

4.2.1 USEPA Method 1-4

The exhaust velocities and flow rates were determined following the United States Environmental Protection Agency (USEPA) Method 2, "Determination of Stack Gas Velocity and Flow Rate (Type S Pitot Tube)". Velocity measurements were taken with a pre-calibrated S-Type pitot tube and incline manometer. Velocity and sampling points for each traverse were determined from USEPA Method 1, "Sample and Velocity Traverses for Stationary Sources". Volumetric flow rates were determined following the equal area method as outlined in USEPA Method 2. Temperature measurements were made simultaneously with the velocity measurements and conducted using a chromel-alumel type "k" thermocouple in conjunction with a digital temperature indicator.

The dry molecular weight of the stack gas was determined following calculations outlined in USEPA Method 3, "Gas Analysis for the Determination of Dry Molecular Weight". Stack moisture content was determined through direct condensation and according to USEPA Method 4, "Determination of Moisture Content in Stack Gases". Detailed flow and moisture information is located in Appendix D.

4.2.2 USEPA Method 10

USEPA Method 10, "Determination of Carbon Monoxide Emissions from Stationary Sources (Instrument Analyzer Procedure)", was used to measure the carbon monoxide concentration of the flue gas. The exhaust gas sample was withdrawn from a single point at the centre of the duct/stack using a stainless steel probe. The sample proceeded through a heated filter where particulate matter was removed. The sample was then transferred via a heated Teflon® line to a sample conditioner. The Teflon line was heated to 120°C (250°F) to prevent any condensation. The sample was then routed through a manifold system and introduced to the individual CEM's for measurement. A Thermo Fisher Teco 48i Non-Dispersive Infrared Analzyer (NDIR) was used for CO measurements. A schematic of the sampling system apparatus is located in Appendix B.

Prior to testing at the roof level sampling location, a 3-point stratification test was conducted at 16.7, 50 and 83.3 percent of the stack diameter for at least twice the response time as outlined in the method. At this location the CO concentration was measured to be uniform in the stack cross section and was less than ±5% of the mean concentration and 0.5ppm of the mean concentration for all three traverse points. The gas stream was considered to be unstratified and a single sampling point, located at the centroid of the stack was used for sampling. Stratification information is included in Appendix E.

Prior to testing, a 3-point analyzer calibration error check was conducted using USEPA protocol gases. The calibration error check was performed by introducing zero, mid and high level calibration gases directly into the analyzer. The calibration error check was performed to confirm that the analyzer response was within ±2% of the certified calibration gas introduced. Prior to each test run, a system-bias test was performed where known concentrations of calibration gases were introduced at the probe tip to measure if the analyzers response was within ±5% of the introduced calibration gas concentrations. At the conclusion of each test run a system-bias check was performed to evaluate the percent drift from pre and post-test system bias checks. The system bias checks confirmed that the analyzer did not drift greater than ±3% throughout a test run.

Data acquisition was provided using a data logger system programmed to collect and record data at one second intervals. Average one minute concentrations were calculated from the one second measurements.

Appendix C contains detailed data for CO and NOx emissions, including summary of results and 1 minute averages for C-Wing and D-Wing 4.01 Oxidizers. Calibration error check and system bias check information is located in Appendix E with calibration gas Certificates of Accuracy located in Appendix F

4.2.3 USEPA Method 7E

NOx emissions were measured following USEPA Method 7E, "Determination of Nitrogen Oxides Emissions from Stationary Sources." The NOx concentration was measured using a Thermo Fisher Model 42i Chemiluminescence gas analyzer. The exhaust gas sample was withdrawn from a single point at the centre of the duct/stack using a stainless steel probe. The sample proceeded through a heated filter where particulate matter was removed. . The sample was then transferred via a heated Teflon® line to a sample conditioner. The Teflon line was heated to 120°C (250°F) to prevent any condensation. The sample was then routed through a manifold system and introduced to the individual CEM's for measurement.

A NO/NO2 conversion check was performed prior to the start of the sampling by introducing NO2 gas into the NOx analyzer. The analyzers NOx concentration readout was greater than 90% of the introduced calibration gas; therefore, the conversion met the converter efficiency requirement of section 13.5 of USEPA Method 7E. NO/NO2 conversion data is located in Appendix E.

Calibration error and system-bias checks were performed as described in section 4.2.2.

5 PROCESS DATA

FCA CTC representatives provided production information during testing of the Oxidizers including engine torque (lb/ft), speed (RPM) and fuel usage (gal/hr) and the operating temperature data from each of the oxidizers. Detailed information of the type, amount and conditions of the engines being run during the testing as well as the operating temperature of the oxidizers is located in Appendix H.

6 RESULTS

The average emission results for this study are presented in the tables below. Detailed information regarding each test run can be found in Appendix C and D.

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7 CONCLUSIONS

Testing was successfully completed on March 22nd and 23rd, 2017. All parameters were tested in accordance with USEPA referenced methodologies.

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