FINAL REPORT

FORD MOTOR COMPANY

LIVONIA, MICHIGAN

LIVONIA AUTOMATIC TRANSMISSION NEW PRODUCT CENTER: CARBON MONOXIDE TESTING REPORT

RWDI #2300174

November 29, 2022

SUBMITTED TO

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EXECUTIVE SUMMARY

RWDI USA LLC (RWDI) has been retained by Ford Motor Company (Ford) to complete the emission sampling program at the Livonia Automatic Transmission New Product Center (ATNPC) located at 35500 Plymouth Road, Livonia, Michigan. ATNPC operates Phase II dynamometers used to test automatic transmissions. The testing evaluated carbon monoxide (CO) concentrations. The test program was completed on October 11, 2022.

Executive Table i: Phase II – Emission Results

Parameter	Concentration			
	Test 1	Test 2	Test 3	Average
CO Concentration (ppmvd)	2,114	1,275	1,105	1,498
CO Emission Rate (lb/hr)	27.9	17.1	14.3	19.8
CO Emission Rate (lb/gallon)	0.56	0.51	0.43	0.50
CO Emission Rate (lb/MMBtu)	4.97	4.58	3.87	4.47

TABLE OF CONTENTS

1 INTRODUCTION 1
1.1 Location and Dates of Testing 1
1.2 Purpose of Testing 1
1.3 Description of Source 1
1.4 Personnel Involved in Testing 1
2 SUMMARY OF RESULTS 2
2.1 Operating Data 2
2.2 Applicable Permit Number 2
3 SOURCE DESCRIPTION 2
3.1 Description of Process and Emission Control Equipment 2
3.2 Process Flow Sheet or Diagram (if applicable) 2
3.3 Type and Quantity of Raw and Finished Materials 2
3.4 Normal Rated Capacity of Process 2
3.5 Process Instrumentation Monitored During the Test 2
4 SAMPLING AND ANALYTICAL PROCEDURES 3
4.1 Description of Sampling Train and Field Procedures 3
4.1.1 Stack Velocity, Temperature, and Volumetric Flow Rate Determination 3
4.1.2 Carbon Monoxide (CO), Oxygen (O_2), and Carbon Dioxide (CO_2) 3
4.1.3 Gas Dilution System 4
4.2 Description of Recovery and Analytical Procedures 4
4.3 Sampling Port Description 4
5 TEST RESULTS AND DISCUSSION 5
5.1 Detailed Results 5
5.2 Discussion of Results 5
5.3 Variations in Testing Procedures 5
5.4 Process Upset Conditions During Testing 5
5.5 Maintenance Performed in Last Three Months 5
5.6 Re-Test 5
5.7 Audit Samples 5
5.8 Calibration Sheets 6
5.9 Sample Calculations 6
5.10 Field Data Sheets 6
5.11 Laboratory Data 6

LIST OF TABLES

(Found Within the Report Text)

Table 1.4: Testing Personnel.....1
Table 5.1 & Executive Table i: Phase II – Emission Results.....Executive Summary & 5

LIST OF TABLES

Table 1: Detailed Results

LIST OF FIGURES

Figure 1: FG Phase 2
Figure 2: USEPA Method 2
Figure 3: USEPA Method 3A and 10
Figure 4: USEPA Method 4

LIST OF GRAPHS

Graph 1: Phase2 CO Data - Test 1
Graph 2: Phase2 CO Data - Test 2
Graph 3: Phase2 CO Data - Test 3

LIST OF APPENDICES

Appendix A: Process Data
Appendix B: CEMs Data
Appendix C: Flows and Moistures
Appendix D: Calibration Documents
Appendix E: Example Calculations
Appendix F: Test Plan and EGLE Correspondence

1 INTRODUCTION

RWDI USA LLC (RWDI) has been retained by Ford Motor Company (Ford) to complete the emission sampling program at the Livonia Automatic Transmission New Product Center (ATNPC) located at 35500 Plymouth Road, Livonia, Michigan. ATNPC operates Phase II dynamometers used to test automatic transmissions. The testing evaluated carbon monoxide (CO) concentrations. The test program was completed on October 11, 2022.

1.1 Location and Dates of Testing

The test program was completed on October 11, 2022 at the Livonia ATNPC facility.

1.2 Purpose of Testing

The testing was conducted to determine emission rates for CO per Permit to Install 44-22.

1.3 Description of Source

The Livonia ATNPC facility has Phase II dynamometers used to test the automatic transmissions.

1.4 Personnel Involved in Testing

Table 1.4: Testing Personnel

Susan Hicks Environmental Engineer Shicks3@ford.com	**Ford Motor Company**	(313) 594-3185
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2 SUMMARY OF RESULTS

2.1 Operating Data

Ford personnel made sure the unit was operating correctly and production was at acceptable capacity. Process data is provided in **Appendix A**. The CEMs data can be found in **Appendix B**. The flow and moisture data can be found in **Appendix C**.

2.2 Applicable Permit Number

PTI 44-22

3 SOURCE DESCRIPTION

3.1 Description of Process and Emission Control Equipment

Livonia ATNPC operated four of the six Phase II dynamometers during the testing. There is no control device installed on this unit.

3.2 Process Flow Sheet or Diagram (if applicable)

The process flow diagram can be obtained upon request.

3.3 Type and Quantity of Raw and Finished Materials

The test cells are fueled by a combination of gasoline and diesel.

3.4 Normal Rated Capacity of Process

The plant was operating at normal production during the testing.

3.5 Process Instrumentation Monitored During the Test

Ford personnel recorded the fuel usage and which cells were operating during each test.

Zero and upscale calibration checks were conducted both before and after each test run in order to quantify measurement system calibration drift and sampling system bias. Upscale is either the mid- or high-range gas, whichever most closely approximates the flue gas level. During these checks, the calibration gases were introduced into the sampling system at the probe outlet so that the calibration gases were analyzed in the same manner as the flue gas samples.

A gas sample was continuously extracted from the stack and delivered to a series of gas analyzers, which measure the pollutant or diluent concentrations in the gas. The analyzers were calibrated on-site using EPA Protocol No. 1 certified calibration mixtures. The probe tip was equipped with a sintered stainless-steel filter for particulate removal. The end of the probe was connected to a heated Teflon sample line, which delivered the sample gases from the stack to the CEM system. The heated sample line was designed to maintain the gas temperature above 250°F in order to prevent condensation of stack gas moisture within the line.

Before entering the analyzers, the gas sample passed directly into a refrigerated condenser, which cools the gas to approximately 35°F to remove the stack gas moisture. After passing through the condenser, the dry gas entered a Teflon-head diaphragm pump and a flow control panel, which delivered the gas in series to the O_2, CO_2 and CO analyzers. Each of these analyzers measured the respective gas concentrations on a dry volumetric basis.

4.1.3 Gas Dilution System

Calibration gas was mixed using an Environics 4040 Gas Dilution System. The mass flow controllers are factory calibrated using a primary flow standard traceable to the United States National Institute of Standards and Technology (NIST). Each flow controller utilizes an 11-point calibration table with linear interpolation, to increase accuracy and reduce flow controller nonlinearity. A multi-point EPA Method 205 check was executed in the field prior to testing to ensure accurate gas-mixtures. The gas dilution system consisting of calibrated orifices or mass flow controllers and dilutes a high-level calibration gas to within ±2% of predicted values. The gas divider is capable of diluting gases at set increments and was evaluated for accuracy in the field in accordance with US EPA Method 205 "*Verification of Gas Dilution Systems for Field Instrument Calibrations*". The gas divider dilutions were measured to evaluate that the responses are within ±2% of predicted values. In addition, a certified mid-level calibration gas within ±10% of one of the tested dilution gases was introduced into an analyzer to ensure the response of the gas calibration is within ±2% of gas divider dilution concentration.

4.2 Description of Recovery and Analytical Procedures

There were no samples to recover during this test program. All testing used real time data from the analyzers.

4.3 Sampling Port Description

The stack figure can be found in the **Figures Tab**. The stack was 11.5" in diameter.

5 TEST RESULTS AND DISCUSSION

5.1 Detailed Results

Table 5.1: Phase II – Emission Results

Parameter	Concentration			
	Test 1	Test 2	Test 3	Average
CO Concentration ppmvd)	2,114	1,275	1,105	1,498
CO Emission Rate (lb/hr)	27.9	17.1	14.3	19.8
CO Emission Rate (lb/gallon)	0.56	0.51	0.43	0.50
CO Emission Rate (lb/MMBtu)	4.97	4.58	3.87	4.47

5.2 Discussion of Results

Based on the average results, the CO emission factors for the Phase II process were determined to be 0.50 lb/gallon of fuel and 4.47 lb/MMBTU.

5.3 Variations in Testing Procedures

There were no testing variations.

5.4 Process Upset Conditions During Testing

There were normal process breaks during production.

5.5 Maintenance Performed in Last Three Months

There has been no maintenance in the last three months.

5.6 Re-Test

This was not a retest.

5.7 Audit Samples

This test did not require any audit samples.

5.8 Calibration Sheets

Calibration sheets can be found in **Appendix D**.

5.9 Sample Calculations

Sample calculations can be found in **Appendix E**.

5.10 Field Data Sheets

Field data sheets can be found in **Appendix B** and **Appendix C**.

5.11 Laboratory Data

There was no laboratory data from this testing program.

TABLES

Table 1: CO EMISSIONS TABLE

Source: Ford Livonia ATNPC
RWDI Project #2300174

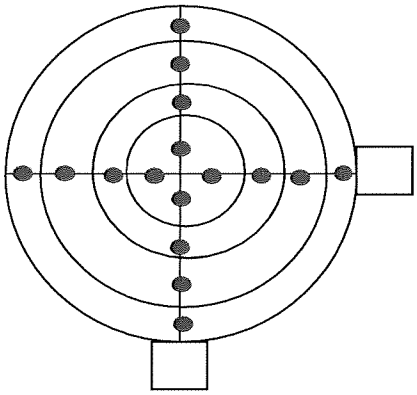
Parameter	1	2	3	Average
Date	11-Oct-22	11-Oct-22	11-Oct-22	--
Start Time:	8:18	9:55	12:10	--
Stop Time:	9:17	10:54	13:09	--
Duration (mins):	60	60	60	--
Outlet Flow Rate (dscfm):	3,031	3,065	2,960	3,019
Outlet Flow Rate (dm^3/s):	1.43	1.45	1.40	1.43
Moisture:	0.030	0.036	0.027	0.031
Outlet CO Concentration (ppm_d):	2114.21	1274.48	1104.84	1497.84
Outlet CO Concentration (mg/m^3_d):	2461.30	1483.72	1286.22	1743.75
Outlet CO Concentration (lb/hr_d):	27.92	17.06	14.28	19.75
CO Emission Rate (lb/mmbtu (Gasoline + Diesel))	4.97	4.58	3.87	4.47
CO Emission Rate (lb/gallon)	0.56	0.51	0.43	0.50
Gallons Used	50.16	33.42	33.08	38.89
Fuel Heat Content (Btu/hr)	5,617,072	3,725,354	3,688,954	4,343,793

Note: "d" indicated based on dry conditions

FIGURES

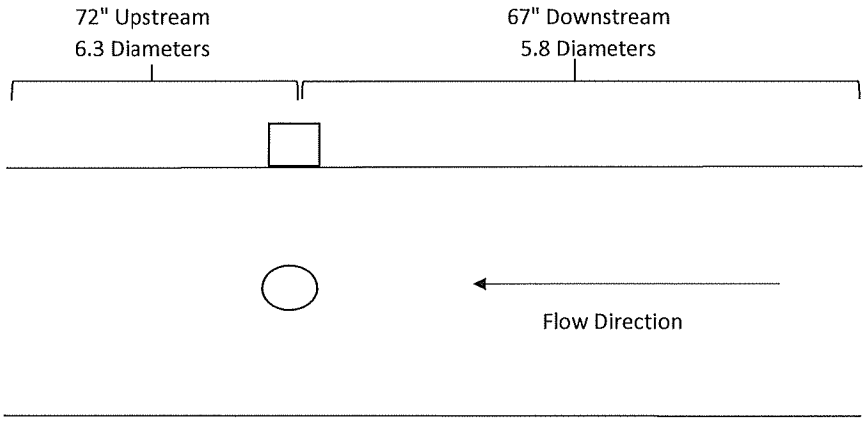
Figure No. 1: FG Phase 2

Diameter: 11.5



Not to Scale

Sampling Points (in.)	
1	0.37
2	1.21
3	2.23
4	3.71
5	7.79
6	9.27
7	10.29
8	11.13

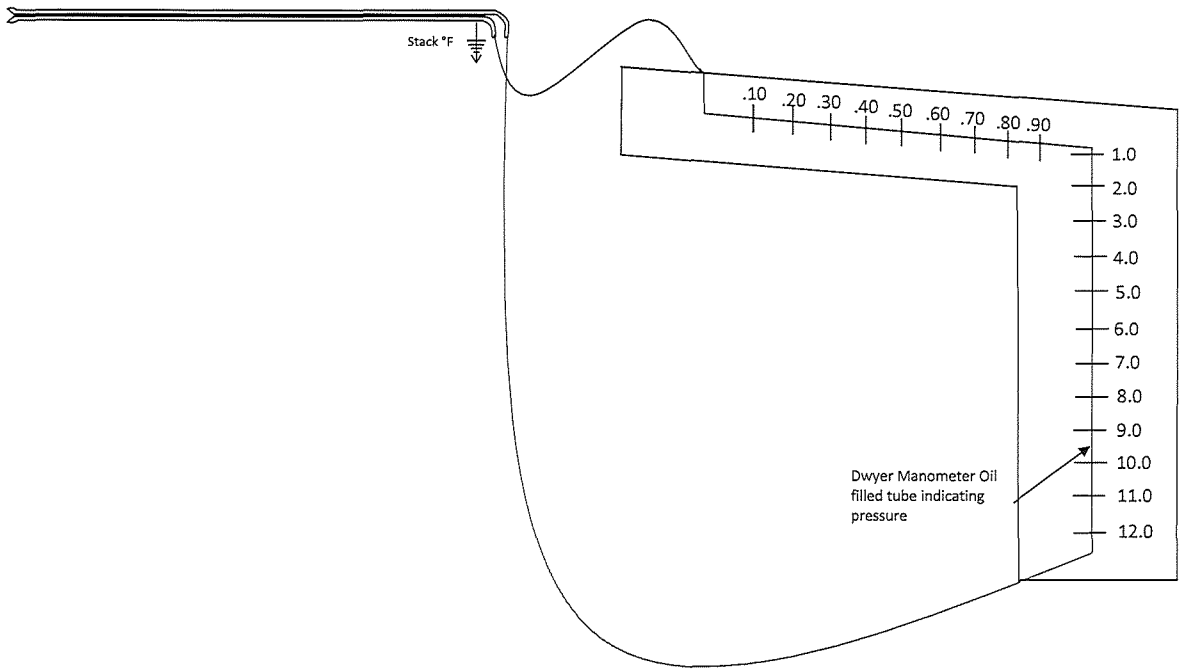


Ford Livonia ATNPC
Ford Motor Company
Livonia, Michigan

Date:
October 11, 2022

RWDI USA LLC
2239 Star Court
Rochester Hills, MI 48309

Figure No. 2 USEPA Method 2

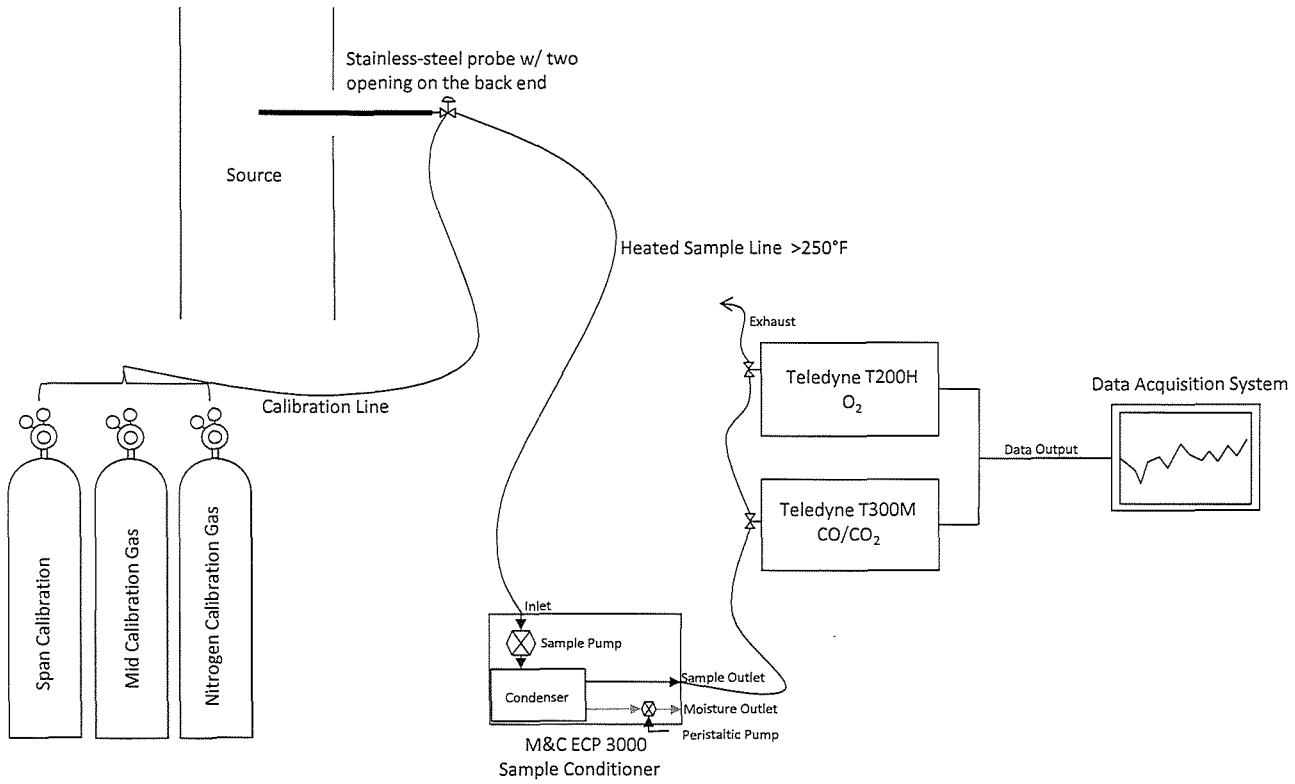


USEPA Method 2

Ford Motor Company
Livonia ATNPC
FG Phase 2
Livonia, Michigan

October 11, 2022

Figure No. 3 USEPA Method 3A and 10



USEPA Method 3A and 10

Ford Motor Company

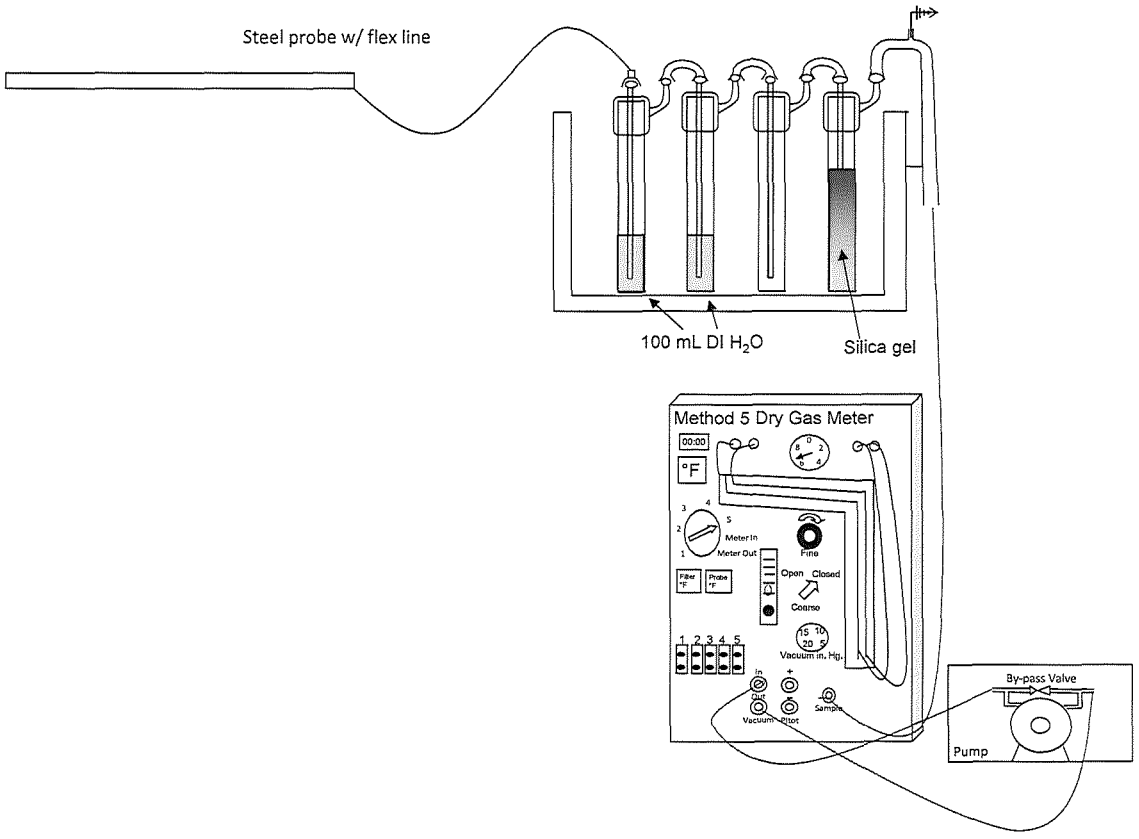
Livonia ATNPC

FG Phase 2

Livonia, Michigan

October 11, 2022

Figure No. 4 USEPA Method 4



USEPA Method 4

Ford Motor Company

Livonia ATNPC

FG Phase 2

Livonia, Michigan

October 11, 2022