

**Nitrogen Oxides
Emissions Testing
of
Boiler No. 3**

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AIR QUALITY DIV.

**Nexteer Automotive
3900 Holland Road
Saginaw, Michigan**

**State Registration No. A6175
Permit to Install 99-13**

Prepared for
**Nexteer Automotive
Saginaw, Michigan**

Bureau Veritas Project No. 11013-000250.00
February 19, 2014



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Executive Summary

Nexteer Automotive retained Bureau Veritas North America, Inc. to test air emissions from Boiler No. 3 exhaust at its facility in Saginaw, Michigan. The testing was performed in order to satisfy testing requirements and evaluate compliance with emission limits in Michigan Department of Environmental Quality Permit to Install 99-13 for the Boiler No. 3 source.

Air emissions testing consisted of measuring the following parameters:

- Flue gas velocity, molecular weight, and moisture content
- Concentration of oxygen (% O₂)
- Concentration of oxides of nitrogen (parts per million NO_x)

Bureau Veritas tested the following source:

- **Boiler No. 3** 150 million British thermal unit per hour (MMBtu/hr) heat input natural-gas-fired boiler that supplies 125,000 pound per hour (lb/hr) of process steam to the facility

On January 16, 2014, air emission testing was performed following United States Environmental Protection Agency (USEPA) Methods 1 through 4, 7E, and 19 and State of Michigan Part 10 Rules at the outlet of the boiler. The air emission testing was conducted as described in the Intent-to-Test plan submitted to MDEQ on November 11, 2013, and approved by MDEQ on November 27, 2013 with the following exceptions; the boiler was operated greater than 90% capacity for Runs 1 and 2, at 80% capacity for Run 3, and at 70% for Runs 4 through 6. The steam load was reduced to 70% to achieve compliance with the NO_x mass emission rate permit limit.

The results of the testing are summarized in the table on the following page. Detailed results, included omitted test runs 1 through 3, are presented in Table 1 in the appendix of this report.



Natural Gas-Fired Boiler No. 3

Boiler No. 3 Emission Results

| Parameter | Units | Run 4 | Run 5 | Run 6 | Average | Permit Limit [†] |
|--|----------|--------|--------|--------|---------------|---------------------------|
| Steam Production | kpph | 86.2 | 86.8 | 87.8 | 86.9 | N/A |
| Natural Gas Use | scf/hr | 93,000 | 92,000 | 91,000 | 92,000 | N/A |
| NO _x concentration [‡] | ppmvd | 70.2 | 70.5 | 70.7 | 70.4 | N/A |
| O ₂ concentration [‡] | % | 4.2 | 4.1 | 4.1 | 4.1 | N/A |
| NO _x Mass Emission Rate | lb/MMBtu | 0.091 | 0.091 | 0.091 | 0.091 | 0.1 |
| NO _x Mass Emission Rate | lb/hr | 13.4 | 14.0 | 14.8 | 14.1 | 15.0 |

[†]: Limit is expressed as the average of three test runs.
[‡]: concentration corrected for analyzer drift per USEPA Method 7E, equation 7E-5b
 kpph: thousand pound per hour
 scf/hr: standard cubic foot per hour
 ppmvd: part per million by volume, dry basis

The results of this test program indicate Boiler No. 3 at the Nexteer Automotive facility is operating in compliance with permit limits for the measured parameters when operating at an average steam production of 86.9 kpph or 69.5% of maximum capacity.



1.0 Introduction

Nexteer Automotive retained Bureau Veritas North America, Inc. to test air emissions from Boiler No. 3 exhaust at its facility in Saginaw, Michigan. The testing was performed in order to satisfy testing requirements and evaluate compliance with emission limits in Michigan Department of Environmental Quality Permit to Install 99-13 for the Boiler No. 3 source.

Air emissions testing consisted of measuring the following parameters:

- Flue gas velocity, molecular weight, and moisture content
- Concentration of oxygen (% O₂)
- Concentration of oxides of nitrogen (parts per million NO_x)

Bureau Veritas tested the following source:

- **Boiler No. 3** 150 million British thermal unit per hour (MMBtu/hr) heat input natural-gas-fired boiler that supplies 125,000 pound per hour (lb/hr) of process steam to the facility

The air emission testing was conducted as described in the Intent-to-Test plan submitted to MDEQ on November 11, 2013, and approved by MDEQ on November 27, 2013 with the following exceptions; the boiler was operated greater than 90% capacity for Runs 1 and 2, at 80% capacity for Run 3, and at 70% for Runs 4 through 6.

1.1 Identification, Location, and Dates of Test

The testing was performed at the Nexteer Automotive facility on January 16, 2014. The source, parameters, and test dates are presented in the following table:

Table 1-1
Source Identification, Parameters, and Dates of Tests

| Source Identification | Parameter | Test Date |
|---|----------------------------------|------------------|
| Boiler No. 3 – EUBR03 | NO _x , O ₂ | January 16, 2014 |
| NO _x : oxides of nitrogen O ₂ : oxygen | | |



1.2 Purpose of Testing

The purpose of the testing was to satisfy testing requirements and evaluate compliance with emission limits in Michigan Department of Environmental Quality Permit to Install 99-13 for the Boiler No. 3 source.

1.3 Description of Source

The source tested generates hot water and steam for distribution to the automotive manufacturing complex. The following table describes the source tested.

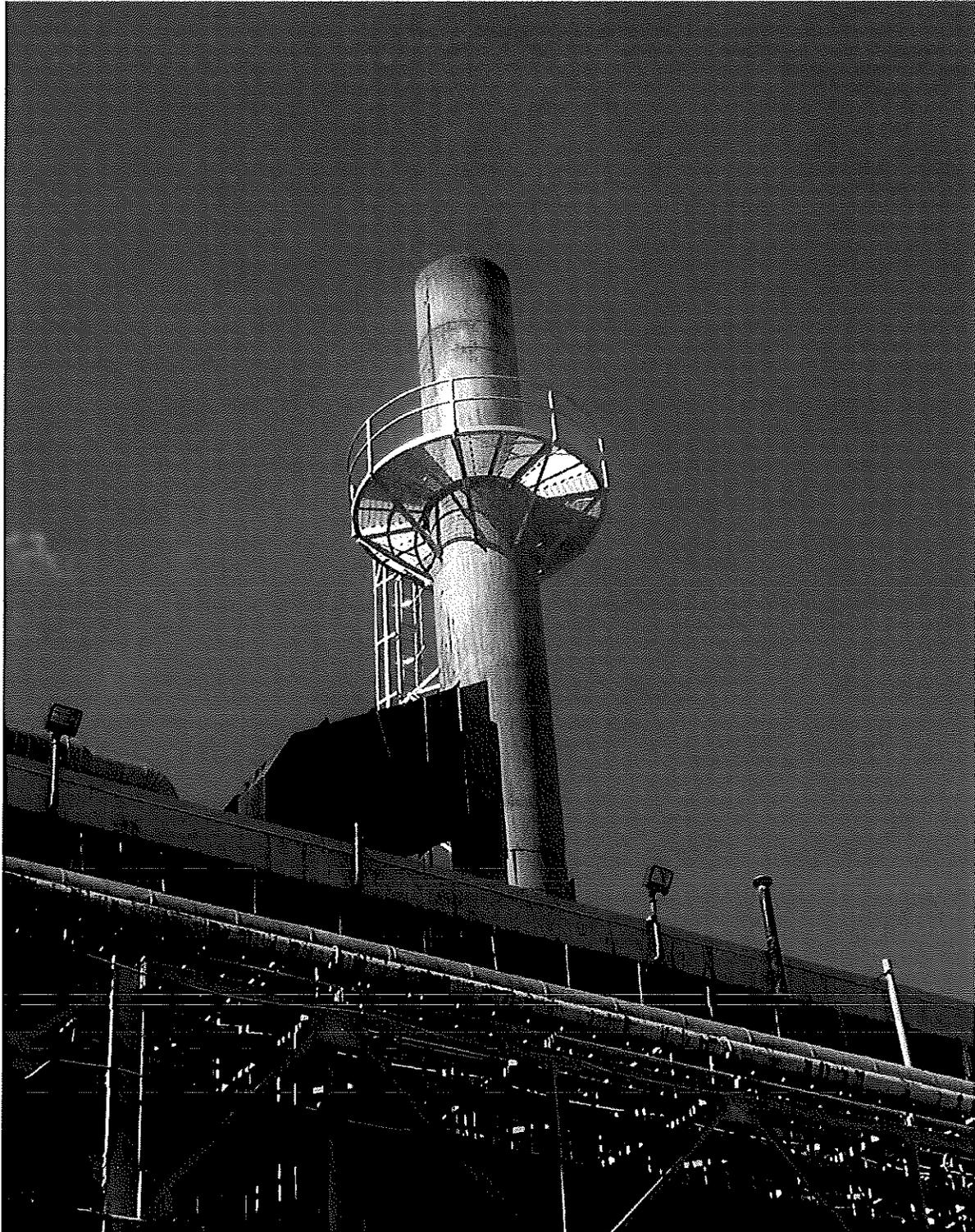
**Table 1-2
Description of Source**

| Emission Unit ID | Emission Unit Description | Flexible Group ID |
|--------------------------|---|--------------------------|
| EUBR03 (Boiler No. 3) | Hot water is generated for plant use using a natural gas boiler. The boiler has a rated heat input of 150 million British thermal units (MMBtu) and can supply 125,000 pounds per hour (lb/hr) of process steam to the plant. | Not applicable |

Figure 1 (after the Figures Tab in the Appendix) depicts the exhaust ductwork and sampling locations.

The boiler exhaust is located on the roof of the powerhouse building. The stack is 66 inches in diameter where it exhausts to atmosphere. Sampling ports are installed in accordance with USEPA Method 1 guidelines. The sampling ports are accessible via a ladder and a platform on the stack. A photograph of the source is presented in Figure 1-1. A photograph of the sampling location is presented in Figure 1-2.

Figure 1-1. Boiler No. 3 Exhaust





Two 4-inch-internal-diameter sampling ports, oriented at 90° to one another, were used for sampling. The sampling ports extend 6 inches outward from the stack interior wall. The sampling ports are located at the following locations relative to the nearest flow disturbances:

- Approximately 18 feet downstream of a duct confluence (~3.3 stack diameters)
- Approximately 11.5 feet upstream of the stack's exhaust to atmosphere (~2.1 stack diameters)

1.4 Contact Information

Mr. Thomas Schmelter, Senior Project Manager with Bureau Veritas, directed the compliance testing program. Mr. Dominic DeCarlo, Facilities and Environmental Engineer, and Ms. Kim Bostek, Supervisor and Environmental Engineer, with Nexteer Automotive, provided process coordination and arranged for facility operating parameters to be recorded.

Mr. Nathan Hude with MDEQ witnessed the testing. Mr. Witkopp is the state inspector assigned to the facility. Contact information for these individuals is listed in Table 1-3 on the following page.



**Table 1-3
Contact Information**

| | |
|--|---|
| Nexteer Automotive | |
| <p>Dominic DeCarlo Facilities and Environmental Engineer 3900 Holland Road Saginaw, Michigan 48601 Telephone: 989.757.5987 Facsimile: 989.757.4044 dominic.decarlo@nexteer.com</p> | <p>Kim Bostek Supervisor, Environmental Engineer 3900 Holland Road Saginaw, Michigan 48601 Telephone: 989.757.4504 Facsimile: 989.757.5884 kimberly.bostek@nexteer.com</p> |
| Emission Testing Company | |
| <p>Thomas Schmelter, QSTI Senior Project Manager Bureau Veritas North America, Inc. 22345 Roethel Drive Novi, Michigan 48375 Telephone: 248.344.3003 Facsimile: 248.344.2656 thomas.schmelter@us.bureauveritas.com</p> | |
| Regulatory Agency | |
| <p>Nathan Hude Michigan Dept. of Environmental Quality Air Quality Division - Technical Programs Unit Constitution Hall 2nd Floor South Tower 525 W Allegan Lansing, Michigan 48933-1502 Telephone: 517.284.6779 Facsimile: 517.335.3122 huden@michigan.gov</p> | <p>Ben Witkopp Michigan Dept. of Environmental Quality Air Quality Division - Saginaw Bay District Constitution Hall 2nd Floor South Tower 525 W Allegan Lansing, Michigan 48933-1502 Telephone: 517.284.6779 Facsimile: 517.335.3122 huden@michigan.gov</p> |



2.0 Summary of Results

2.1 Operating Data

Nexteer Automotive personnel recorded operating parameters during the emissions testing. The following operating data were recorded:

- Natural gas use (standard cubic foot per hour)
- Boiler load as steam output (lb/hour)

Mr. Hude with MDEQ verified that the operating parameters were recorded appropriately. The recorded operating parameters are included in Appendix E and summarized in Table 2-1.

**Table 2-1
January 16, 2014, Boiler No. 3 Operating Parameters**

| Testing Parameter | Run | Sampling Time | Steam Output (kpph) | Natural Gas Use (standard cubic feet per hour) |
|-------------------|-----|----------------|----------------------------|--|
| NO _x | 1 | 8:20 to 9:20 | 118.6 | 123,000 |
| | 2 | 10:00 to 11:00 | 116.6 | 121,000 |
| | 3 | 12:30 to 13:00 | 110.6 | 120,000 |
| | 4 | 13:30 to 14:30 | 86.2 | 93,000 |
| | 5 | 14:50 to 15:50 | 86.8 | 92,000 |
| | 6 | 16:00 to 17:00 | 87.8 | 91,000 |
| | | | Average[†] | 86.9 |

[†]: runs 4, 5 and 6 used to calculate average emission results in comparison to permit limits
kpph : thousand pound per hour
Operating parameters were averaged over the duration of each test run.

2.2 Applicable Permit or Source Designation

The applicable permit is Michigan Department of Environmental Quality Permit to Install 99-13.

2.3 Comparison to Emission Regulations

The permit requires testing to evaluate compliance with the following emission limits within 60 days after achieving maximum production rate, but not later than 180 days after commencement of initial start-up. The results are used to evaluate compliance with the facility's emission limits for NO_x. The relevant emission limits in the permit are presented in Table 2-2.



**Table 2-2
Emission Limits**

| Source | Oxides of Nitrogen Emission Limit |
|-------------------|--------------------------------------|
| Boiler 3 – EUBR03 | 0.1 lb NO _x /MMBtu |
| | 15 lb NO _x /hr |

The results of the testing are compared to permit limits in Table 2-3. Detailed results are presented in Table 1 after the Tables tab in the Appendix. Graphs of measured oxygen and oxides of nitrogen concentrations are provided after the Graphs tab.

Natural Gas-Fired Boiler No. 3

Boiler No. 3 Emission Results

| Parameter | Units | Run 4 | Run 5 | Run 6 | Average | Permit Limit ¹ |
|------------------------------------|----------|--------|--------|--------|---------------|---------------------------|
| Steam Production | kpph | 86.2 | 86.8 | 87.8 | 86.9 | N/A |
| Natural Gas Use | scf/hr | 93,000 | 92,000 | 91,000 | 92,000 | N/A |
| NO _x Concentration | ppmvd | 70.2 | 70.5 | 70.7 | 70.4 | N/A |
| O ₂ Concentration | % | 4.2 | 4.1 | 4.1 | 4.1 | N/A |
| NO _x Mass Emission Rate | lb/MMBtu | 0.091 | 0.091 | 0.091 | 0.091 | 0.1 |
| NO _x Mass Emission Rate | lb/hr | 13.4 | 14.0 | 14.8 | 14.1 | 15.0 |

¹: Limit is expressed as the average of three test runs.

kpph: thousand pound per hour

scf/hr: standard cubic foot per hour

ppmvd: part per million by volume, dry basis

The results of this test program indicate Boiler No. 3 at the Nexteer Automotive facility is operating in compliance with permit limits for the measured parameters when operating at an average steam production of 86.9 kpph or 69.5% of maximum capacity.



3.0 Source Description

3.1 Process Description

Nexteer Automotive is a designer and manufacturer of steering columns, shafts, integral steering gears, rack and pinion steering gears, power steering pumps, advanced steering systems and complete steering modules with anti-theft features for various vehicle manufacturers. Operations are conducted in six building and a powerhouse on the property.

The powerhouse was built in 1952 and operates three coal-fired boilers (Boiler No. 1 is no longer in operation) and two natural-gas-fired boilers to generate process and heating steam for use throughout the complex. Boiler No. 3 is a natural-gas-fired boiler with a maximum heat input capacity of 150 mmBtu. The powerhouse has the capacity to generate a maximum of 460,000 pounds per hour (pph) of steam.

Boilers 4, 5, and 6 are underthrow stoker coal-fired that have a maximum heat input capacity of 220 million British thermal units per hour (mmBtu/hr). Soot blows are performed on average once per day on the boiler(s) in operation. The soot blows are typically 45 minutes in duration and assist in the cleaning of the tubes in the convective back pass and air pre-heater. Boiler No. 2 is a natural-gas-fired boiler with a maximum heat input capacity of 77 mmBtu.

Boiler No. 3 was recently converted from a coal-fired boiler to a 150,000 mmBtu/hr natural gas fired boiler. Emissions from this source are generated through the combustion of natural-gas using low oxides of nitrogen (NO_x) burners and are vented through exhaust stack SV-BR03 exiting the roof of the powerhouse building.

3.2 Process Flow

Coal is conveyed from the coal yard and into the top floor coal bunker of the powerhouse. A coal chute positioned on the conveyor directs the coal into the selected boiler bunker. From the coal bunker, coal is gravity-fed into a scale that intermittently releases coal in 200-pound increments into three underthrow rotary feeders. The feeders distribute the coal approximately 30 feet across the rear of the traveling grate.

Combustion air is added to the furnace using a forced draft fan. The combustion air either mixes with natural gas at the burner in Boiler's No. 2 or No. 3 or flows through the coal boilers 4, 5, and 6's traveling grates and into the combustion chamber. The coal combustion across the traveling grate heats the water wall tubes and steam drum. Flue gas from the furnace is exhausted using an induction fan that creates negative pressure within the combustion chamber. The flue gas is directed through the Multi-Clones, heat exchanger (economizer), and baghouse before exhausting to atmosphere.



Bottom ash from the coal combustion is collected in hoppers. Fly ash generated by the combustion is captured by multiple cyclones and re-injected into the boiler to be burned. The air emissions from the cyclones are directed to a baghouse equipped with a series of bag filters for particulate matter control. Fly and bottom ash are conveyed to two silos for storage. Emissions from the baghouses are discharged to the atmosphere through the boiler stacks tested.

Coal combustion heats water wall tubes and the upper steam drum. The water wall tubes transfer water between the mud drum and the upper steam drum. The mud drum contains water and is indirectly heated by the furnace. The upper steam drum, directly heated by the furnace, captures steam and directs it to the common header pipe where the steam is distributed at approximately 135 pounds per square inch throughout the facility. The steam condensate is returned to the powerhouse.

Up to 90% of the water/steam generated by the boilers returns to the powerhouse and is directed to a water storage holding vessel in the basement of the powerhouse. From the holding vessel, the water is directed to a deaerated feed tank where tap water is added to compensate for the distribution loss. Corrosion inhibitors and pH balancing chemicals are added prior to the water from the deaerated tank being introduced into the boiler steam drum.

3.3 Materials Processed During Tests

The materials processed during the test were water and natural gas. Water is monitored as steam produced (measured in pounds of steam per hour). Natural gas was monitored in cubic feet per hour. These data were recorded by Nexteer Automotive personnel and are summarized in Section 2.1.

Prior to initiating a test run, Bureau Veritas coordinated with Nexteer Automotive, which verified the process was operating in accordance with designated specifications. Recorded operating data are included in Appendix E.

3.4 Rated Capacity of Process

The capacities of the boilers are based on their respective heat input ratings. The operating capacity of each boiler is based on steam demand and the amount of steam pressure in the steam distribution piping. The rated capacity of each boiler, as noted in the applicable permit, is presented in the following table:



Table 3-1
Rated Capacity of EU-BOILERS

| Boiler | Rated Capacity (mmBtu/hr) |
|---------------|--------------------------------------|
| 2 | 77 |
| 3 | 150 |
| 4 | 220 |
| 5 | 220 |
| 6 | 220 |

mmBtu/hr: million British thermal unit per
hour



4.0 Sampling and Analytical Procedures

Bureau Veritas measured emissions in accordance with the procedures specified in the USEPA Standards of Performance for New Stationary Sources and State of Michigan Part 10 Rules Intermittent Testing and Sampling. The sampling and analytical methods used are indicated in the Table 4-1:

**Table 4-1
Sampling and Analytical Methods**

| Parameter | Source | Reference Method | |
|---|--------------|------------------|--|
| | Boiler No. 3 | Method | Title |
| Sampling ports and traverse points | ● | USEPA 1 | Sample and Velocity Traverses for Stationary Sources |
| Velocity and flowrate | ● | USEPA 2 | Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube) |
| Molecular weight | | USEPA 3 | Gas Analysis for the Determination of Dry Molecular Weight |
| Molecular weight | ● | USEPA 3A | Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure) |
| Moisture content | ● | USEPA 4 | Determination of Moisture Content in Stack Gases (approximation method) |
| Oxides of nitrogen (NO _x) | ● | USEPA 7E | Determination of Nitrogen Oxides Emissions from Stationary Sources (Instrumental Analyzer Procedure) |
| NO _x emission rates (lb/mmBtu) | ● | USEPA 19 | Determination of Sulfur Dioxide Removal Efficiency and Particulate Matter, Sulfur Dioxide, and Nitrogen Oxide Emission Rates |

● Indicates a test parameter for each test run

4.1 Sampling Train and Procedures

The following sections describe the USEPA source sampling methods used during this test program.

4.1.1 Volumetric Flowrate (USEPA Methods 1 and 2)

USEPA Method 1, "Sample and Velocity Traverses for Stationary Sources" from the Code of Federal Regulations, Title 40, Part 60 (40 CFR 60), Appendix A, was used to select the sampling locations and determine the number of traverse points. The velocity measurement locations and number of velocity traverse points are presented in the following table:



**Table 4-2
Sampling Location and Number of Traverse Points**

| Sampling Locations | Duct Diameter (inch) | Duct Diameters Downstream to Flow Disturbance (diameter) | Duct Diameters Upstream to Flow Disturbances (diameter) | Number of Ports Used | Traverse Points per Port | Total Points | Cylconic Flow Check Average Null Angle |
|--------------------|-----------------------------|---|--|----------------------|--------------------------|--------------|---|
| Boiler 3 | 66 | 2.1 | 3.3 | 2 | 8 | 16 | 12 |

Figure 1 (see Figures Tab) depict the sampling location and traverse points.

Method 2, “Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube),” was used to measure flue gas velocity and calculate volumetric flowrate. An S-type Pitot tube and thermocouple assembly calibrated in accordance with Method 2, Section 10.0, connected to an electronic manometer was used during testing. Because the dimensions of the Pitot tube met the requirements outlined in Method 2, Section 10.1, and were within the specified limits, the baseline Pitot tube coefficient of 0.84 (dimensionless) was assigned. The electronic manometer and thermometer have been calibrated using Calibration Standards which are traceable to National Institute of Standards (NIST). Refer to Appendix A for the Pitot tube, electronic manometer, and thermometer inspection and calibration sheets. Refer to Appendix B for sample calculations of flue gas velocity and volumetric flow rate.

Cyclonic Flow Check. Bureau Veritas evaluated whether cyclonic flow was present at the sampling location. Cyclonic flow is defined as a flow condition with an average null angle greater than 20°. The direction of flow can be determined by aligning the Pitot tube to obtain zero (null) velocity head reading—the direction would be parallel to the Pitot tube face openings or perpendicular to the null position. By measuring the angle of the Pitot tube face openings in relation to the stack walls when a null angle is obtained, the direction of flow is measured. If the absolute average of the flow direction angles is greater than 20 degrees, the flue gas is considered to be cyclonic at that sampling location and an alternative location should be found.

The average of the measured traverse point flue gas velocity null angles was:

- 12° from the direction of flow

The measurements indicate the absence of cyclonic flow at the Boiler No. 3 exhaust sampling location. Field data sheets are included in Appendix C. Computer-generated field data sheets are included in Appendix D.



4.1.2 Molecular Weight (USEPA Method 3)

The carbon dioxide contribution to flue gas molecular weight was evaluated using Method 3, "Gas Analysis for the Determination of Dry Molecular Weight." Flue gas was extracted from the stack through a probe positioned near the centroid of the duct and directed into a Fyrite® gas analyzer. The concentrations of carbon dioxide (CO₂) were measured by chemical absorption with a Fyrite® gas analyzer to within ±0.5%. The average CO₂ result of the grab samples were used to calculate molecular weight.

4.1.3 Moisture Content (USEPA Method 4)

The moisture content of the flue gas was measured using USEPA Method 4, "Determination of Moisture Content in Stack Gases." Bureau Veritas' modular USEPA Method 4 stack sampling system consists of:

- A stainless steel probe.
- Tygon® umbilical line connecting the probe to the impingers.
- A set of four Greenburg-Smith (GS) impingers with the configuration shown in Table 5-3 situated in a chilled ice bath.
- A length of sample line.
- An Environmental Supply® control case equipped with a pump, dry-gas meter, and calibrated orifice.

**Table 5-3
USEPA Method 4 Impinger Configuration**

| Impinger | Type | Contents | Amount |
|----------|-----------------|------------------|------------------|
| 1 | Modified | Water | ~100 milliliters |
| 2 | Greenburg Smith | Water | ~100 milliliters |
| 3 | Modified | Empty | 0 milliliters |
| 4 | Modified | Silica desiccant | ~300 grams |

Prior to initiating a test run, the sampling train was leak-checked by capping the probe tip and applying a vacuum of approximately 15 inches of mercury to the sampling train. The dry-gas



meter was then monitored for approximately 1 minute to verify that the sample train leak rate is less than 0.02 cubic feet per minute (cfm). The sample probe was then inserted into the sampling port near the centroid of the stack in preparation of sampling. Flue gas was extracted at a constant rate from the stack, with moisture removed from the sample stream by the chilled impingers.

At the conclusion of the test run, a post-test leak check was conducted and the impinger train was carefully disassembled. The weight of liquid or silica gel in each impinger was measured with a scale capable of measuring ± 0.5 gram. The weight of water collected within the impingers and volume of flue gas sampled was used to calculate the percent moisture content. Refer to Figure 2 after the Figures Tab for a drawing of the USEPA Method 4 sampling train.

4.1.4 O₂ and NO_x (USEPA Methods 3A and 7E)

O₂ and NO_x concentrations were measured following USEPA Methods 3A, "Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrument Analyzer Procedure)" and 7E, "Determination of Nitrogen Oxides Emissions from Stationary Sources (instrument analyzer procedure)." Sampling for O₂ and NO_x consisted of extracting the flue gas from the stack through:

- A stainless-steel probe
- Heated Teflon sample line to prevent condensation
- A chilled Teflon impinger train with peristaltic pump to remove moisture from the sampled gas stream prior to entering the analyzer
- Thermo 42CHL NO_x chemiluminescence and Teledyne paramagnetic oxygen gas analyzer

Data was recorded at 1-second intervals on a laptop computer equipped with data acquisition software (DAS). Recorded pollutant concentrations were averaged over the duration of each test run.

Prior to testing at the Boiler No. 3 stack, a 3-point stratification test was conducted at 17, 50, and 83% of the stack diameter for at least twice the response time. The results of the 3-point stratification demonstrated that sampling from a single point near the centroid of the duct was appropriate.

An NO/NO₂ conversion check was performed utilizing an approximate 50-ppmv NO₂ calibration gas. The NO concentration was greater than 90% of the introduced NO₂ calibration standard.



A calibration error check was performed by introducing zero-, mid-, and high-level calibration gases directly into the analyzers. The calibration error check was performed to evaluate the analyzers response within the acceptable $\pm 2\%$ range of the calibration span.

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 $\pm 5\%$ of the calibration span. At the conclusion of each test run, an additional system-bias check was performed to evaluate the percent drift from pre- and post-test system-bias checks. If percent drift was less than 3.0% of span, the test is considered valid.

Figure 3 depicts the USEPA Method 3A and 7E sampling train. Calibration data along with the USEPA Protocol 1 certification sheets for the calibration gases used are included in Appendix A.

4.1.5 NO_x Emission Rate (USEPA Method 19)

USEPA Method 19, "Determination of Sulfur Dioxide Removal Efficiency and Particulate Matter, Sulfur Dioxide, and Nitrogen Oxide Emission Rates," was used to calculate the Boiler No. 3 NO_x emission rates in units specified by the air permit. Oxygen concentrations and appropriate F factors (ratios of combustion gas volumes to heat inputs) were used to calculate NO_x emission rates from measured NO_x and O₂ concentrations. Specifically, Equation 19-1 from the method was used:

$$E = C_d F_d \frac{20.9}{(20.9 - \%O_{2d})}$$

Where:

- E = Pollutant emission rate (lb/million-Btu)
- C_d = Pollutant concentration, dry basis (lb/scf)
- F_d = Volumes of combustion components per unit of heat content (8,710 dscf/MM Btu for natural gas)
- %O_{2d} = Concentration of oxygen on a dry basis (%)

4.2 Recovery and Analytical Procedures

Recovery and analytical procedures were not applicable to this test program.

4.3 Cross-Sectional View Sketch

Figure 1 depicts the cross-sectional view and sampling port locations for the Boiler No. 3 source.



5.0 Test Results and Discussion

5.1 Results

The results of this testing program are summarized in Section 2.0 and presented in Table 1 after the Tables Tab. Graphs of the oxygen and oxides of nitrogen concentrations are presented in Graphs 1 through 6.

5.2 Significance of Results to Emission Regulations

The emissions results are used to evaluate compliance with emission limits for NO_x. Tables showing the results and air emissions limits in the applicable permit are presented in Section 2.0.

The results of this test program indicate Boiler No. 3 at the Nexteer Automotive facility is operating in compliance with permit limits for the measured parameters when operating at an average steam production of 86.9 kpph or 69.5% of maximum capacity.

5.3 Sampling Variations or Operating Conditions

No sampling variations or deviations were encountered during this test program. The boiler was operated greater than 90% capacity for Runs 1 and 2, at 80% capacity for Run 3, and at 70% for Runs 4 through 6. The steam load was reduced to 70% to achieve compliance with the NO_x mass emission rate permit limit.

5.4 Upset Conditions

No upset conditions were encountered during this test program.

5.5 Air Pollution Control Device Maintenance

No significant air pollution control device maintenance activities have occurred within the past three months.

5.6 Results of Audit Samples

Audit samples were not required during this testing program.



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5.7 Calibration and Inspection Sheets

Calibration and inspection sheets are presented in Appendix A.

5.8 Sample Calculations

Sample calculations are presented in Appendix B.

5.9 Field Data Sheets

Field data sheets are presented in Appendix C. Computer-generated data sheets are presented in Appendix D. Facility operating parameters are presented in Appendix E.

5.10 Laboratory Data

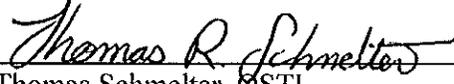
Laboratory data was not required during this test program.

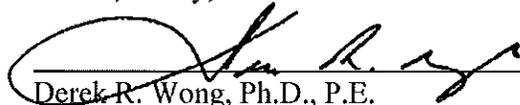


Limitations

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Table



Table 1
Boiler No. 3 O₂ and NO_x Emissions Results
Nexteer Automotive
Saginaw, Michigan
Bureau Veritas Project No. 11013-000250.00
Sampling Date: January 16, 2014

| Parameter | Units | Run 1 | Run 2 | Run 3* | Run 4 | Run 5 | Run 6 | Average* |
|--|---------------------------|---------|---------|---------|--------|--------|--------|----------|
| Start Time | hr:min | 8:20 | 10:00 | 12:30 | 13:30 | 14:50 | 16:00 | |
| Duration | min | 60 | 60 | 30 | 60 | 60 | 60 | 60 |
| Steam Production | lb/hr | 118,600 | 116,600 | 110,600 | 86,200 | 86,800 | 87,800 | 86,933 |
| Fuel Consumption | scf/hr | 123,000 | 121,000 | 120,000 | 93,000 | 92,000 | 91,000 | 92,000 |
| Volumes of combustion component per unit of heat content (F _d) | dscf/mmBtu | 8,710 | 8,710 | 8,710 | 8,710 | 8,710 | 8,710 | 8,710 |
| Volumetric Flowrate (Q _{me, dry}) | dscf/min | 30,997 | 31,190 | 29,910 | 26,728 | 27,681 | 29,207 | 27,872 |
| O ₂ Concentration (C _{exp}) | % | 3.2 | 2.8 | 3.7 | 4.2 | 4.1 | 4.0 | 4.1 |
| Pre-test system calibration, zero gas (C ₀) | % | 0 | 0.2 | 0.2 | 0.1 | 0 | 0 | 0 |
| Post-test system calibration, zero gas (C ₀) | % | 0.2 | 0.2 | 0.1 | 0 | 0 | 0.2 | 0.1 |
| Certified low bracket gas concentration (C _{MA}) | % | 11.0 | 11.0 | 11.0 | 11.0 | 11.0 | 11.0 | 11.0 |
| Pre-test system calibration, low bracket gas (C _{LD}) | % | 11.1 | 11.0 | 11.0 | 10.8 | 10.9 | 10.8 | 10.8 |
| Post-test system calibration, low bracket gas (C _{LD}) | % | 11.0 | 11.0 | 10.8 | 10.9 | 10.8 | 10.8 | 10.8 |
| Average Corrected O ₂ Concentration (C _{exp})† | % | 3.1 | 2.7 | 3.6 | 4.2 | 4.1 | 4.1 | 4.1 |
| NO _x Concentration (C _{exp}) | ppmvd | 77.5 | 79.4 | 72.3 | 68.2 | 68.1 | 68.0 | 68.1 |
| Pre-test system calibration, zero gas (C ₀) | ppmvd | 0.5 | 0.7 | 0.7 | 0.9 | 0.7 | 0.9 | 0.8 |
| Post-test system calibration, zero gas (C ₀) | ppmvd | 0.7 | 0.7 | 0.9 | 0.7 | 0.9 | 0.9 | 0.8 |
| Certified low bracket gas concentration (C _{MA}) | ppmvd | 88.8 | 88.8 | 88.8 | 88.8 | 88.8 | 88.8 | 88.8 |
| Pre-test system calibration, low bracket gas (C _{LD}) | ppmvd | 88.9 | 88.0 | 87.9 | 86.7 | 85.5 | 85.5 | 85.9 |
| Post-test system calibration, low bracket gas (C _{LD}) | ppmvd | 88.0 | 87.9 | 86.7 | 85.5 | 85.5 | 85.0 | 85.3 |
| Average Corrected NO _x Concentration (C _{exp})† | ppmvd | 77.7 | 80.1 | 73.4 | 70.2 | 70.5 | 70.7 | 70.4 |
| Average NO _x Concentration Corrected to 3% Oxygen | ppmvd @ 3% O ₂ | 78.3 | 78.7 | 75.9 | 75.2 | 75.3 | 75.1 | 75.2 |
| NO _x Mass Emission Rate | lb/mmBtu | 9.3 | 9.6 | 8.8 | 8.4 | 8.4 | 8.4 | 8.4 |
| NO _x Mass Emission Rate | lb/mmBtu | 0.095 | 0.096 | 0.092 | 0.091 | 0.091 | 0.091 | 0.091 |
| NO _x Mass Emission Rate | lb/hr | 17.3 | 17.9 | 15.7 | 13.4 | 14.0 | 14.8 | 14.1 |

* corrected for analyzer drift

† flow calculated using estimated moisture content

*: Runs 4, 5 and 6 used to calculate three-run average

dscf/mmBtu: dry standard cubic feet per minute-million British thermal unit

C₀: average of the initial and final system calibration bias check responses from the low-level (or zero) calibration gas, ppmv

C_{MA}: actual concentration of the upscale calibration gas, ppmv

C_{LD}: Average of initial and final system calibration bias check responses for the upscale calibration gas, ppmv

C_{me}: Average effluent gas concentration adjusted for bias, ppmv

ppmvd: part per million by volume, dry basis

lb/scf: pound per standard cubic feet

lb/mmBtu: pound per million British thermal unit

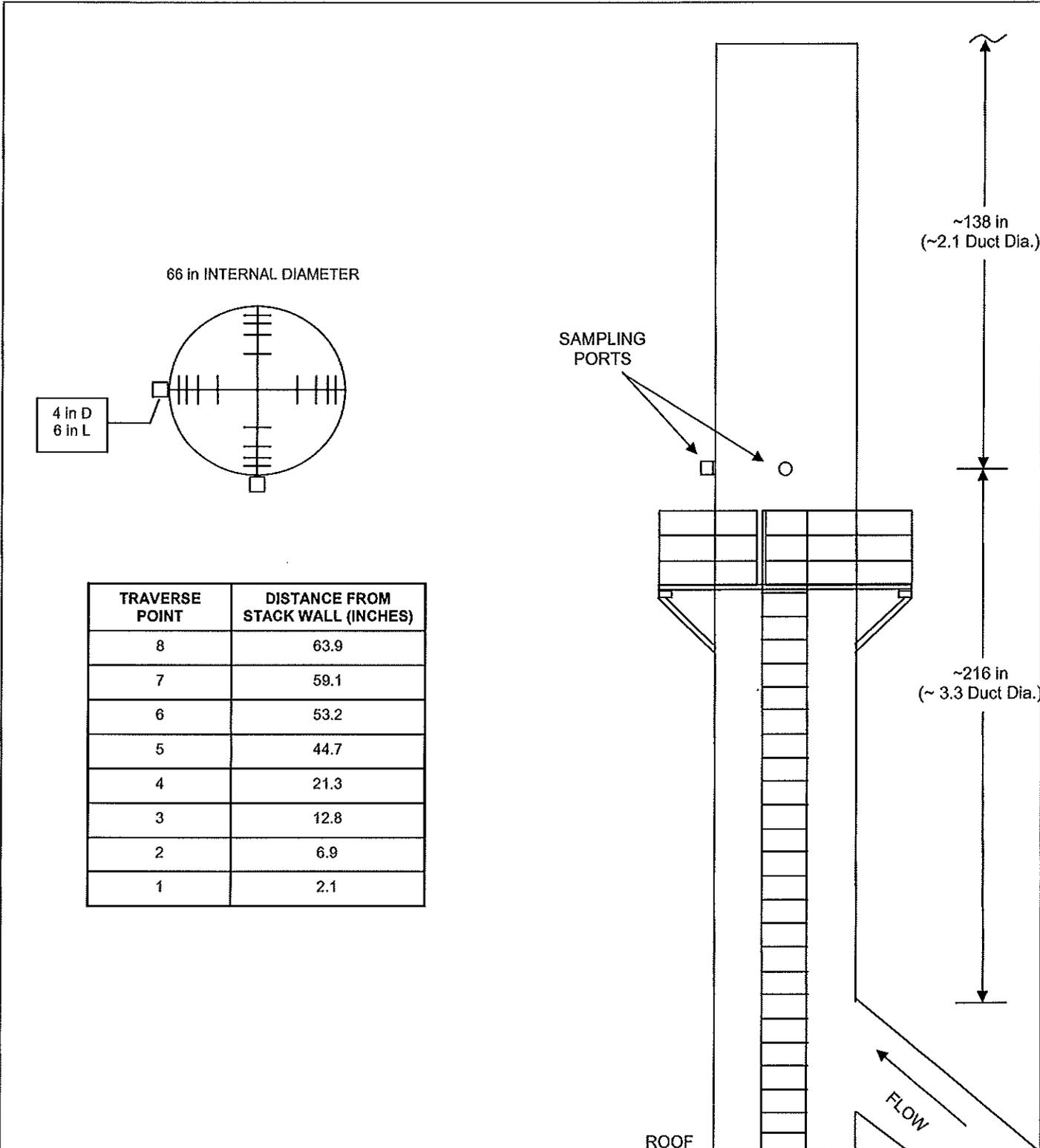
lb/hour: pound per hour

O₂: oxygen

NO_x: oxides of nitrogen



Figures



| | DISTANCE FROM PORTS TO NEAREST UPSTREAM BEND/DISTURBANCE | DISTANCE FROM PORTS TO NEAREST DOWNSTREAM BEND/DISTURBANCE |
|----------|--|--|
| Boiler 3 | ~216 INCHES (~3.3 DIAMETERS) | ~138 INCHES (~2.1 DIAMETERS) |

Figure 1
Boiler No. 3 Outlet Sampling Ports
and Traverse Point Locations



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Saginaw, Michigan

Project No. 11013-000250.00

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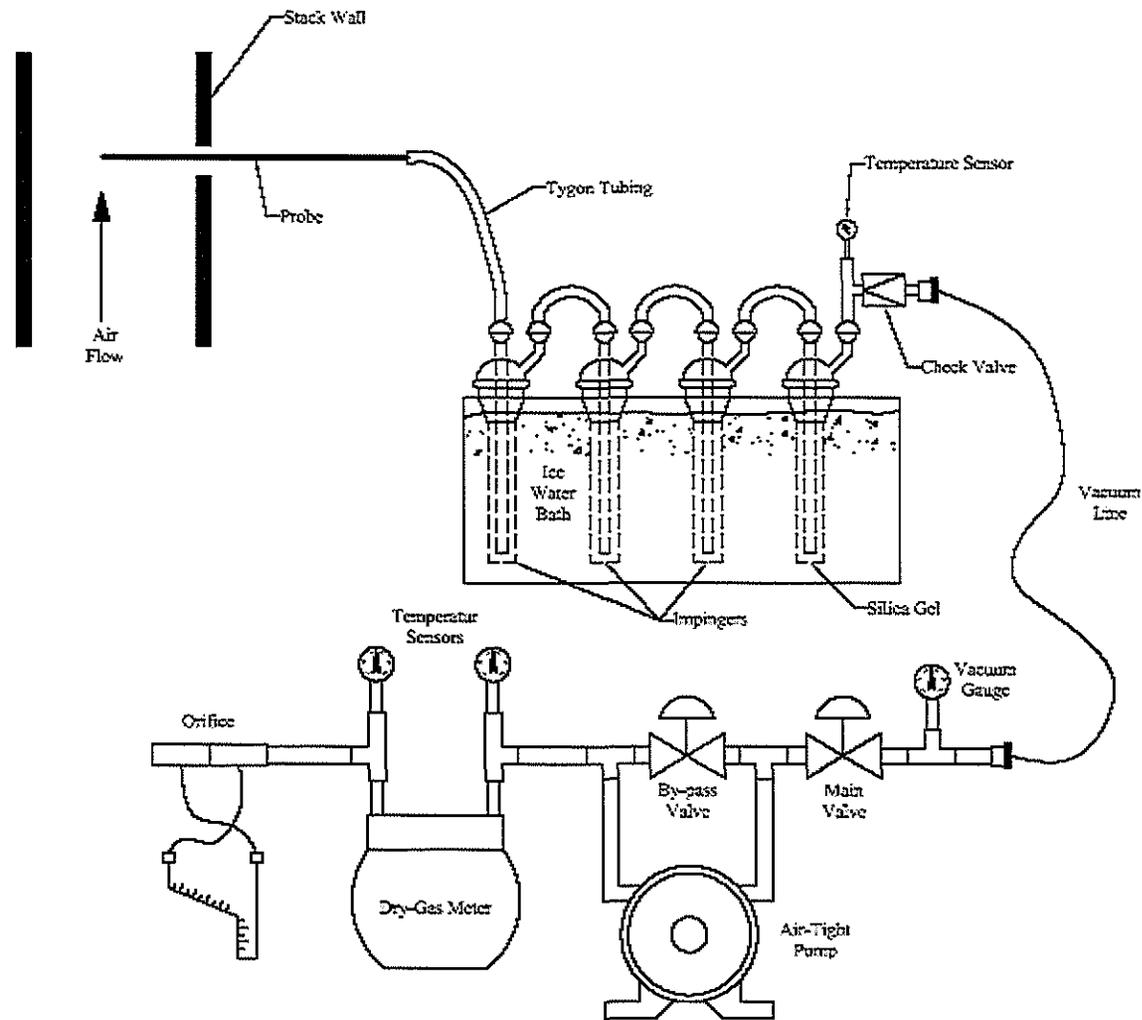


Figure 2
USEPA Method 4 Sampling Train



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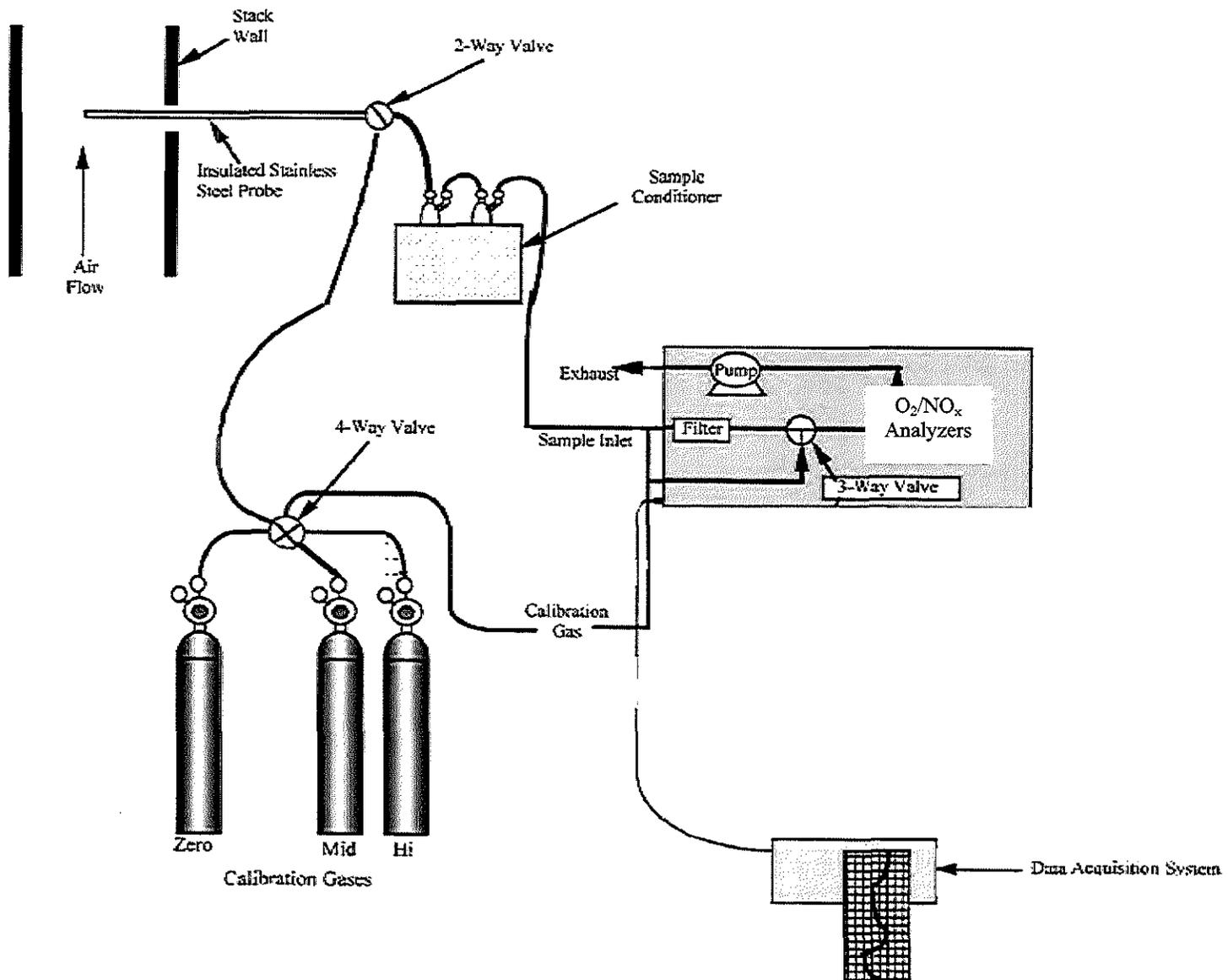


Figure 3
USEPA Method 3A and 7E Sampling Train



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