FINAL REPORT

FORD MOTOR COMPANY

DEARBORN, MICHIGAN

DEARBORN DYNAMOMETER BUILDING F&G WING: CO & VOC DESTRUCTION EFFICIENCY AND NOx TESTING

RWDI #2205678

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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 Dearborn Dynamometer Building (DYNA) located at 1701 W Village Road, Dearborn, Michigan. Dyna operates as an engineering facility for engine calibration and design for current and future engines. The purpose of the emission test program was to understand the performance and emission rates on four (4) thermal oxidizers (TOs) from the Dyna F&G wing.

This emissions testing program included evaluation of carbon monoxide (CO) and volatile organic compounds (VOC) prior to and after each TO along with NOx testing at the inlet and outlet of each TO. Dyna F&G Wing has 30 dynamometer test cells. There are 4 thermal oxidizers that control the emissions from these wings. The testing program provides destruction efficiency for each of the thermal oxidizers and generate emissions factors each system. The test program was completed from August 2nd-5th, 2022.

Executive Table i: Emission Factor and Minimum Operating Temperature Data Summary

Parameter	Units	TO-1 (Average)	TO-2 (Average)	TO-3 (Average)	TO-4 (Average)	System Average
CO Emission Factor	lb/gal	0.011	0.0030	0.0004	0.0012	0.0039
	lb/MMBTU	0.090	0.025	0.0030	0.010	0.032
NOx Emission Factor	lb/gal	0.076	0.073	0.075	0.053	0.069
	lb/MMBTU	0.625	0.604	0.601	0.432	0.565
VOC (THC) (Emission Factor)	lb/gal	0.0019	0.0011	0.0003	0.0003	0.0009
	lb/MMBTU	0.015	0.009	0.002	0.003	0.0073
Average Combustion Chamber Temperature	°F	1456	1447	1449	1448	1450

Executive Table ii: CO Results

Parameter	TO-1 (Average)	TO-2 (Average)	TO-3 (Average)	TO-4 (Average)
Inlet Concentration (ppmvd)	513.9	84.6	53.7	79.4
Inlet Emission Rate (lb/hr)	6.91	1.00	0.52	0.94
Outlet Concentration (ppmvd)	5.04	1.93	0.29	0.81
Outlet Emission Rate (lb/hr)	0.085	0.023	0.003	0.010
Outlet Emission Rate (lb/Gal combined fuel)	0.011	0.0030	0.0004	0.0012
Outlet Emission Rate (lb/MMBTU) (Fuel Only)	0.090	0.025	0.0030	0.010
Destruction Efficiency (%)	98.7	97.3	99.5	99.2

Executive Table iii: NOx Results

Parameter	TO-1	TO-2	TO-3	TO-4
Outlet Concentration (ppmvd)	60.61	55.16	63.46	52.97
Outlet Emission Rate (as measured) (lb/hr)	1.67	1.10	1.00	1.01
Emissions Rate for Engines (RTO Inlet Data)				
Emission Rate Engines (RTO Inlet) (lb/hr)	0.57	0.56	0.54	0.41
Emission Rate Engines (lb/MMBTU) (Fuel Only)	0.625	0.604	0.601	0.432
Emission Rate Engines (lb/MMBTU) (Natural Gas Only)	0.164	0.181	0.201	0.143
Emission Rate Engines (lb/MMBTU) (Fuel + Natural Gas Only)	0.130	0.139	0.150	0.107
Emission Rate Engines (lb/gallon)	0.076	0.073	0.075	0.053
Emissions Rate for Engines + RTO (RTO Outlet Data)				
Emission Rate Engines + RTO (RTO Outlet) (lb/hr)	1.67	1.10	1.00	1.01
Emission Rate Engines + RTO (lb/MMBTU) (Fuel Only)	1.79	1.21	1.10	1.03
Emission Rate Engines + RTO (lb/MMBTU) (Natural Gas Only)	0.481	0.358	0.368	0.349
Emission Rate Engines + RTO (lb/MMBTU) (Fuel + Natural Gas Only)	0.379	0.276	0.275	0.260
Emission Rate Engines + RTO (lb/gallon)	0.219	0.147	0.136	0.126
Emissions Rate for RTO (RTO Outlet – RTO Inlet Data)				
Emission Rate RTO (RTO Outlet – RTO Inlet) (lb/hr)	1.10	0.54	0.46	0.60
Emission Rate RTO (lb/MMBTU) (Fuel Only)	1.17	0.607	0.497	0.594
Emission Rate RTO (lb/MMBTU) (Natural Gas Only)	0.317	0.177	0.167	0.206
Emission Rate RTO (lb/MMBTU) (Fuel + Natural Gas Only)	0.249	0.137	0.125	0.152
Emission Rate RTO (lb/gallon)	0.143	0.074	0.062	0.073

Executive Table iv: VOC Results

Parameter	TO-1 (Average)	TO-2 (Average)	TO-3 (Average)	TO-4 (Average)
Results as THC				
THC Inlet Concentration (ppmvd)	19.3	7.6	8.5	5.5
THC Inlet Emission Rate (lb/hr)	0.41	0.14	0.13	0.10
THC Outlet Concentration (ppmvd)	0.55	0.43	0.14	0.15
THC Outlet Emission Rate (lb/hr)	0.015	0.008	0.002	0.003
THC Outlet Emission Rate (lb/MMBTU) (Fuel Only)	0.015	0.009	0.002	0.003
THC Outlet Emission Rate (lb/gallon)	0.0019	0.0011	0.0003	0.0003
THC Destruction Efficiency (%)	96.4	94.3	98.3	97.4
Results as NMOC				
NMOC Inlet Concentration (ppmvd)	15.0	5.53	7.20	4.43
NMOC Inlet Emission Rate (lb/hr)	0.32	0.11	0.11	0.08
NMOC Outlet Concentration (ppmvd)	0.46	0.35	0.20	0.30
NMOC Outlet Emission Rate (lb/hr)	0.012	0.007	0.003	0.006
NMOC Outlet Emission Rate (lb/MMBTU) (Fuel Only)	0.013	0.007	0.003	0.005
NMOC Outlet Emission Rate (lb/gallon)	0.0016	0.0009	0.0004	0.0007
NMOC Destruction Efficiency (%)	96.2%	93.3	97.1	92.8

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1 INTRODUCTION

RWDI USA LLC (RWDI) has been retained by Ford Motor Company (Ford) to complete the emission sampling program at the Dearborn Dynamometer Building (Dyna) located at 1701 W Village Road, Dearborn, Michigan. Dyna operates as an engineering facility for engine calibration and design for current and future engines. The purpose of the emission test program was to show compliance on four thermal oxidizers (TOs) from the Dyna F&G wing. This emissions testing program included evaluation of carbon monoxide (CO) and volatile organic compounds (VOC) prior to and after each TO along with NOx testing at the inlet and outlet of each TO. Dyna F&G Wing has 30 dynamometer test cells. There are 4 thermal oxidizers that control the emissions from these wings. The testing program provides destruction efficiency for each of the thermal oxidizers and generate emissions factors.

1.1 Location and Dates of Testing

The test program was completed on August 2nd - 5th, 2022 at the Ford Dyna facility.

1.2 Purpose of Testing

The emissions test program is required by Michigan Department of Environment, Great Lakes, and Energy (EGLE) permit number MI-ROP-B6230-2022.

1.3 Description of Source

Dyna tests engines for vehicles manufactured by Ford. Testing is performed in any of approximately 30 Dynamometer Test Cells located in the Dyna F&G Wings. The dynamometers are controlled by four oxidizers.

1.4 Personnel Involved in Testing

Table 1.4.1: Testing Personnel

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2 SUMMARY OF RESULTS

2.1 Operating Data

Operational data collected during the testing includes the number of vehicles produced during each test. This information can be found in **Appendix A**.

2.2 Applicable Permit Number

MI-ROP-B6230-2022.

3 SOURCE DESCRIPTION

3.1 Description of Process and Emission Control Equipment

Dyna tests engines for vehicles manufactured by Ford. Testing is performed in any of approximately 30 Dynamometer Test Cells located in the Dyna F&G Wings. The dynamometers are controlled by four (4) oxidizers.

3.2 Process Flow Sheet or Diagram

Each RTO has a single inlet and single outlet. The figures can be found in the **Figure Section**.

3.3 Type and Quantity of Raw and Finished Materials

Pipeline quality natural gas is used in each TO as combustion fuel. Test cells are fueled by a combination of gasoline and diesel.

3.4 Normal Rated Capacity of Process

The facility has 30 test cells, during each test, each room has monitoring process data. Process data is provided in **Appendix A**.

3.5 Process Instrumentation Monitored During the Test

Test cells operate on a regular basis. The engines used included a mixture of gasoline and diesel fuel. The cells recorded the usage and a total for each fuel for each run.

4 SAMPLING AND ANALYTICAL PROCEDURES

The emission test program utilized the following test methods codified at Title 40, Part 60, Appendix A of the Code of Federal Regulations (40 CFR 60, Appendix A):

- **Method 1** – Sample and Velocity Traverses for Stationary Sources
- **Method 2** – Determination of Stack Gas Velocity and Volumetric Flowrate
- **Method 3A** – Determination of Molecular Weight of Dry Stack Gases (instrumental)
- **Method 4** – Determination of Moisture Content in Stack Gases
- **Method 7E** – Determination of Oxides of Nitrogen from Stationary Sources
- **Method 10** – Determination of Carbon Monoxide from Stationary Sources
- **Method 25A** – Determination of Total Gaseous Organic Concentrations using a Flame Ionization Analyzer

4.1 Stack Velocity, Temperature, and Volumetric Flow Rate

The exhaust velocities and flow rates were determined following U.S. EPA Method 2, "Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)". Velocity measurements were taken with a pre-calibrated S-Type pitot tube and incline manometer or digital manometer. Volumetric flow rates were determined following the equal area method as outlined in U.S. EPA Method 2. Temperature measurements were made simultaneously with the velocity measurements and were conducted using a chromel-alumel type "k" thermocouple in conjunction with a calibrated digital temperature indicator.

The dry molecular weight of the stack gas was determined following calculations outlined in U.S. EPA Method 3A, "Gas Analysis for the Determination of Dry Molecular Weight".

Stack moisture content was determined through direct condensation and according to U.S. EPA Method 4, "Determination of Moisture Content of Stack Gases". A schematic of the Method 1 to 4 sampling train is provided in **Figure Section**. Three (3) moisture tests were completed on each of the noted sources below:

- **TO-1** – Inlet and Outlet
- **TO-2** – Inlet only
- **TO-3** – Inlet only
- **TO-4** – Inlet Only

4.1.1 Modification to Sampling Methods

For TO2, TO-3 and TO-4, there is no access to the outlet ports, due to safety and logistics. RWDI agreed with EGLE to measure the inlet locations of each of the TOs and the outlet of TO-1 only. This modification assumed that for TO-2, TO-3 and TO-4, the inlet flow rate would be the same as the outlet flow rate, as discussed with EGLE.

4.2 Volatile Organic Compounds

VOC and CH_4 concentrations were recorded simultaneously at the inlet and outlet of each TO during each test. Only one (1) TO was tested at a time. The measurements were taken continuously following USEPA Method 25A on each inlet and outlet (using a non-methane/methane analyzer). As outlined in Method 25A, the measurement location was taken at the centroid of each source.

Each test consisted of three (3) 60-minute tests. Regular performance checks on the CEMS were carried out by zero and span calibration checks using USEPA Protocol calibration gases. These checks verified the ongoing precision of the monitor with time by introducing pollutant-free (zero) air followed by known calibration gas (span) into the monitor. The response of the monitor to pollutant-free air and the corresponding sensitivity to the span gases was reviewed frequently as an ongoing indication of analyzer performance.

Prior to testing, a 4-point analyzer calibration error check were conducted using USEPA protocol gases. The calibration error check was performed by introducing zero, low, mid, and high-level calibration gases up the heated line to the probe tip. The calibration error check was performed to confirm that the analyzer response is within ±5% of the certified calibration gas introduced. 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 check was used to confirm that the analyzer did not drift greater than ±3% throughout a test run.

Zero and mid gas calibration checks were conducted both before and after each test run to quantify measurement system calibration drift and sampling system bias. During these checks, the calibration gases were introduced into the sampling system at the probe tip 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 the gas analyzer, which measures the pollutant or diluent concentrations in the gas. The probe tip was equipped with a sintered stainless-steel filter for particulate removal or heated filter system. 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.

To subtract methane from THC, the methane must be converted from methane as methane to methane as propane and then subtracted from the THC number. The methane response factor (RF) is used in the conversion and was determined each test by introducing a known methane concentration to the analyzer and dividing the methane channel response by the THC channel response. Dividing methane by the RF gives methane as propane and was then subtracted from the THC concentration.

A schematic of the USEPA Method 25A is provided in **Figures Section**.

Results were reported as THC and as Non-Methane Organic Compounds (NMOC).

4.3 Sampling for Carbon Monoxide (CO), Oxides of Nitrogen (NOx), Oxygen (O_2) and Carbon Dioxide (CO_2)

Three (3) 60-minute tests were performed on the inlet and outlet (concurrently) of each of the TOs. Note that NOx was completed for information purposes for Ford. The data is included in the results section. For NOx, the results are provided as the following:

- NOx from engines (process) which included the measurements taken from the inlet of the RTO;
- NOx from engines + RTO (process + control) which included the measurements taken from the outlet of the RTO; and
- NOx from RTOs only (control) which was determined by subtracting the outlet from the RTO from the inlet for the RTO to estimate the difference.

CO and NOx concentrations were determined utilizing RWDI's continuous emissions monitoring (CEM) system following US EPA Method 7E and 10. O_2 and CO_2 were measured at each location continuously as per Method 3A. 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 is 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 was 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 was used to confirm that the analyzer did not drift greater than ±3% throughout a test run.

Zero and upscale calibration checks was 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 was 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 were 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 was pass 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 NOx, O_2, CO_2 and CO analyzers. Each of these analyzers were measure the respective gas concentrations on a dry volumetric basis.

A stratification check was taken for each location prior to testing using O_2. **Figure Section** contains an illustration of the USEPA Method 3A, 7E and 10 sampling train.

4.4 Gas Dilution System

Calibration gas were 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. The calibration is done yearly, and the records are included in the Source Testing Report. 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 were 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 was 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

4.5 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.

4.6 Sampling Port Description

All sampling ports meet USEPA Method 1 locations and can be found in the **Figure Section**.

5 TEST RESULTS AND DISCUSSION

5.1 Detailed Results

Table 5.1.1: Emission Factor and Minimum Operating Temperature Data Summary

Parameter	Units	TO-1 (Average)	TO-2 (Average)	TO-3 (Average)	TO-4 (Average)	System Average
CO Emission Factor	lb/gal	0.011	0.0030	0.0004	0.0012	0.0039
	lb/MMBTU	0.090	0.025	0.0030	0.010	0.032
NOx Emission Factor	lb/gal	0.076	0.073	0.075	0.053	0.069
	lb/MMBTU	0.625	0.604	0.601	0.432	0.565
VOC (THC) (Emission Factor)	lb/gal	0.0019	0.0011	0.0003	0.0003	0.0009
	lb/MMBTU	0.015	0.009	0.002	0.003	0.0073
Combustion Chamber Temperature	°F	1456	1447	1449	1448	1450

Table 5.1.2: CO Results

Parameter	TO-1 (Average)	TO-2 (Average)	TO-3 (Average)	TO-4 (Average)
Inlet Concentration (ppmvd)	513.9	84.6	53.7	79.4
Inlet Emission Rate (lb/hr)	6.91	1.00	0.52	0.94
Outlet Concentration (ppmvd)	5.04	1.93	0.29	0.81
Outlet Emission Rate (lb/hr)	0.085	0.023	0.003	0.010
Outlet Emission Rate (lb/Gal combined fuel)	0.011	0.0030	0.0004	0.0012
Outlet Emission Rate (lb/MMBTU) (Fuel Only)	0.090	0.025	0.0030	0.010
Destruction Efficiency (%)	98.7	97.3	99.5	99.2

Table 5.1.3: NOx Results

Parameter	TO-1	TO-2	TO-3	TO-4
Outlet Concentration (ppmvd)	60.61	55.16	63.46	52.97
Outlet Emission Rate (as measured) (lb/hr)	1.67	1.10	1.00	1.01
Emissions Rate for Engines (RTO Inlet Data)				
Emission Rate Engines (RTO Inlet) (lb/hr)	0.57	0.56	0.54	0.41
Emission Rate Engines (lb/MMBTU) (Fuel Only)	0.625	0.604	0.601	0.432
Emission Rate Engines (lb/MMBTU) (Natural Gas Only)	0.164	0.181	0.201	0.143
Emission Rate Engines (lb/MMBTU) (Fuel + Natural Gas Only)	0.130	0.139	0.150	0.107
Emission Rate Engines (lb/gallon)	0.076	0.073	0.075	0.053
Emissions Rate for Engines + RTO (RTO Outlet Data)				
Emission Rate Engines + RTO (RTO Outlet) (lb/hr)	1.67	1.10	1.00	1.01
Emission Rate Engines + RTO (lb/MMBTU) (Fuel Only)	1.79	1.21	1.10	1.03
Emission Rate Engines + RTO (lb/MMBTU) (Natural Gas Only)	0.481	0.358	0.368	0.349
Emission Rate Engines + RTO (lb/MMBTU) (Fuel + Natural Gas Only)	0.379	0.276	0.275	0.260
Emission Rate Engines + RTO (lb/gallon)	0.219	0.147	0.136	0.126
Emissions Rate for RTO (RTO Outlet – RTO Inlet Data)				
Emission Rate RTO (RTO Outlet – RTO Inlet) (lb/hr)	1.10	0.54	0.46	0.60
Emission Rate RTO (lb/MMBTU) (Fuel Only)	1.17	0.607	0.497	0.594
Emission Rate RTO (lb/MMBTU) (Natural Gas Only)	0.317	0.177	0.167	0.206
Emission Rate RTO (lb/MMBTU) (Fuel + Natural Gas Only)	0.249	0.137	0.125	0.152
Emission Rate RTO (lb/gallon)	0.143	0.074	0.062	0.073

Table 5.1.4: VOC Results

Parameter	TO-1 (Average)	TO-2 (Average)	TO-3 (Average)	TO-4 (Average)
Results as THC				
THC Inlet Concentration (ppmvd)	19.3	7.6	8.5	5.5
THC Inlet Emission Rate (lb/hr)	0.41	0.14	0.13	0.10
THC Outlet Concentration (ppmvd)	0.55	0.43	0.14	0.15
THC Outlet Emission Rate (lb/hr)	0.015	0.008	0.002	0.003
THC Outlet Emission Rate (lb/MMBTU) (Fuel Only)	0.015	0.009	0.002	0.003
THC Outlet Emission Rate (lb/gallon)	0.0019	0.0011	0.0002	0.0003
THC Destruction Efficiency (%)	96.4	94.3	98.3	97.4
Results as NMOC				
NMOC Inlet Concentration (ppmvd)	15.0	5.53	7.20	4.43
NMOC Inlet Emission Rate (lb/hr)	0.32	0.11	0.11	0.08
NMOC Outlet Concentration (ppmvd)	0.46	0.35	0.20	0.30
NMOC Outlet Emission Rate (lb/hr)	0.012	0.007	0.003	0.006
NMOC Outlet Emission Rate (lb/MMBTU) (Fuel Only)	0.013	0.007	0.003	0.005
NMOC Outlet Emission Rate (lb/gallon)	0.0016	0.0009	0.0004	0.0007
NMOC Destruction Efficiency (%)	96.2%	93.3	97.1	92.8

5.2 Discussion of Results

The detailed results can be found in the following Graphs and Appendices:

- **Graphs 1A to 12A –** Summary of CO and NOx Results
- **Graphs 1B to 12 B –** Summary of VOC Results
- **Appendix B –** Summary of CO, NOx, VOC, O_2 and CO_2 Results
- **Appendix F –** Raw and Corrected Data for CEMS Results

5.3 Variations in Testing Procedures

There were no sampling 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 Flows and Moisture

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

5.9 Calibration Data

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

5.10 Process Data

Field data sheets can be found in **Appendix A**.

5.11 Example Calculations

Field data sheets can be found in **Appendix E**.

5.12 Laboratory Data

There was no laboratory data from this testing program.

TABLES

Table 1A: CO_NOx EMISSIONS TABLE (SVDYNO-OXIDIZER1)

Source: Ford DYNA - SVDYNO-OXIDIZER1
RWDI Project #2205678

Parameter	1	2	3	Average
Date	2-Aug-22	2-Aug-22	2-Aug-22	--
Start Time:	8:35	10:16	13:05	--
Stop Time:	9:34	11:16	14:05	--
Duration (mins):	60	60	60	--
Inlet Flow Rate (dscfm):	2,905	2,981	3,408	3,098
Inlet Flow Rate (dm^3/s):	1.37	1.41	1.61	1.46
Moisture:	0.022	0.023	0.027	0.024
Inlet CO Concentration (ppm_d):	652.6	408.2	480.8	513.9
Inlet CO Concentration (mg/m^3d):	759.7	475.2	559.8	598.2
Inlet CO Concentration (lb/hr_d):	8.26	5.31	7.15	6.91
Inlet NOx Concentration (ppm_d):	37.03	25.33	16.19	26.19
Inlet NOx Concentration (mg/m^3d):	70.81	48.43	30.96	50.07
Inlet NOx Concentration (lb/hr):	0.77	0.54	0.40	0.57
Outlet Flow Rate (dscfm):	3,644	3,724	4,251	3,873
Outlet Flow Rate (dm^3/s):	1.72	1.76	2.01	1.83
Moisture:	0.063	0.062	0.061	0.062
Outlet CO Concentration (ppm_d):	5.40	4.62	5.09	5.04
Outlet CO Concentration (mg/m^3_d):	6.28	5.38	5.93	5.86
Outlet CO Concentration (lb/hr_d):	0.086	0.075	0.094	0.085
Outlet NOx Concentration (ppm_d):	69.26	60.89	51.68	60.61
Outlet NOx Concentration (mg/m^3):	132.44	116.43	98.83	115.90
Outlet NOx Concentration (lb/hr):	1.81	1.63	1.58	1.67
Destruction Efficiency (CO) (%):	99.0%	98.6%	98.7%	98.7%
CO Emission Rate (lb/mmbtu (Natural Gas only))	0.025	0.022	0.027	0.025
CO Emission Rate (lb/mmbtu (Gasoline + Diesel))	0.104	0.080	0.087	0.090
CO Emission Rate (lb/mmbtu (Natural Gas + Gasoline + Diesel))	0.020	0.017	0.021	0.019
CO Emission Rate (lb/gallon)	0.013	0.010	0.011	0.011
NOx (Engine + Natural Gas) Emissions (as Measured) Outlet				
NOx Emission from TO (TO Outlet) (lb/hr)	1.807	1.625	1.576	1.669
NOx Emission Rate (lb/mmbtu (Natural Gas only))	0.521	0.473	0.451	0.481
NOx Emission Rate (lb/mmbtu (Gasoline + Diesel only))	2.193	1.733	1.445	1.790
NOx Emission Rate (lb/mmbtu (Natural Gas + Gasoline + Diesel))	0.421	0.371	0.343	0.379
NOx Emission Rates (lb/gallon)	0.265	0.213	0.178	0.219
NOx Engine Emissions (as Measured) (NOx Inlet)				
NOx Emission from TO (TO Inlet) (lb/hr)	0.769	0.542	0.395	0.569
NOx Emission Rate (lb/mmbtu (Natural Gas only))	0.222	0.158	0.113	0.164
NOx Emission Rate (lb/mmbtu (Gasoline + Diesel only))	0.934	0.577	0.363	0.625
NOx Emission Rate (lb/mmbtu (Natural Gas + Gasoline + Diesel))	0.179	0.124	0.086	0.130
NOx Emission Rates (lb/gallon)	0.113	0.071	0.045	0.076
NOx TO Emissions (as Measured) (NOx Outlet - Inlet)				
NOx Emission from TO (TO Outlet - TO Inlet) (lb/hr)	1.037	1.084	1.180	1.100
NOx Emission Rate (lb/mmbtu (Natural Gas only))	0.299	0.315	0.338	0.317
NOx Emission Rate (lb/mmbtu (Gasoline + Diesel only))	1.259	1.155	1.082	1.166
NOx Emission Rate (lb/mmbtu (Natural Gas + Gasoline + Diesel))	0.242	0.248	0.257	0.249
NOx Emission Rates (lb/gallon)	0.152	0.142	0.133	0.143
Gallons Used	6.81	7.62	8.85	7.76
Heat Content (Btu/hr)	823,940	938,009	1,090,319	950,756
Natural Gas (cfh)	3,399	3,371	3,428	3,399
Natural Gas (Btu/hr)	3,466,980	3,438,420	3,496,560	3,467,320

Note: "d" indicated based on dry conditions

Table 1B: THC EMISSIONS TABLE (SVDYNO-OXIDIZER1)

Source: Ford DYNA - SVDYNO-OXIDIZER1
RWDI Project #2205678

Parameter	1	2	3	Average
Date	2-Aug-22	2-Aug-22	2-Aug-22	--
Start Time:	8:35	10:16	13:05	--
Stop Time:	9:35	11:16	14:05	--
Duration (mins):	60	60	60	--
Inlet Flow Rate (dscfm):	2,905	2,981	3,408	3,098
Inlet Flow Rate (dm^3/s):	1.37	1.41	1.61	1.46
Moisture:	0.022	0.023	0.027	0.024
Inlet THC Concentration (as propane) (ppm_w):	22.2	17.5	16.9	18.8
Inlet THC Concentration (as propane) (ppm_d):	22.6	17.9	17.3	19.3
Inlet THC Concentration (as propane) (mg/m3d):	41.5	32.8	31.8	35.4
Inlet THC Concentration (as propane) (lb/hr_d):	0.45	0.37	0.41	0.41
Inlet Methane Correction Factor	2.54	2.37	2.34	2.42
Inlet Methane Concentration (as methane) (ppm_w):	15.73	7.25	7.69	10.22
Inlet Methane Concentration (as methane) (ppm_d):	16.08	7.41	7.90	10.46
Inlet Methane Concentration (as propane) (ppm_w):	6.19	3.06	3.29	4.18
Inlet Methane Concentration (as propane) (ppm_d):	6.33	3.13	3.38	4.28
Inlet Methane Concentration (as propane) (mg/m3):	11.60	5.73	6.19	7.84
Inlet Methane Concentration (as propane) (lb/hr):	0.13	0.06	0.08	0.09
Inlet NMOC Concentration (as propane) (ppmv):	16.31	14.74	13.97	15.01
Inlet NMOC Concentration (as propane) (lbs/hr):	0.32	0.30	0.33	0.32
Outlet Flow Rate (dscfm):	3,644	3,724	4,251	3,873
Outlet Flow Rate (dm^3/s):	1.72	1.76	2.01	1.83
Moisture:	0.063	0.062	0.061	0.062
Outlet THC Concentration (as propane) (ppm_w):	0.45	0.48	0.61	0.51
Outlet THC Concentration (as propane) (ppm_d):	0.48	0.51	0.65	0.55
Outlet THC Concentration (as propane) (mg/m^3_d):	0.87	0.94	1.19	1.00
Outlet THC Concentration (as propane) (lb/hr_d):	0.012	0.013	0.019	0.015
Outlet Methane Correction Factor	2.67	2.60	2.61	2.63
Outlet Methane Concentration (as methane) (ppm_w):	-0.060	0.126	0.564	0.21
Outlet Methane Concentration (as methane) (ppm_d):	-0.064	0.134	0.600	0.22
Outlet Methane Concentration (as propane) (ppm_w):	-0.022	0.048	0.216	0.08
Outlet Methane Concentration (as propane) (ppm_d):	-0.024	0.052	0.230	0.09
Outlet Methane Concentration (as propane) (mg/m^3):	-0.044	0.095	0.421	0.16
Outlet Methane Concentration (as propane) (lb/hr):	-0.0006	0.0013	0.0067	0.002
Outlet NMOC Concentration (as propane) (ppmv):	0.50	0.46	0.42	0.46
Outlet NMOC Concentration (as propane) (lbs/hr):	0.013	0.012	0.012	0.012
Destruction Efficiency (THC) (%):	97.4%	96.4%	95.3%	96.4%
Destruction Efficiency (NMOC) (%):	96.1%	96.1%	96.2%	96.2%
THC Emission Rate (lb/mmbtu (Natural Gas only))	0.0034	0.0038	0.0054	0.0042
THC Emission Rate (lb/mmbtu (Gasoline + Diesel))	0.014	0.014	0.017	0.015
THC Emission Rate (lb/mmbtu (Natural Gas + Gasoline + Diesel))	0.0028	0.0030	0.0042	0.0033
THC Emission Rate (lb/gallon)	0.0018	0.0017	0.0022	0.0019
NMOC Emission Rate (lb/mmbtu (Natural Gas only))	0.0036	0.0034	0.0035	0.0035
NMOC Emission Rate (lb/mmbtu (Gasoline + Diesel))	0.015	0.013	0.011	0.013
NMOC Emission Rate (lb/mmbtu (Natural Gas + Gasoline + Diesel))	0.0029	0.0027	0.0027	0.0028
NMOC Emission Rate (lb/gallon)	0.0018	0.0016	0.0014	0.0016
Gallons Used	6.81	7.62	8.85	7.76
Gasoline + Diesel Heat Content (Btu/hr)	823,940	938,009	1,090,319	950,756
Natural Gas (cfh)	3,399	3,371	3,428	3,399
Natural Gas (Btu/hr)	3,466,980	3,438,420	3,496,560	3,467,320

Note: "d" indicated based on dry conditions

Table 2A: CO_NOx EMISSIONS TABLE (SVDYNO-OXIDIZER2)

Source: Ford DYNA - SVDYNO-OXIDIZER2
RWDI Project #2205678

Parameter	1	2	3	Average
Date	3-Aug-22	3-Aug-22	3-Aug-22	--
Start Time:	8:20	10:05	12:25	--
Stop Time:	9:20	11:05	13:25	--
Duration (mins):	60	60	60	--
Inlet Flow Rate (dscfm):	3,037	2,619	2,651	2,769
Inlet Flow Rate (dm^3/s):	1.43	1.24	1.25	1.31
Moisture:	0.030	0.026	0.026	0.027
Inlet CO Concentration (ppm_d):	45.9	42.3	165.6	84.6
Inlet CO Concentration (mg/m3d):	53.4	49.3	192.8	98.5
Inlet CO Concentration (lb/hr_d):	0.61	0.48	1.91	1.00
Inlet NOx Concentration (ppm_d):	32.84	22.26	28.41	27.83
Inlet NOx Concentration (mg/m3):	62.79	42.56	54.32	53.22
Inlet NOx Concentration (lb/hr):	0.71	0.42	0.54	0.56
Outlet CO Concentration (ppm_d):	1.62	1.09	3.07	1.93
Outlet CO Concentration (mg/m^3_d):	1.89	1.27	3.57	2.25
Outlet CO Concentration (lb/hr_d):	0.021	0.013	0.035	0.023
Outlet NOx Concentration (ppm_d):	58.62	52.49	54.36	55.16
Outlet NOx Concentration (mg/m^3):	112.10	100.36	103.94	105.47
Outlet NOx Concentration (lb/hr):	1.27	0.99	1.03	1.10
Destruction Efficiency (CO) (%):	96.5%	97.4%	98.1%	97.3%
CO Emission Rate (lb/mmbtu (Natural Gas only))	0.006	0.004	0.012	0.008
CO Emission Rate (lb/mmbtu (Gasoline + Diesel))	0.020	0.017	0.037	0.025
Emission Rate (lb/mmbtu (Natural Gas + Gasoline + Diesel))	0.005	0.003	0.009	0.006
CO Emission Rate (lb/gallon)	0.0025	0.0021	0.0045	0.0030
NOx (Engine + Natural Gas) Emissions (as Measured) Outlet				
NOx Emission from TO (TO Outlet) (lb/hr)	1.271	0.987	1.031	1.096
NOx Emission Rate (lb/mmbtu (Natural Gas only))	0.383	0.339	0.352	0.358
NOx Emission Rate (lb/mmbtu (Gasoline + Diesel only))	1.204	1.349	1.080	1.211
Emission Rate (lb/mmbtu (Natural Gas + Gasoline + Diesel))	0.291	0.271	0.266	0.276
NOx Emission Rates (lb/gallon)	0.147	0.162	0.132	0.147
NOx Engine Emissions (as Measured) (NOx Inlet)				
NOx Emission from TO (TO Inlet) (lb/hr)	0.712	0.419	0.539	0.556
NOx Emission Rate (lb/mmbtu (Natural Gas only))	0.215	0.144	0.184	0.181
NOx Emission Rate (lb/mmbtu (Gasoline + Diesel only))	0.674	0.572	0.564	0.604
Emission Rate (lb/mmbtu (Natural Gas + Gasoline + Diesel))	0.163	0.115	0.139	0.139
NOx Emission Rates (lb/gallon)	0.082	0.069	0.069	0.073
NOx TO Emissions (as Measured) (NOx Outlet - Inlet)				
NOx Emission from TO (TO Outlet - TO Inlet) (lb/hr)	0.559	0.568	0.492	0.540
NOx Emission Rate (lb/mmbtu (Natural Gas only))	0.169	0.195	0.168	0.177
NOx Emission Rate (lb/mmbtu (Gasoline + Diesel only))	0.530	0.777	0.516	0.607
Emission Rate (lb/mmbtu (Natural Gas + Gasoline + Diesel))	0.128	0.156	0.127	0.137
NOx Emission Rates (lb/gallon)	0.065	0.093	0.063	0.074
Gallons Used	8.66	6.10	7.80	7.52
Heat Content (Btu/hr)	1,055,921	731,775	954,358	914,018
Natural Gas (cfh)	3,253	2,851	2,867	2,990
Natural Gas (Btu/hr)	3,318,060	2,908,020	2,924,340	3,050,140

Note: "d" indicated based on dry conditions

Table 2B: THC EMISSIONS TABLE (SVDYNO-OXIDIZER2)

Source: Ford DYNA - SVDYNO-OXIDIZER2
RWDI Project #2205678

Parameter	1	2	3	Average
Date	3-Aug-22	3-Aug-22	3-Aug-22	--
Start Time:	8:20	10:05	12:25	--
Stop Time:	9:20	11:05	13:25	--
Duration (mins):	60	60	60	--
Inlet Flow Rate (dscfm):	3,037	2,619	2,651	2,769
Inlet Flow Rate (dm^3/s):	1.43	1.24	1.25	1.31
Moisture:	0.030	0.026	0.026	0.027
Inlet THC Concentration (as propane) (ppm_w):	7.8	6.9	7.4	7.3
Inlet THC Concentration (as propane) (ppm_d):	8.0	7.1	7.5	7.6
Inlet THC Concentration (as propane) (mg/m3d):	14.7	13.0	13.8	13.8
Inlet THC Concentration (as propane) (lb/hr_d):	0.17	0.13	0.14	0.14
Inlet Methane Correction Factor	2.39	2.29	2.28	2.32
Inlet Methane Concentration (as methane) (ppm_w):	2.87	7.04	3.72	4.54
Inlet Methane Concentration (as methane) (ppm_d):	2.96	7.23	3.82	4.67
Inlet Methane Concentration (as propane) (ppm_w):	1.20	3.07	1.63	1.97
Inlet Methane Concentration (as propane) (ppm_d):	1.24	3.16	1.67	2.02
Inlet Methane Concentration (as propane) (mg/m3):	2.27	5.79	3.07	3.71
Inlet Methane Concentration (as propane) (lb/hr):	0.026	0.057	0.030	0.038
Inlet NMOC Concentration (as propane) (ppmv):	6.79	3.93	5.87	5.53
Inlet NMOC Concentration (as propane) (lbs/hr):	0.14	0.07	0.11	0.11
Outlet THC Concentration (as propane) (ppm_w):	0.22	0.33	0.69	0.41
Outlet THC Concentration (as propane) (ppm_d):	0.22	0.34	0.71	0.43
Outlet THC Concentration (as propane) (mg/m^3_d):	0.41	0.63	1.30	0.78
Outlet THC Concentration (as propane) (lb/hr_d):	0.005	0.006	0.013	0.008
Outlet Methane Correction Factor	2.49	2.35	2.33	2.39
Outlet Methane Concentration (as methane) (ppm_w):	-0.49	-0.03	1.00	0.16
Outlet Methane Concentration (as methane) (ppm_d):	-0.51	-0.03	1.03	0.16
Outlet Methane Concentration (as propane) (ppm_w):	-0.20	-0.01	0.43	0.07
Outlet Methane Concentration (as propane) (ppm_d):	-0.20	-0.01	0.44	0.07
Outlet Methane Concentration (as propane) (mg/m^3):	-0.37	-0.02	0.81	0.14
Outlet Methane Concentration (as propane) (lb/hr):	-0.004	-0.0002	0.008	0.001
Outlet NMOC Concentration (as propane) (ppmv):	0.43	0.36	0.27	0.35
Outlet NMOC Concentration (as propane) (lbs/hr):	0.009	0.006	0.005	0.007
Destruction Efficiency (THC) (%):	97.2%	95.2%	90.6%	94.3%
Destruction Efficiency (NMOC) (%):	93.7%	91.0%	95.4%	93.3%
THC Emission Rate (lb/mmbtu (Natural Gas only))	0.0014	0.0021	0.0044	0.0026
THC Emission Rate (lb/mmbtu (Gasoline + Diesel))	0.004	0.008	0.014	0.009
Emission Rate (lb/mmbtu (Natural Gas + Gasoline + Diesel))	0.0011	0.0017	0.0033	0.0020
THC Emission Rate (lb/gallon)	0.0005	0.0010	0.0017	0.0011
NMOC Emission Rate (lb/mmbtu (Natural Gas only))	0.0027	0.0022	0.0017	0.0022
NMOC Emission Rate (lb/mmbtu (Gasoline + Diesel))	0.008	0.009	0.005	0.007
Emission Rate (lb/mmbtu (Natural Gas + Gasoline + Diesel))	0.0020	0.0018	0.0013	0.0017
NMOC Emission Rate (lb/gallon)	0.0010	0.0010	0.0006	0.0009
Gallons Used	8.66	6.10	7.80	7.52
Gasoline + Diesel Heat Content (Btu/hr)	1,055,921	731,775	954,358	914,018
Natural Gas (cfh)	3,253	2,851	2,867	2,990
Natural Gas (Btu/hr)	3,318,060	2,908,020	2,924,340	3,050,140

Note: "d" indicated based on dry conditions

Table 3A: CO_NOx EMISSIONS TABLE (SVDYNO-OXIDIZER3)

Source: Ford DYNA - SVDYNO-OXIDIZER3
RWDI Project #2205678

Parameter	1	2	3	Average
Date	4-Aug-22	4-Aug-22	4-Aug-22	--
Start Time:	8:05	9:50	12:30	--
Stop Time:	9:05	10:50	13:30	--
Duration (mins):	60	60	60	--
Inlet Flow Rate (dscfm):	2,018	2,253	2,369	2,213
Inlet Flow Rate (dm^3/s):	0.96	1.06	1.12	1.05
Moisture:	0.035	0.031	0.035	0.033
Inlet CO Concentration (ppm_d):	55.7	58.8	46.6	53.7
Inlet CO Concentration (mg/m3d):	64.8	68.5	54.2	62.5
Inlet CO Concentration (lb/hr_d):	0.49	0.58	0.48	0.52
Inlet NOx Concentration (ppm_d):	45.12	27.83	31.20	34.71
Inlet NOx Concentration (mg/m3):	86.27	53.20	59.66	66.38
Inlet NOx Concentration (lb/hr):	0.66	0.45	0.53	0.54
Outlet CO Concentration (ppm_d):	0.15	0.47	0.24	0.29
Outlet CO Concentration (mg/m^3_d):	0.17	0.55	0.28	0.33
Outlet CO Concentration (lb/hr_d):	0.0013	0.0046	0.0025	0.0028
Outlet NOx Concentration (ppm_d):	74.36	56.58	59.43	63.46
Outlet NOx Concentration (mg/m^3):	142.18	108.18	113.64	121.33
Outlet NOx Concentration (lb/hr):	1.08	0.91	1.01	1.00
Destruction Efficiency (CO) (%):	99.7%	99.2%	99.5%	99.5%
CO Emission Rate (lb/mmbtu (Natural Gas only))	0.0005	0.0017	0.0009	0.0010
CO Emission Rate (lb/mmbtu (Gasoline + Diesel))	0.0016	0.0051	0.0025	0.0030
CO Emission Rate (lb/mmbtu (Natural Gas + Gasoline + Diesel))	0.0004	0.0013	0.0007	0.0008
CO Emission Rate (lb/gallon)	0.0002	0.0006	0.0003	0.0004
NOx (Engine + Natural Gas) Emissions (as Measured) Outlet				
NOx Emission from TO (TO Outlet) (lb/hr)	1.081	0.910	1.010	1.000
NOx Emission Rate (lb/mmbtu (Natural Gas only))	0.418	0.327	0.358	0.368
NOx Emission Rate (lb/mmbtu (Gasoline + Diesel only))	1.307	0.993	0.995	1.098
NOx Emission Rate (lb/mmbtu (Natural Gas + Gasoline + Diesel))	0.317	0.246	0.263	0.275
NOx Emission Rates (lb/gallon)	0.163	0.123	0.123	0.136
NOx Engine Emissions (as Measured) (NOx Inlet)				
NOx Emission from TO (TO Inlet) (lb/hr)	0.656	0.447	0.530	0.544
NOx Emission Rate (lb/mmbtu (Natural Gas only))	0.254	0.161	0.188	0.201
NOx Emission Rate (lb/mmbtu (Gasoline + Diesel only))	0.793	0.488	0.522	0.601
NOx Emission Rate (lb/mmbtu (Natural Gas + Gasoline + Diesel))	0.192	0.121	0.138	0.150
NOx Emission Rates (lb/gallon)	0.099	0.060	0.065	0.075
NOx TO Emissions (as Measured) (NOx Outlet - Inlet)				
NOx Emission from TO (TO Outlet - TO Inlet) (lb/hr)	0.425	0.462	0.480	0.456
NOx Emission Rate (lb/mmbtu (Natural Gas only))	0.164	0.166	0.170	0.167
NOx Emission Rate (lb/mmbtu (Gasoline + Diesel only))	0.514	0.505	0.473	0.497
NOx Emission Rate (lb/mmbtu (Natural Gas + Gasoline + Diesel))	0.125	0.125	0.125	0.125
NOx Emission Rates (lb/gallon)	0.064	0.062	0.058	0.062
Gallons Used	6.64	7.40	8.20	7.41
Heat Content (Btu/hr)	827,321	915,821	1,014,744	919,295
Natural Gas (cfh)	2,536	2,725	2,767	2,676
Natural Gas (Btu/hr)	2,586,720	2,779,500	2,822,340	2,729,520

Note: "d" indicated based on dry conditions

Table 3b: THC EMISSIONS TABLE (SVDYNO-OXIDIZER3)

Source: Ford DYNA - SVDYNO-OXIDIZER3
RWDI Project #2205678

Parameter	1	2	3	Average
Date	4-Aug-22	4-Aug-22	4-Aug-22	--
Start Time:	8:05	9:50	12:30	--
Stop Time:	9:05	10:50	13:30	--
Duration (mins):	60	60	60	--
Inlet Flow Rate (dscfm):	2,018	2,253	2,369	2,213
Inlet Flow Rate (dm^3/s):	0.96	1.06	1.12	1.05
Moisture:	0.035	0.031	0.035	0.033
Inlet THC Concentration (as propane) (ppm_w):	9.84	8.02	6.89	8.25
Inlet THC Concentration (as propane) (ppm_d):	10.20	8.27	7.13	8.53
Inlet THC Concentration (as propane) (mg/m3d):	18.7	15.2	13.1	15.6
Inlet THC Concentration (as propane) (lb/hr_d):	0.14	0.13	0.12	0.13
Inlet Methane Correction Factor	2.37	2.28	2.27	2.31
Inlet Methane Concentration (as methane) (ppm_w):	2.53	4.00	2.40	2.98
Inlet Methane Concentration (as methane) (ppm_d):	2.62	4.13	2.49	3.08
Inlet Methane Concentration (as propane) (ppm_w):	1.07	1.75	1.06	1.29
Inlet Methane Concentration (as propane) (ppm_d):	1.11	1.81	1.10	1.34
Inlet Methane Concentration (as propane) (mg/m3):	2.03	3.32	2.01	2.45
Inlet Methane Concentration (as propane) (lb/hr):	0.015	0.028	0.018	0.020
Inlet NMOC Concentration (as propane) (ppmv):	9.09	6.46	6.04	7.20
Inlet NMOC Concentration (as propane) (lbs/hr):	0.13	0.10	0.10	0.11
Outlet THC Concentration (as propane) (ppm_w):	0.11	0.15	0.15	0.14
Outlet THC Concentration (as propane) (ppm_d):	0.11	0.15	0.16	0.14
Outlet THC Concentration (as propane) (mg/m^3_d):	0.20	0.28	0.29	0.26
Outlet THC Concentration (as propane) (lb/hr_d):	0.0015	0.0024	0.0026	0.0022
Outlet Methane Correction Factor	2.59	2.53	2.57	2.56
Outlet Methane Concentration (as methane) (ppm_w):	-0.14	-0.12	-0.16	-0.14
Outlet Methane Concentration (as methane) (ppm_d):	-0.15	-0.13	-0.17	-0.15
Outlet Methane Concentration (as propane) (ppm_w):	-0.05	-0.05	-0.06	-0.06
Outlet Methane Concentration (as propane) (ppm_d):	-0.06	-0.05	-0.06	-0.06
Outlet Methane Concentration (as propane) (mg/m^3):	-0.10	-0.09	-0.12	-0.10
Outlet Methane Concentration (as propane) (lb/hr):	-0.0008	-0.0008	-0.0011	-0.0009
Outlet NMOC Concentration (as propane) (ppmv):	0.17	0.20	0.23	0.20
Outlet NMOC Concentration (as propane) (lbs/hr):	0.0023	0.0031	0.0037	0.0030
Destruction Efficiency (THC) (%):	98.9%	98.1%	97.8%	98.3%
Destruction Efficiency (NMOC) (%):	98.2%	96.9%	96.3%	97.1%
THC Emission Rate (lb/mmbtu (Natural Gas only))	0.0006	0.0008	0.0009	0.0008
THC Emission Rate (lb/mmbtu (Gasoline + Diesel))	0.002	0.003	0.003	0.002
THC Emission Rate (lb/mmbtu (Natural Gas + Gasoline + Diesel))	0.0005	0.0006	0.0007	0.0006
THC Emission Rate (lb/gallon)	0.0002	0.0003	0.0003	0.0003
NMOC Emission Rate (lb/mmbtu (Natural Gas only))	0.0009	0.0011	0.0013	0.0011
NMOC Emission Rate (lb/mmbtu (Gasoline + Diesel))	0.003	0.003	0.004	0.003
NMOC Emission Rate (lb/mmbtu (Natural Gas + Gasoline + Diesel))	0.0007	0.0008	0.0010	0.0008
NMOC Emission Rate (lb/gallon)	0.0004	0.0004	0.0004	0.0004
Gallons Used	6.64	7.40	8.20	7.41
Gasoline + Diesel Heat Content (Btu/hr)	827,321	915,821	1,014,744	919,295
Natural Gas (cfh)	2,536	2,725	2,767	2,676
Natural Gas (Btu/hr)	2,586,720	2,779,500	2,822,340	2,729,520

Note: "d" indicated based on dry conditions

Table 4a: CO_NOx EMISSIONS TABLE (SVDYNO-OXIDIZER4)

Source: Ford DYNA - SVDYNO-OXIDIZER4
RWDI Project #2205678

Parameter	1	2	3	Average
Date	5-Aug-22	5-Aug-22	5-Aug-22	--
Start Time:	8:00	10:00	12:30	--
Stop Time:	9:00	11:00	13:30	--
Duration (mins):	60	60	60	--
Inlet Flow Rate (dscfm):	2,663	2,537	2,861	2,687
Inlet Flow Rate (dm^3/s):	1.26	1.20	1.35	1.27
Moisture:	0.032	0.035	0.030	0.032
Inlet CO Concentration (ppm_d):	140.6	17.9	79.6	79.4
Inlet CO Concentration (mg/m3d):	163.7	20.9	92.7	92.4
Inlet CO Concentration (lb/hr):	1.64	0.20	0.99	0.94
Inlet NOx Concentration (ppm_d):	24.73	36.13	5.29	22.05
Inlet NOx Concentration (mg/m3):	47.29	69.09	10.11	42.16
Inlet NOx Concentration (lb/hr):	0.47	0.66	0.11	0.41
Outlet CO Concentration (ppm_d):	1.54	0.06	0.84	0.81
Outlet CO Concentration (mg/m^3_d):	1.79	0.07	0.98	0.95
Outlet CO Concentration (lb/hr):	0.018	0.001	0.010	0.010
Outlet NOx Concentration (ppm_d):	58.29	63.67	36.94	52.97
Outlet NOx Concentration (mg/m^3):	111.46	121.75	70.63	101.28
Outlet NOx Concentration (lb/hr):	1.11	1.16	0.76	1.01
Destruction Efficiency (CO) (%):	98.9%	99.7%	98.9%	99.2%
CO Emission Rate (lb/mmbtu (Natural Gas only))	0.0068	0.0002	0.0034	0.0035
CO Emission Rate (lb/mmbtu (Gasoline + Diesel))	0.0216	0.0007	0.0084	0.0102
CO Emission Rate (lb/mmbtu (Natural Gas + Gasoline + Diesel))	0.0052	0.0002	0.0024	0.0026
CO Emission Rate (lb/gallon)	0.0026	0.0001	0.0010	0.0012
NOx (Engine + Natural Gas) Emissions (as Measured) Outlet				
NOx Emission from TO (TO Outlet) (lb/hr)	1.114	1.159	0.756	1.010
NOx Emission Rate (lb/mmbtu (Natural Gas only))	0.424	0.379	0.244	0.349
NOx Emission Rate (lb/mmbtu (Gasoline + Diesel only))	1.340	1.127	0.609	1.026
NOx Emission Rate (lb/mmbtu (Natural Gas + Gasoline + Diesel))	0.322	0.283	0.174	0.260
NOx Emission Rates (lb/gallon)	0.163	0.140	0.076	0.126
NOx Engine Emissions (as Measured) (NOx Inlet)				
NOx Emission from TO (TO Inlet) (lb/hr)	0.473	0.658	0.108	0.413
NOx Emission Rate (lb/mmbtu (Natural Gas only))	0.180	0.215	0.035	0.143
NOx Emission Rate (lb/mmbtu (Gasoline + Diesel only))	0.569	0.640	0.087	0.432
NOx Emission Rate (lb/mmbtu (Natural Gas + Gasoline + Diesel))	0.137	0.161	0.025	0.107
NOx Emission Rates (lb/gallon)	0.069	0.080	0.011	0.053
NOx TO Emissions (as Measured) (NOx Outlet - Inlet)				
NOx Emission from TO (TO Outlet - TO Inlet) (lb/hr)	0.641	0.501	0.648	0.597
NOx Emission Rate (lb/mmbtu (Natural Gas only))	0.244	0.164	0.209	0.206
NOx Emission Rate (lb/mmbtu (Gasoline + Diesel only))	0.772	0.488	0.522	0.594
NOx Emission Rate (lb/mmbtu (Natural Gas + Gasoline + Diesel))	0.185	0.123	0.149	0.152
NOx Emission Rates (lb/gallon)	0.094	0.061	0.065	0.073
Gallons Used	6.85	8.25	9.99	8.36
Heat Content (Btu/hr)	830,988	1,028,034	1,241,043	1,033,355
Natural Gas (cfh)	2,575	3,001	3,040	2,872
Natural Gas (Btu/hr)	2,626,500	3,061,020	3,100,800	2,929,440

Note: "d" indicated based on dry conditions

Table 4b: THC EMISSIONS TABLE (SVDYNO-OXIDIZER4)

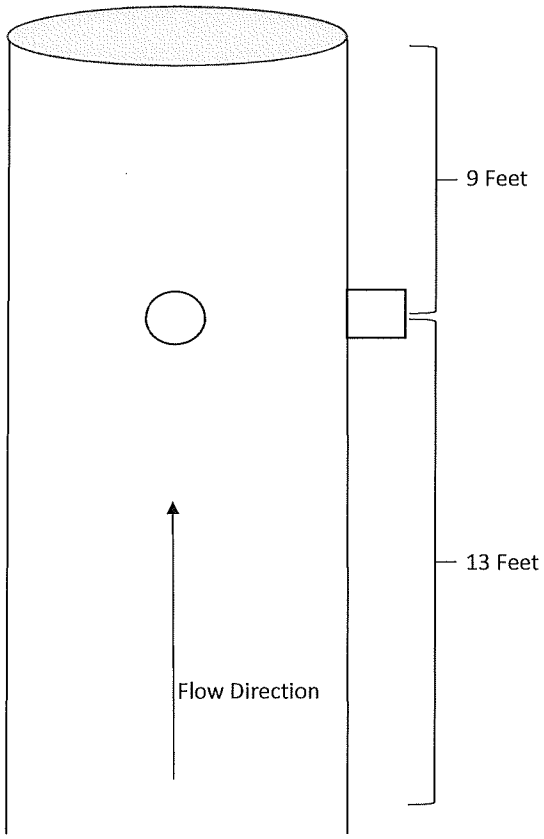
Source: Ford DYNA - SVDYNO-OXIDIZER4
RWDI Project #2205678

Parameter	1	2	3	Average
Date	5-Aug-22	5-Aug-22	5-Aug-22	--
Start Time:	8:00	10:00	12:30	--
Stop Time:	9:00	11:00	13:30	--
Duration (mins):	60	60	60	--
Inlet Flow Rate (dscfm):	2,663	2,537	2,861	2,687
Inlet Flow Rate (dm^3/s):	1.26	1.20	1.35	1.27
Moisture:	0.032	0.035	0.030	0.032
Inlet THC Concentration (as propane) (ppm_w):	5.17	5.95	4.69	5.27
Inlet THC Concentration (as propane) (ppm_d):	5.35	6.16	4.83	5.45
Inlet THC Concentration (as propane) (mg/m3d):	9.80	11.3	8.86	10.0
Inlet THC Concentration (as propane) (lb/hr_d):	0.10	0.11	0.09	0.10
Inlet Methane Correction Factor	2.46	2.51	2.40	2.46
Inlet Methane Concentration (as methane) (ppm_w):	2.73	1.47	2.99	2.40
Inlet Methane Concentration (as methane) (ppm_d):	2.82	1.53	3.08	2.48
Inlet Methane Concentration (as propane) (ppm_w):	1.11	0.59	1.25	0.98
Inlet Methane Concentration (as propane) (ppm_d):	1.15	0.61	1.29	1.01
Inlet Methane Concentration (as propane) (mg/m3):	2.10	1.12	2.36	1.86
Inlet Methane Concentration (as propane) (lb/hr):	0.021	0.011	0.025	0.019
Inlet NMOC Concentration (as propane) (ppmv):	4.20	5.55	3.55	4.43
Inlet NMOC Concentration (as propane) (lbs/hr):	0.08	0.10	0.07	0.08
Outlet THC Concentration (as propane) (ppm_w):	0.07	0.24	0.12	0.14
Outlet THC Concentration (as propane) (ppm_d):	0.08	0.24	0.12	0.15
Outlet THC Concentration (as propane) ($mg/m^3{}_d$):	0.14	0.45	0.23	0.27
Outlet THC Concentration (as propane) (lb/hr_d):	0.0014	0.0043	0.0024	0.0027
Outlet Methane Correction Factor	2.57	2.61	2.43	2.54
Outlet Methane Concentration (as methane) (ppm_w):	-0.25	-0.15	-0.71	-0.37
Outlet Methane Concentration (as methane) (ppm_d):	-0.26	-0.16	-0.74	-0.39
Outlet Methane Concentration (as propane) (ppm_w):	-0.10	-0.06	-0.29	-0.15
Outlet Methane Concentration (as propane) (ppm_d):	-0.10	-0.06	-0.30	-0.16
Outlet Methane Concentration (as propane) (mg/m^3):	-0.18	-0.11	-0.56	-0.28
Outlet Methane Concentration (as propane) (lb/hr):	-0.0018	-0.0011	-0.0059	-0.0030
Outlet NMOC Concentration (as propane) (ppmv):	0.18	0.30	0.43	0.30
Outlet NMOC Concentration (as propane) (lbs/hr):	0.0033	0.0053	0.0084	0.0056
Destruction Efficiency (THC) (%):	98.6%	96.0%	97.5%	97.4%
Destruction Efficiency (NMOC) (%):	95.8%	94.5%	88.0%	92.8%
THC Emission Rate (lb/mmbtu (Natural Gas only))	0.0005	0.0014	0.0008	0.0009
THC Emission Rate (lb/mmbtu (Gasoline + Diesel))	0.0017	0.0041	0.0019	0.0026
THC Emission Rate (lb/mmbtu (Natural Gas + Gasoline + Diesel))	0.00041	0.00104	0.00056	0.00067
THC Emission Rate (lb/gallon)	0.00021	0.00052	0.00024	0.00032
NMOC Emission Rate (lb/mmbtu (Natural Gas only))	0.0012	0.0017	0.0027	0.0019
NMOC Emission Rate (lb/mmbtu (Gasoline + Diesel))	0.0039	0.0052	0.0067	0.0053
NMOC Emission Rate (lb/mmbtu (Natural Gas + Gasoline + Diesel))	0.00094	0.0013	0.0019	0.0014
NMOC Emission Rate (lb/gallon)	0.00048	0.00064	0.00084	0.00065
Gallons Used	6.85	8.25	9.99	8.36
Gasoline + Diesel Heat Content (Btu/hr)	830,988	1,028,034	1,241,043	1,033,355
Natural Gas (cfh)	2,575	3,001	3,040	2,872
Natural Gas (Btu/hr)	2,626,500	3,061,020	3,100,800	2,929,440

Note: "d" indicated based on dry conditions

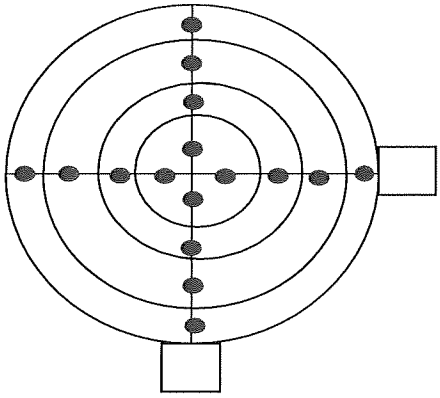
FIGURES

Figure No. 1



Diameter: 27.5

Sampling Points (in.)	
1	0.88
2	2.89
3	5.34
4	8.88
5	18.62
6	22.17
7	24.61
8	26.62



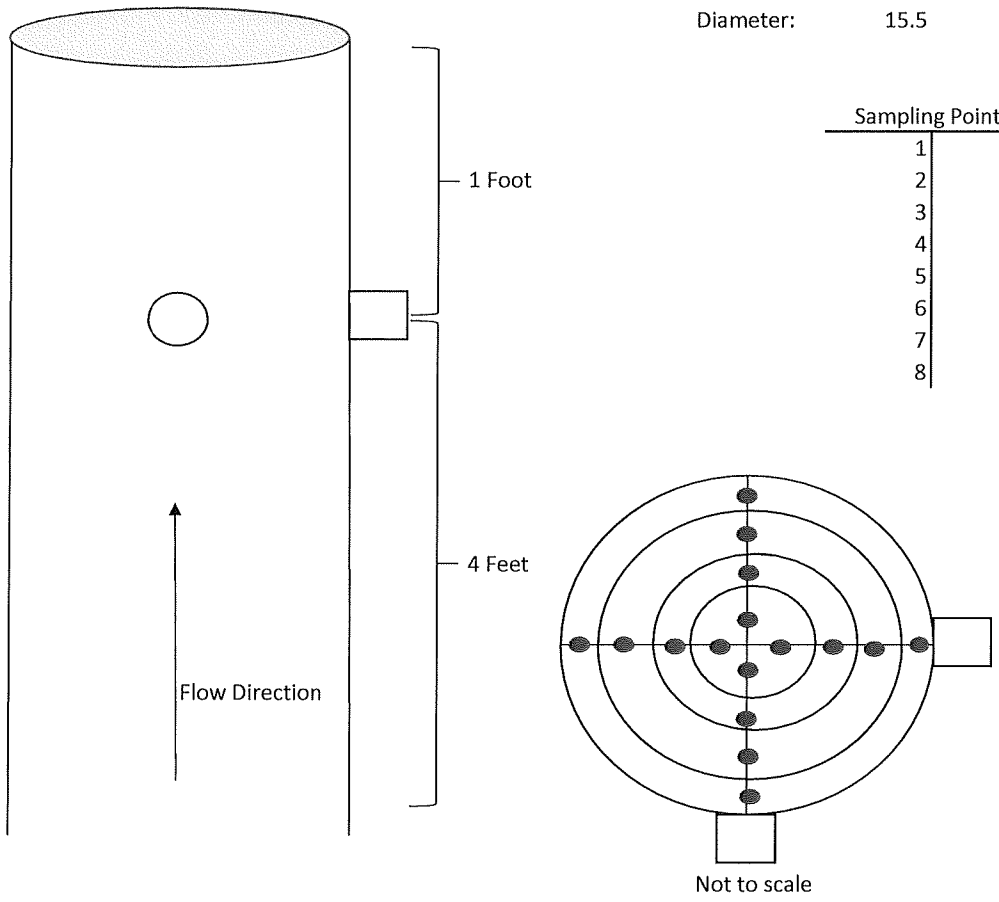
Not to scale

TO 1 Outlet
Ford
DYNA
Dearborn, Michigan

Date:
2-Aug-22

RWDI USA LLC
2239 Star Court
Rochester Hills, MI 48309

Figure No. 2



Diameter: 15.5

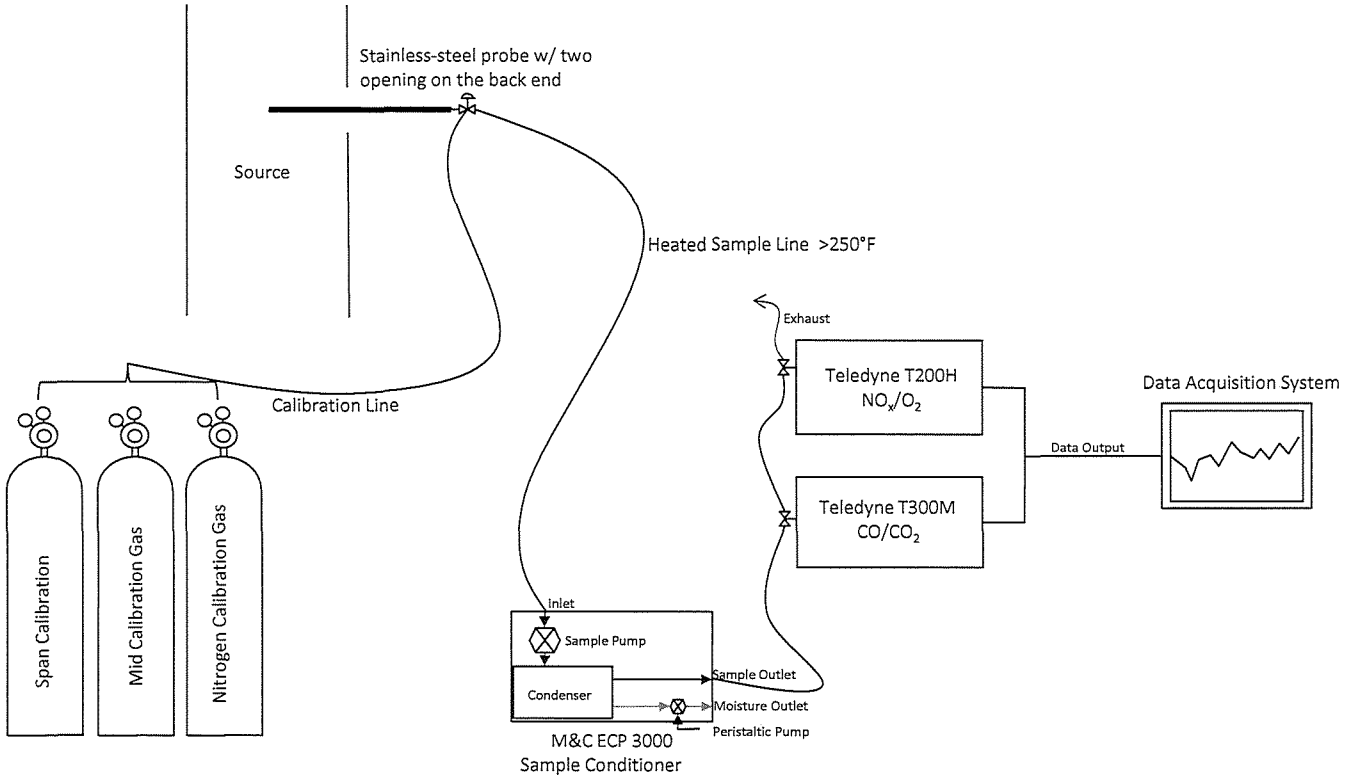
Sampling Points (in.)	
1	0.50
2	1.63
3	3.01
4	5.01
5	10.49
6	12.49
7	13.87
8	15.00

TO 1-4 Inlet
Ford
DYNA
Dearborn, Michigan

Date:
August 2-5, 2022

RWDI USA LLC
2239 Star Court
Rochester Hills, MI 48309

Figure No. 3: USEPA Method 3A,6C,7E,10 Schematic



USEPA Method 3A,6C,7E,10

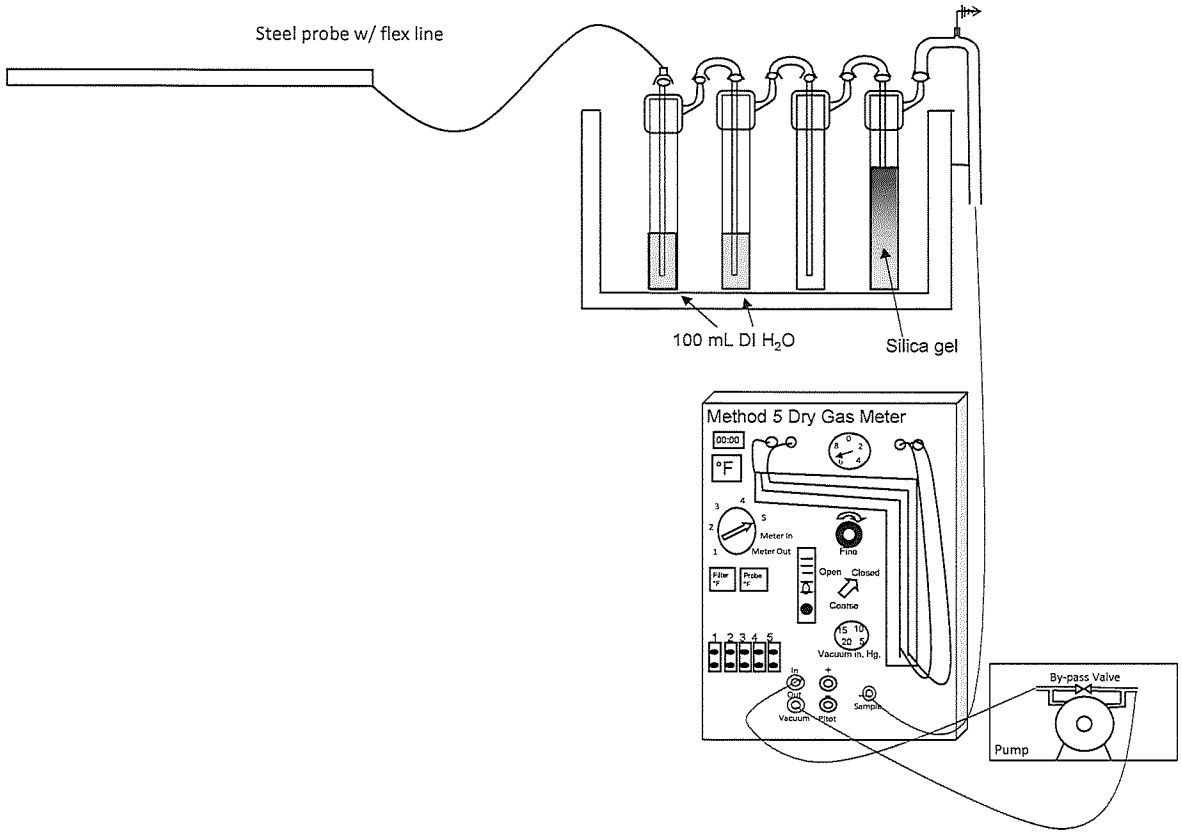
Ford

DYNA

Dearborn, Michigan

August 2-5, 2022

Figure No. 4



USEPA Method 4

Ford

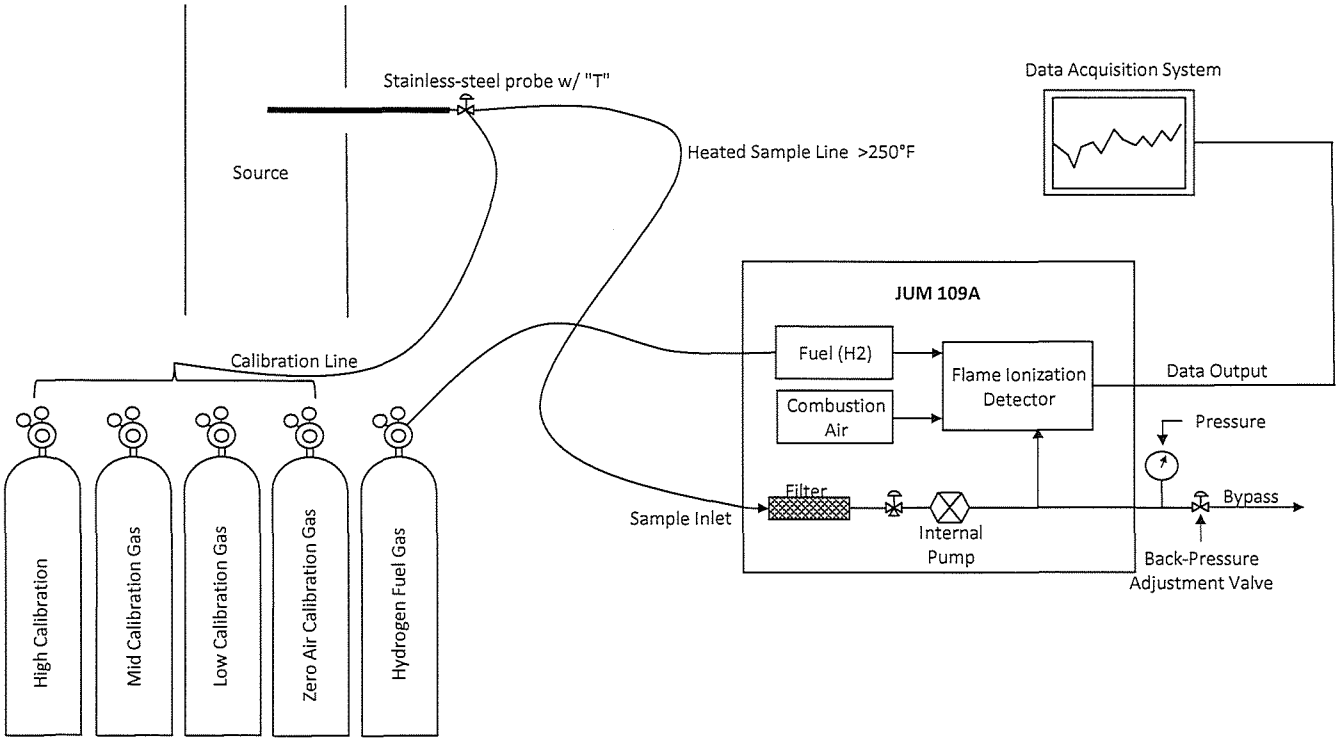
DYNA

TO 1-4

Dearborn, Michigan

August 2-5, 2022

Figure No. 5: USEPA Method 25A Schematic



USEPA Method 25A

Ford

DYNA

Dearborn, Michigan

August 2-5, 2022