Air Emission Test
of
Heat Treatment Line

Henrob Corporation
Heat Treatment Line

30000 South Hill Road
New Hudson, Michigan
Permit No. 94-13A and 177-15

Henrob Corporation
New Hudson, Michigan

Bureau Veritas Project No. 11016-000034.00

April 1, 2016

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Executive Summary

Henrob Corporation retained Bureau Veritas North America, Inc. to perform testing for air emissions from one representative heat treatment line at the Henrob Corporation facility in New Hudson, Michigan. Henrob Corporation manufactures self-piercing rivet products and processes them through heat treatment lines to alter their physical properties. Air emissions are generated through the combustion of natural gas and residual cutting oils in a burn off furnace and through a water-wash process designed to remove quench oils prior to processing the rivets through a tempering furnace.

The purpose of the testing was to:

- Measure volatile organic compound (VOC) emissions from (1) Stack SV2HFurnace#1(burn off furnace) and (2) Stack SV-3Washer#2 (post quench washer).

- Develop VOC emission factors (in pounds of VOC/ton metal) to be used to evaluate compliance with certain emission limits within Michigan Department of Environmental Quality Permit No. 94-13A and 177-15.

On March 9, 2016, Bureau Veritas measured air emissions at the exhaust stacks of the burn off furnace and post quench washer at Heat Treatment Line 1 (EU-HT1-1). Four 60-minute tests to measure Volatile Organic Compounds (VOCs) concentrations and mass emission rates were conducted using United States Environmental Protection Agency (USEPA) Reference Methods 1, 2, 3, 4, 25A, and 205. The results of the testing are summarized in the table on the following page.

Heat Treatment Line 1 VOC Results
Compared to the Permit Emission Limit

Source Stack	Parameter	Unit	Run 1	Run 2	Run 3	Run 4	Average Result*	Permit Limit
Heat Treatment Line 1 (EU-HT1-1)								
EU-HT1-1	Total VOC Emission Factor	lb VOC/ton metal	0.13	0.066	0.12	0.084	**0.10**	NA
	Estimated Annual Emissions at Maximum Permitted Metal Throughput‡	ton VOC/yr	0.13	0.066	0.12	0.084	0.10	1.0†

VOC: volatile organic compound
lb VOC/ton metal: pound VOC per ton of metal
ton VOC/yr: ton VOC per year
* Run 1 was voided in the field due to a production gap, and average results are calculated using Runs 2, 3, and 4.
† Based on a rolling 12-month rolling time period as determined at the end of each calendar month. Note the permit limit is expressed as 2.0 ton VOC/yr for heat treatment lines 1 and 2.
‡ Average result is calculated using the maximum permitted metal throughput of 2,000 tons per year. Note the permit limit is expressed as 4,000 tons of metal per year for heat treatment lines 1 and 2.
Note Total VOC emission rate is based on the summation of the emission rate from Stack SV2HFurnace#1 and Stack Stack SV-3Washer#2

The results of the testing indicate compliance with the applicable permit limit of 1.0 tons of VOC per year for the EU-HT1-1 line based on the material use limit of 2,000 tons per year.

1.0 Introduction

Henrob Corporation retained Bureau Veritas North America, Inc. to perform air emissions testing at the Henrob Corporation facility in New Hudson, Michigan. Henrob Corporation manufactures self-pierce rivets products through heat treatment line.

This report presents the results of VOC air emissions testing from two sources in one representative heat treatment line (EU-HT1-1): burn off furnace and post quench washer. The testing was conducted on March 9, 2016.

1.1 Summary of Test Program

Henrob Corporation manufactures self-pierce rivets products through heat treatment lines. Self-pierce riveting is a cold joining process used to fasten two or more sheets of material by driving a rivet through the top sheet(s) and upsetting the rivet, under the influence of a die, into the lower sheet without piercing it. Air emissions are generated through the combustion of natural gas and residual cutting oils in a burn off furnace and through a water-wash process designed to remove quench oils prior to processing the rivets through a tempering furnace.

The purpose of the testing was to:

- Measure VOC emissions from the Stack SV2HFurnace#1 (burn off furnace) and Stack SV-3Washer#2 (post quench washer).

- Develop VOC emission factors to be used to evaluate compliance with certain emission limits within Michigan Department of Environmental Quality (MDEQ) Permit No. 94-13A and 177-15.

The testing was completed on March 9, 2016 in accordance with USEPA Reference Methods 1through 4, 25A, and 205 and the Intent to Test Plan submitted the MDEQ on February 3, 2016 and approved on February 29, 2016.

The sampling conducted is summarized in Table 1-1.

Table 1-1
Source Tested, Parameters, and Test Date

Source	Test Parameters	Test Date
Heat Treatment Line 1 (EU-HT1-1)		
Burn off Furnace	VOCs	March 9, 2016
Post Quench	VOCs	March 9, 2016

1.2 Contact Information

Contact information is listed in Table 1-2. Messrs. Thomas Schmelter, Senior Project Manager with Bureau Veritas, led the emissions testing program. Mr. Joseph Liebau, Environmental and Quality Engineer with Henrob Corporation provided process coordination and arranged for facility operating parameters to be recorded. The testing was witnessed by Mr. Mark Dziadosz, Environmental Quality Analyst, and Mr. Remilando Pinga, Senior Environmental Engineeer, with MDEQ.

Table 1-2
Contact Information

Henrob Corporation	BVNA
Joseph Liebau Environmental and Quality Engineer 30000 South Hill Road New Hudson, Michigan 48165 Telephone: 248.493.3847 Joseph.Liebau@us.henrob.com	Thomas Schmelter, QSTI Senior Project Manager 22345 Roethel Drive Novi, Michigan 48375 Telephone: 248.344.3003 thomas.schmelter@us.bureauveritas.com
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Mark Dziadosz Environmental Quality Analyst Air Quality Division Southeast District Office 27700 Donald Court Warren, Michigan 48092-2793 Telephone: 586.753.3745 dziadoszm@michigan.gov	Remilando Pinga Senior Environmental Engineer Air Quality Division Southeast District Office 27700 Donald Court Warren, Michigan 48092-2793 Telephone: 586.753.3744 pingar@michigan.gov

2.0 Source and Sampling Locations

2.1 Process Description

Henrob Corporation manufactures self-pierce riveting products, used in a mechanical fastening process suitable for joining aluminum or mixed materials that cannot be reliably welded. Rivets are applied by driving a rivet through the top sheet(s) and upsetting the rivet, under the influence of a die, into the lower sheet without piercing it.

Figure 2-1 Self-piercing Rivets

At the Henrob Corporation facility in New Hudson, Michigan, various rivets products are produced with diameters of 5 millimeter (mm) and 3 mm. Round wire coils of specified metal composition are introduced into a forging and stamping machine by a wire draw. The wire is cut to length and introduced into the die of the forging machine. The die transforms the solid wire into a hollow rivet body with flared end. After the rivets are formed they are placed in approximate 300 to 350 kilogram bins. The bins are temporarily stored before being processed to the heat treatment line area, where the air emission testing was conducted.

There are two identical heat treatment lines in operation within the facility's building. One representative heat treatment line (EU-HT1-1) was tested. The rivets are processed through the heat treat lines for a duration of approximately 141 minutes at a rate of approximately 250 kilograms per hour.

The rivets are transferred to a hopper where they are unloaded via a vibrating tray onto a conveyor at the start of the heat treatment line. The rivets are introduced into a washer containing heated water and detergent to remove residual cutting oils that may be present from the forging process. The clean rivets are conveyed through a flame curtain and enter a hardening or burn off furnace. The air from the burn off oven furnace is captured and exhausted to the atmosphere through an exhaust stack (SV-2HFFurnace#1). The high heat (~900°C) within the furnace followed by gradual cooling anneals the metal to reduce internal stresses.

After exiting burn off furnace, rivets are conveyed into an oil quench pit to cool the rivets. A magnet conveyor removes the rivets from the oil quench pit and conveys them into a post quench oil parts washer. The parts washer is maintained at 136 °C and is designed to remove the quench oil from the rivets. Air emissions from the parts washer are captured and exhausted to atmosphere via the parts washer exhaust stack (SV-3Washer#2). After the post quench process, rivets are transferred to a tempering furnace where the metal is hardened at approximately 390°C. Once the rivets exit the tempering furnace, they are collected in totes and transferred to a mechanical plating area.

Plating materials including aluminum, copper, glass powder, and other products are mechanically added onto the surface of the rivets to prevent corrosion and increase durability. After going through quality assurance/quality control (QA/QC) inspections, rivets are poured into sorting equipment, embedded into rubber tape, packed, and shipped as a final product.

Henrob Corporation personnel recorded operating parameters during the emission testing. The recorded operating parameters provided to Bureau Veritas are included in Appendix E.

2.2 Control Equipment

A flame curtain is used to control the atmosphere within the main hardening furnace. The flame curtain covers the opening to the oven with a sheet of flame. This reduces the amount of ambient air from entering the furnace and helps maintain the internal furnace temperature. In addition, the flame curtain can oxidize residual combustible gas in the furnace that escapes through the entrance opening. A photograph of the flame curtain entrance to the hardening burn off furnace is presented as Figure 2-2.

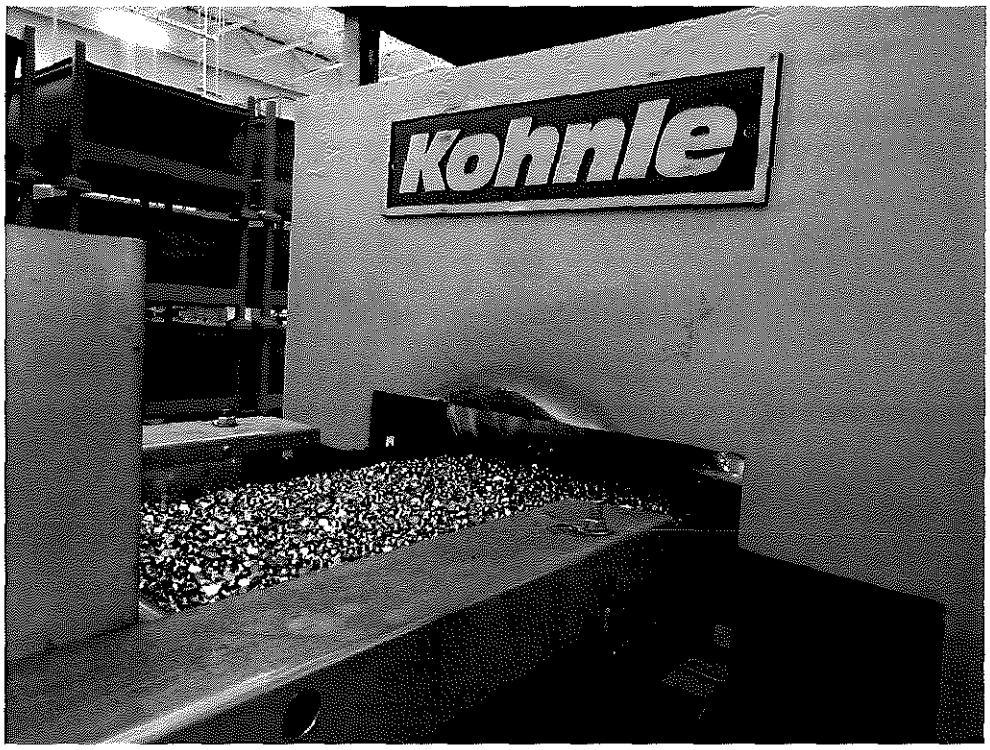

Figure 2-2 Photograph of Flame Curtain Control Device

Two stacks exhaust the captured gaseous emissions within the heat treatment line to atmosphere. One stack exhausts the burn off furnace with a diameter of 20 inches. The other stack exhausts the post quench oil parts washer and has a diameter of 8 inches.

2.3 Flue Gas Sampling Location

Descriptions of the sampling locations are presented in the following sections.

2.3.1 Burn Off Furnace Stack Sampling Location

The burn off furnace exhaust stack is located above the main hardening furnace flame curtain. One 3-inch diameter and one 1-inch diameter sampling port are located in the vertical stack which exits to the atmosphere through the roof. The stack diameter is 20 inches. The ports are located:

- Approximately 20 feet (12 equivalent duct diameters) from the nearest upstream disturbance (bend in ductwork).
- Approximately 18.3 feet (11 equivalent duct diameter) from the nearest downstream disturbance (exhaust to atmosphere).

Figure 1 in the Appendix depicts the burn off furnace stack ports and traverse point locations. A photograph of the burn off furnace sampling location is presented in Figure 2-3.

2.3.2 Post Quench Washer Stack Sampling Location

Downstream of the post quench washer, the stack exhausts to atmosphere. One 3-inch-internal-diameter sampling port and one 1-inch-internal diameter sample port are located in the stack, which has an internal diameter of 8 inches. The ports are located outside of the building and are:

- Approximately 8 feet (12 equivalent duct diameters) from the nearest upstream disturbance (ductwork confluence).
- Approximately 16 feet (24 equivalent duct diameters) from the nearest downstream disturbance (exhaust to atmosphere).

Figure 2 in the Appendix depicts post quench washer sampling ports and traverse point locations. Photographs of the post quench washer stack and sampling locations are presented in Figure 2-4 and Figure 2-5 respectively.

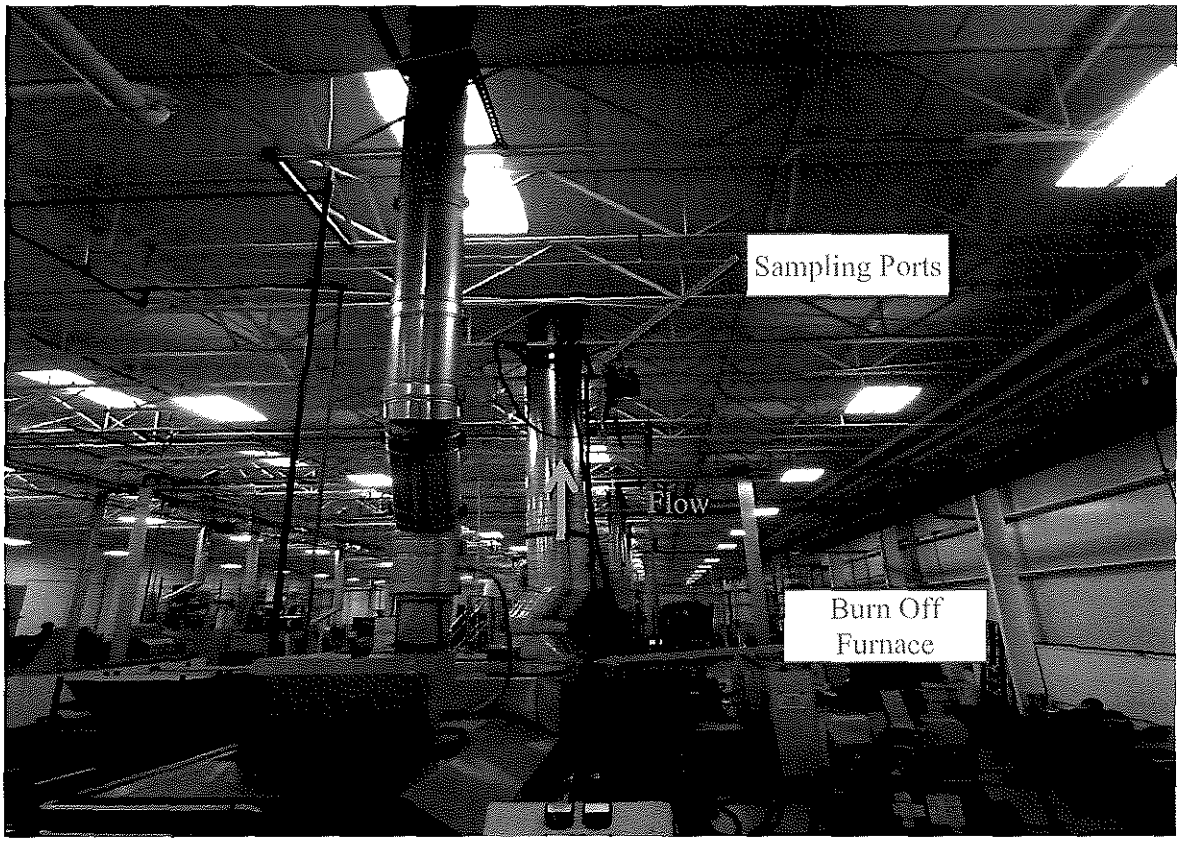

Figure 2-3 Burn Off Furnace Sampling Location

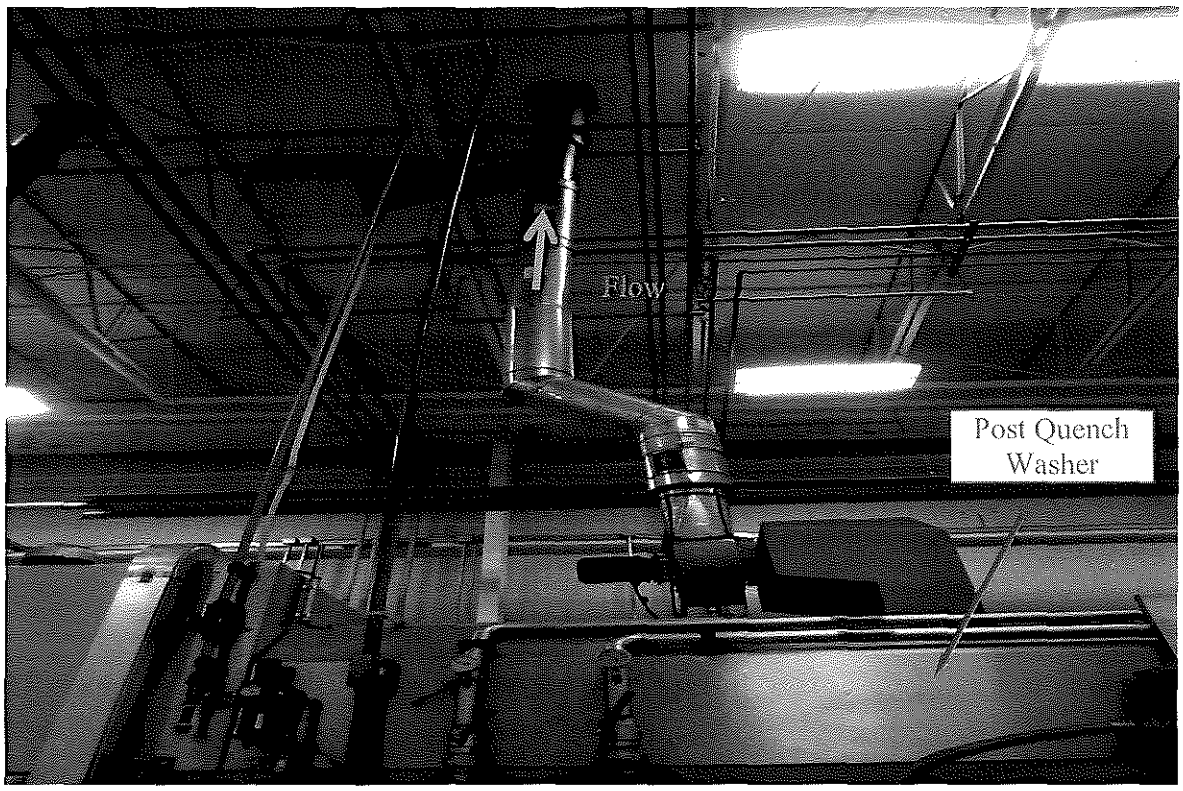

Figure 2-4 Post Quench Washer Stack

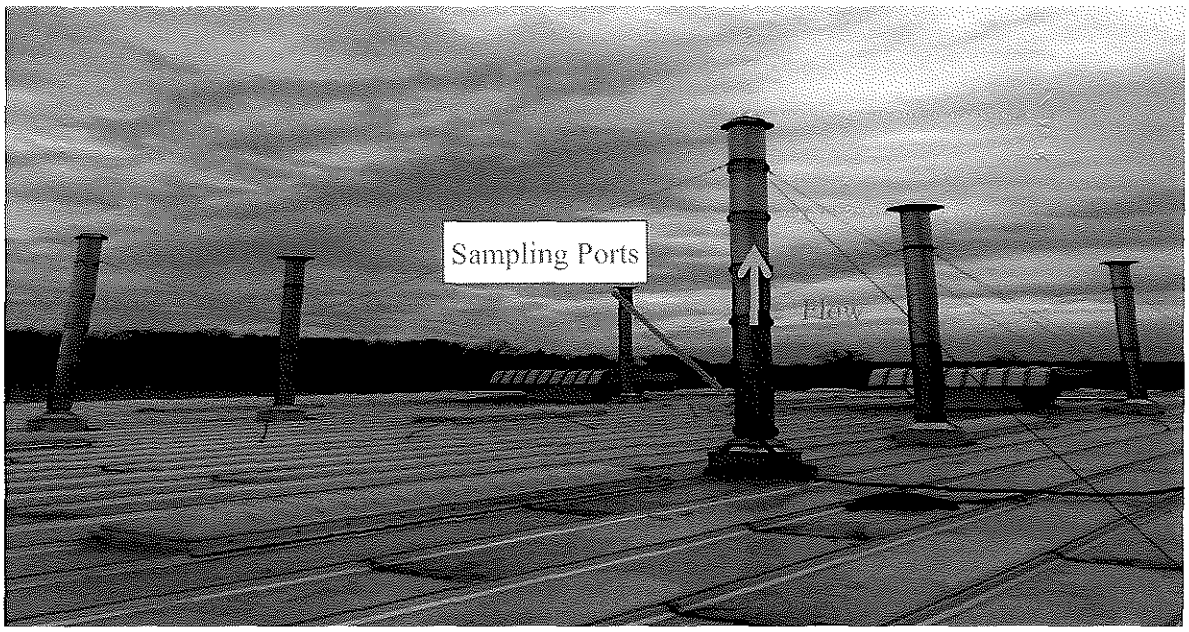

Figure 2-5 Post Quench Washer Sampling Location

3.0 Summary and Discussion of Results

3.1 Objectives and Test Matrix

The purpose of the testing was to (1) measure volatile organic compound (VOC) emissions from (a) Stack SV2HFurnace#1(burn off furnace) and (b) Stack SV-3Washer#2 (post quench washer), and (2) Develop VOC emission factors (in pounds of VOC/ton metal) to be used to evaluate compliance with certain emission limits within Michigan Department of Environmental Quality Permit No. 94-13A and 177-15. The following objectives were completed:

- Measure the VOC mass emissions at the burn off furnace and post quench washer.
- Develop emission factors (lb VOC/ton metal)
- Evaluate compliance with the emission limit based on permitted material use limits.

Table 3-1 summarizes the sampling and analytical test matrix.

Table 3-1
Sampling and Analytical Test Matrix

Sampling Location	Run	Date (2016)	Sampling Time	Parameter	USEPA Method	Analytical Method
Heat Treatment Line 1 (EU-HT1-1)						
Burn off furnace stack (SV2HFurnace#1)	1†	March 9	8:30-9:30	Gas flowrate VOCs	1, 2, 3, 4, 25A, and 205	Differential pressure, gravimetric, flame ionization, gas dilution
	2	March 9	14:20-15:20			
	3	March 9	15:45-16:45			
	4	March 9	17:25-18:25			
Post quench washer stack (SV-3Washer#2)	1†	March 9	8:30-9:30	Gas flowrate VOCs	1, 2, 3, 4, 25A, and 205	Differential pressure, gravimetric, flame ionization, gas dilution
	2	March 9	14:20-15:20			
	3	March 9	15:45-16:45			
	4	March 9	17:25-18:25			

† Run 1 was voided due to production gap

3.2 Field Test Changes and Issues

The testing was performed in accordance with USEPA procedures, during maximum routine operating conditions, as outlined in the Intent-to-Test Plan submitted to MDEQ on February 3, 2016, and approved on February 29, 2016.

No field test changes or issues were encountered during the test program, with the exception of Run 1 being voided due to production gap on March 9, 2016. An approximate 20-minute production gap between product batches was encountered during Run 1. Therefore, one additional test run was conducted for the two sources on March 9, 2016 and the average results were calculated using Test Runs 2, 3, and 4.

3.3 Results

The test results are summarized in Table 3-2. Detailed results are presented in Table 1 after the Tables Tab of this report. Graphs of the VOC concentrations measured during each test run are presented after the Graphs Tab of this report. Sample calculations are presented in Appendix B.

Table 3-2
Heat Treatment Line 1 VOC Results Compared to the Permit Emission Limit

Source Stack	Parameter	Unit	Run 1	Run 2	Run 3	Run 4	Average Result*	Permit Limit
Heat Treatment Line 1 (EU-HT1-1)								
EU-HT1-1	Total VOC Emission Factor	lb VOC/ton metal	0.13	0.066	0.12	0.084	**0.10**	NA
	Estimated Annual Emissions at Maximum Permitted Metal Throughput‡	ton VOC/yr	0.13	0.066	0.12	0.084	0.10	1.0†

VOC: volatile organic compound
lb VOC/ton metal: pound VOC per ton of metal
ton VOC/yr: ton VOC per year
* Run 1 was voided in the field due to a production gap, and average results are calculated using Runs 2, 3, and 4.
† Based on a rolling 12-month rolling time period as determined at the end of each calendar month. Note the permit limit is expressed as 2.0 ton VOC/yr for heat treatment lines 1 and 2.
‡ Average result is calculated using the maximum permitted metal throughput of 2,000 tons per year. Note the permit limit is expressed as 4,000 tons of metal per year for heat treatment lines 1 and 2.
Note Total VOC emission rate is based on the summation of the emission rate from Stack SV2HFurnace#1 and Stack Stack SV-3Washer#2

4.0 Sampling and Analytical Procedures

Bureau Veritas measured emissions in accordance with the procedures specified in 40 CFR 51, Appendix M, "Recommended Test Methods for State Implementation Plans," 40 CFR 60, Appendix A, "Standards of Performance for New Stationary Sources," and State of Michigan Part 10 Rules, "Intermittent Testing and Sampling." The sampling and analytical methods used during this test program are listed in the following table.

Table 4-1
Emission Test Methods

Sampling Method	Parameter	Analysis
EPA 1 and 2	Gas stream volumetric flowrate	Field measurement, S-type Pitot tube
EPA 1a and 2c	Gas stream volumetric flowrate	Field measurement, Standard Pitot tube
EPA 3	Molecular weight	Fyrite® analyzer
EPA 4	Moisture content	Gravimetric
EPA 25A	VOC concentration	Flame ionization detector
EPA 205	Calibration gas dilution	Field verification

4.1 Emission Test Methods

The emission test parameters and sampling procedures at each sampling location are provided in Table 4-2.

Table 4-2
Emission Test Parameters

Parameter	Burn Off Furnace	Post Quench Washer	USEPA Reference	
			Method	Title
Sampling ports and traverse points	●		1	Sample and Velocity Traverses for Stationary Sources
Sampling ports and traverse points		●	1A	Sample and Velocity Traverses for Stationary Sources with Small Stacks or Ducts
Velocity and flowrate	●		2	Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube, Standard Pitot Tube)
Velocity and flowrate		●	2C	Determination of Gas Velocity and Volumetric Flowrate in Small Stacks or Ducts (Standard Pitot Tube)
Molecular weight	●	●	3	Gas Analysis for the Determination of Dry Molecular Weight
Moisture content	●	●	4	Determination of Moisture Content in Stack Gases
Volatile organic compounds	●	●	25A	Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer
Calibration gas dilution	●	●	205	Verification of Gas Dilution Systems for Field Instrument Calibrations

4.1.1 Volumetric Flowrate (USEPA Methods 1 and 2)

Method 1, "Sample and Velocity Traverses for Stationary Sources," from 40 CFR 60, Appendix A, was used to evaluate the adequacy of the sampling location and determine the number of traverse points for the measurement of velocity profiles at the burn off furnace exhaust stack.

USEPA Method 1A, "Sample and Velocity Traverses for Stationary Sources with Small Stacks or Ducts" from 40 CFR 60, Appendix A, was used to select the sampling location and determine the number of traverse points at the post quench washer exhaust stack.

Details of the sampling locations and number of velocity traverse points are presented in Table 4-3. Figures 1 and 2 in the Appendix depicts the burn off furnace and post quench washer sampling locations and traverse points.

Table 4-3
Sampling and Number of Traverse Points

Sampling Location	Duct Diameter (inch)	Distance from Ports to Upstream Flow Disturbance (diameter)	Distance from Ports to Downstream Flow Disturbances (diameter)	Number of Ports used	Traverse Points per Port	Total Points	Cyclonic Flow Check Average Null Angle
Burn Off Furnace	20	12	11	1	6	6	2°
Post Quench Washer	8	12	24	1	6	6	2°

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 a digital manometer were used to measure flue gas velocity. Because the dimensions of the Pitot tube met the requirements outlined in Method 2, Section 10.0, a baseline Pitot tube coefficient of 0.84 (dimensionless) was assigned.

USEPA Method 2C "Determination of Gas Velocity and Volumetric Flow Rate in Small Stacks or Ducts (Standard Pitot Tube)" was used to measure velocity profiles and calculate volumetric flowrate. A standard-type Pitot tube meeting the specification of Section 6.7 of Method 2 and with a baseline Pitot tube coefficient of 0.99 was used to measure volumetric flowrates.

The digital manometer was calibrated using calibration standards that are established by the National Institute of Standards (NIST). Thermocouples were used to measure flue gas temperature. Refer to Appendix A for the Pitot tube, electronic manometer, and thermocouple calibration and inspection sheets.

Refer to Appendix B for sample calculations of flue gas velocity and volumetric flowrate.

Cyclonic Flow Check. Bureau Veritas evaluated whether cyclonic flow was present at the sampling locations. 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 a zero (null) velocity head reading where the direction is 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 wall 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°, the flue gas is considered to be cyclonic at that sampling location and an alternate location is necessary.

The average of the flue gas velocity null angles measured at the traverse points is shown in Table 4-3.

The measurements indicate the absence of cyclonic flow at the sampling locations.

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)

Molecular weight was evaluated using Method 3, "Gas Analysis for the Determination of Dry Molecular Weight." Flue gas was extracted through a probe positioned near the centroid of the duct or stack and directed into a Fyrite® gas analyzer. The concentrations of carbon dioxide (CO_2) and oxygen (O_2) were measured by chemical absorption with the Fyrite® gas analyzer to within ±0.5%. The average CO_2 and O_2 results of the samples were used to calculate molecular weight.

4.1.3 Moisture Content (USEPA Method 4)

The moisture content in the flue gas at the inlet to the RTO was approximated using the wet-bulb dry-bulb method. The moisture content was measured at the outlet sampling location using USEPA Method 4, "Determination of Moisture Content in Stack Gases." Bureau Veritas's modular USEPA Method 4 stack sampling system consisted 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 4-4 situated in a chilled ice bath.
- A sampling line.
- An Environmental Supply® control case equipped with a pump, dry-gas meter, and calibrated orifice.

Figure 3 in the Appendix depicts the USEPA Method 4 sampling train.

Table 4-4
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 nozzle tip and applying a vacuum of approximately 15 inches of mercury to the sampling train. The dry-gas meter was monitored for approximately one minute to measure the sampling train leak rate; the leak rate must be less than 0.02 cubic feet per minute (cfm).

Next, the sampling probe was inserted into the sampling port near the centroid of the stack in preparation for 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 a test run, a post-test leak check was conducted and the impinger train was disassembled. The weight of liquid and silica gel in each impinger was measured with a scale capable of measuring ±0.5 grams. The weight of water collected within the impingers and volume of flue gas sampled were used to calculate the percent moisture content.

4.1.4 Volatile Organic Compounds (USEPA Method 25A)

VOC concentrations were measured following USEPA Method 25A, "Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer." Samples were collected through a stainless steel probe and heated sample line that was inserted into the analyzer's sample port. Bureau Veritas used J.U.M. 3-500 and J.U.M. 3-300A hydrocarbon analyzers equipped with flame ionization detectors.

A flame ionization detector (FID) measures an average hydrocarbon concentration in parts per million by volume (ppmv) of VOC relative to the calibration gas propane. The FID is fueled by 100% hydrogen, which generates a flame with a negligible number of ions. Flue gas is introduced into the FID and enters the flame chamber. The combustion of flue gas generates electrically charged ions. The analyzer applies a polarizing voltage between two electrodes around the flame, producing an electrostatic field. Negatively charged ions (anions) migrate to a collector electrode, while positive charged ions (cations) migrate to a high-voltage electrode. The current between the electrodes is directly proportional to the hydrocarbon concentration in the sample. The flame chamber is depicted in Figure 4-1.

Using the voltage analog signal, measured by the FID, the concentration of VOCs is recorded by a data acquisition system (DAS). The average concentration of VOCs is reported as the calibration gas (i.e., propane) in equivalent units.

Before testing, the FID analyzers were calibrated by introducing a zero-calibration range gas (<1% of span value) and high-calibration range gas (80-90% span value) to the tip of the sampling probe. The span value was set to 1.5 to 2.5 times the expected concentration (e.g., 0-100 ppmv). Next, a low-calibration range gas (25-35% of span value) and mid-calibration range gas (45-55% of span value) were introduced. The analyzers were considered to be calibrated when the analyzer response was ±5% of the calibration gas value.

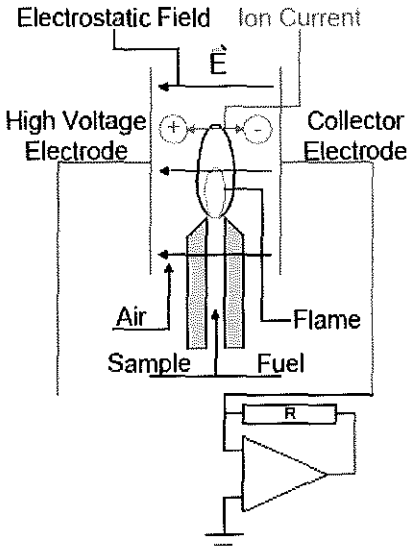

Figure 4-1. FID Flame Chamber

At the conclusion of a test run a calibration drift test was performed by introducing the zero- and mid- or low-calibration gas to the tip of the sampling probe. The test run data were considered valid if the calibration drift test demonstrated that the analyzers were responding within ±3% from pre-test to post-test calibrations. Figure 4 in the Appendix depicts the USEPA Method 25A sampling train. See Appendix A for calibration data.

4.1.5 Gas Dilution (USEPA Method 205)

A gas dilution system was used to introduce known values of calibration gases into the VOC analyzers. The gas dilution system consisted of calibrated mass flow controllers. The system diluted a high-level calibration gas to within ±2% of predicted values. This gas divider was capable of diluting gases at various increments.

Before the start of testing, the gas divider dilutions were verified to be within ±2% of predicted values. Three sets of dilutions of the high-level (851.1 ppmv propane) calibration gas were performed. Subsequently, a certified mid-level calibration gas (85.6 ppmv propane) was introduced into the analyzer; the calibration gas concentration was within ±10% of a dilution. Refer to Appendix A for the calibration gas certifications and the gas dilution field calibration. Table 4-5 presents the USEPA Method 205 gas dilution field verification measurements.

Table 4-5
Gas Dilution Field Verification

Expected Concentration	Acceptable Range†		Actual Concentration 1	Actual Concentration 2	Actual Concentration 3	Pass?
	Low	High				
(ppmv)	(ppmv)	(ppmv)	(ppmv)	(ppmv)	(ppmv)	
500 dilution	490	510	501.4	503.8	507.3	Yes
85 dilution	83.3	86.7	85.2	85.2	85.2	Yes
85.6 standard	83.9	87.3	85.2	85.6	85.5	Yes

† Acceptable range is ±2% of the expected concentration

4.2 Procedures for Obtaining Process Data

Process data were recorded by Mr. Joseph Liebau with Henrob Corporation. Refer to Sections 2.1 and 2.2 for discussions of process and control device data and Appendix E for the operating parameters recorded during testing.

4.3 Sampling Identification and Custody

Sample identification and chain of custody procedures were not applicable to the sampling methods used in this test program.

5.0 QA/QC Activities

Equipment used in this emissions test program passed QA/QC procedures. Refer to Appendix A for equipment calibration and inspection sheets. Field data sheets are presented in Appendix C. Computer-generated Data Sheets are presented within Appendix D.

5.1 Pretest QA/QC Activities

Before testing, the sampling equipment was cleaned, inspected, and calibrated according to procedures outlined in the applicable USEPA sampling methods and USEPA's "Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III, Stationary Source Specific Methods."

5.2 QA/QC Audits

The results of select sampling and equipment QA/QC audits and the acceptable tolerance are presented in the following sections. Calibration and inspection sheets for analyzers, dry-gas meters (DGMs), thermocouples, and Pitot tubes are presented in Appendix A.

5.2.1 Instrument Analyzer QA/QC Audits

The instrument analyzer sampling trains described in Section 4.1 were audited for measurement accuracy and data reliability. The analyzers passed the applicable calibration criteria. Table 5-1 summarizes the gas cylinders used during this test program. Calibration gas selection, bias, and drift checks are included in Appendix A.

Table 5-1
Calibration Gas Cylinder Information

Parameter	Gas Vendor	Cylinder Serial Number	Cylinder Value	Expiration Date
Air	Airgas	32-400623745-1	-	Sept. 09, 2022
Hydrogen	Airgas	CC20386	99.999%	NA
Propane	Airgas	CC443358	851.1 ppm	April 28, 2023
Propane	Airgas	EB00113535	85.6 ppm	April 28, 2023

5.2.2 Dry-Gas Meter QA/QC Audits

Table 5-2 summarizes the DGM calibration check compared to the acceptable USEPA tolerance. Refer to Appendix A for additional DGM calibration information.

Table 5-2
Dry-Gas Meter Calibration QA/QC Audit

Meter Box	Pre-test DGM Calibration Factor (Y) (dimensionless)	Post-test DGM Calibration Check Value (Y) (dimensionless)	Absolute Difference Between Pre- and Post-test DGM Calibrations	Acceptable Tolerance	Calibration Result
7	1.025 February 18, 2016	1.014 March 11, 2016	0.011	≤0.05	Valid

5.2.3 USEPA Method 25A QA/QC Audits

Before and after sampling, the FIDs were audited for quality assurance and control following USEPA Method 25A guidelines. The USEPA Method 25A QA/QC Audits included calibration error and drift checks. The analyzers achieved the following criterion.

- Calibration error and system bias checks verified the analyzers responded to ±5 percent of the calibration standards introduced.
- The analyzer's response to zero and mid or low-calibration standards introduced at the probe tip before and after a test run were within ±3 percent of the analyzer span.

5.2.4 Thermocouple QA/QC Audits

Temperature measurements using thermocouples and digital pyrometers were compared to reference temperatures (i.e., ice water bath, boiling water) to evaluate accuracy of the equipment. The thermocouples and pyrometers measured temperatures within ±1.5% (i.e., the USEPA acceptance criterion) of the reference temperatures. Thermocouple and pyrometer calibration results are presented in the Appendix A.

5.3 QA/QC Problems

QA/QC problems were not encountered during this test program.

Limitations

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Table

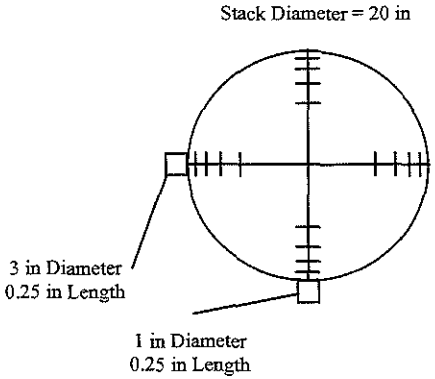
Table 1
Heat Treatment Line 1 (EU-HT1-1) VOC Results

Henrob Corporation
New Hudson, Michigan
Bureau Veritas Project No. 11016-000034.00
Sampling Date: March 9, 2016

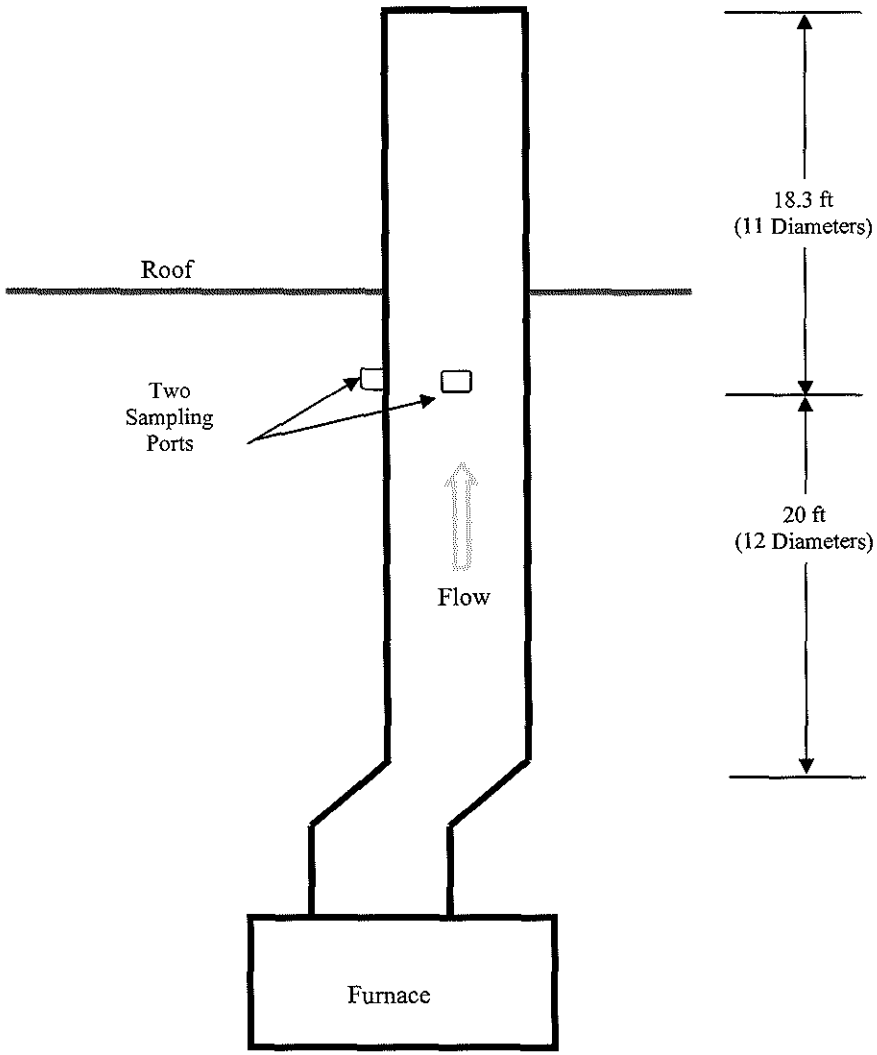
Parameter	Run 1†	Run 2	Run 3	Run 4	Average‡
Sampling Start Time (hh:mm)	8:30	14:20	15:45	17:25	
Sampling Stop Time (hh:mm)	9:30	15:20	16:45	18:25	
Duration of Test (min)	60	60	60	60	60
Process Metal Use (kg/hr)	250	250	250	250	250
Process Metal Use (lb/hr)	**550**	**550**	**550**	**550**	**550**
Process Metal Use (ton/hr)	**0.275**	**0.275**	**0.275**	**0.275**	**0.275**
Burn Off Furnace Flowrate (scfm)	402	667	492	453	504
Burn Off Furnace VOC (ppmv, as propane)	0.8	-0.1	1.0	0.7	0.6
Burn Off Furnace VOC (lb/hr)	0.0022	-0.0005	0.0034	0.0021	0.0018
Corrected Burn Off Furnace VOC (ppmv, as propane)*	**0.7**	**0.3**	**1.1**	**0.5**	**0.7**
Corrected Burn Off Furnace VOC (lb/hr)*	**0.0020**	**0.0012**	**0.0038**	**0.0017**	**0.0022**
Post Quench Washer Flowrate (scfm)	844	848	857	836	846
Post Quench Washer VOC (ppmv, as pronane)	5.8	3.6	4.8	3.7	4.5
Post Quench Washer VOC (lb/hr)	0.034	0.021	0.028	0.021	0.026
Corrected Post Quench Washer VOC (ppmv, propane)*	**5.8**	**3.2**	**4.9**	**3.8**	**4.4**
Corrected Post Quench Washer VOC (lb/hr)*	**0.034**	**0.019**	**0.029**	**0.022**	**0.026**
Total VOC Emission Rate (lb/hr)	**0.036**	**0.020**	**0.033**	**0.023**	**0.028**
Total VOC Emission Factor (lb VOC/ton metal)	**0.13**	**0.073**	**0.12**	**0.084**	**0.10**
Maximum Permitted Metal Throughput (ton metal/yr)	**2,000**	**2,000**	**2,000**	**2,000**	**2,000**
Estimated Annual Emission at Maximum Throughput (ton VOC/yr)	**0.13**	**0.073**	**0.12**	**0.084**	**0.10**

hh:mm hour:minute
min minute
lb/hr pound per hour
kg/hr kilogram per hour
scfm standard cubic foot per minute
† Run 1 was void due to production gap
‡ Average is calculated based on Run 2, 3, and 4
* Concentration corrected for analyzer drift using EPA Method 7E-5b

Figure



Traverse Point	Distance from Wall (in)
6	1.13
5	3.17
4	6.17
3	14.33
2	17.33
1	19.37



	Distance from Sampling Ports to Nearest Downstream Disturbance (ft)	Distance from Sampling Ports to Nearest Upstream Disturbance (ft)
Burn Off Furnace Stack	~18.3 (11 diameters)	~20.0 (12 diameters)

Figure 1
Burn Off Furnace Sampling Ports and Traverse Point Locations

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New Hudson, MI

Project No. 11016-000034.00

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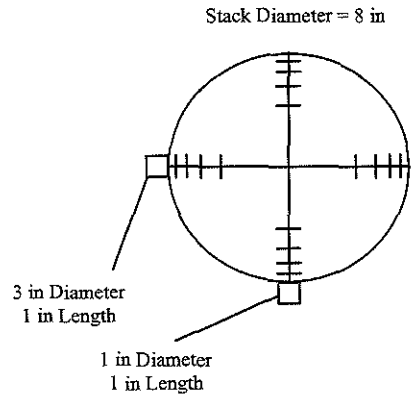
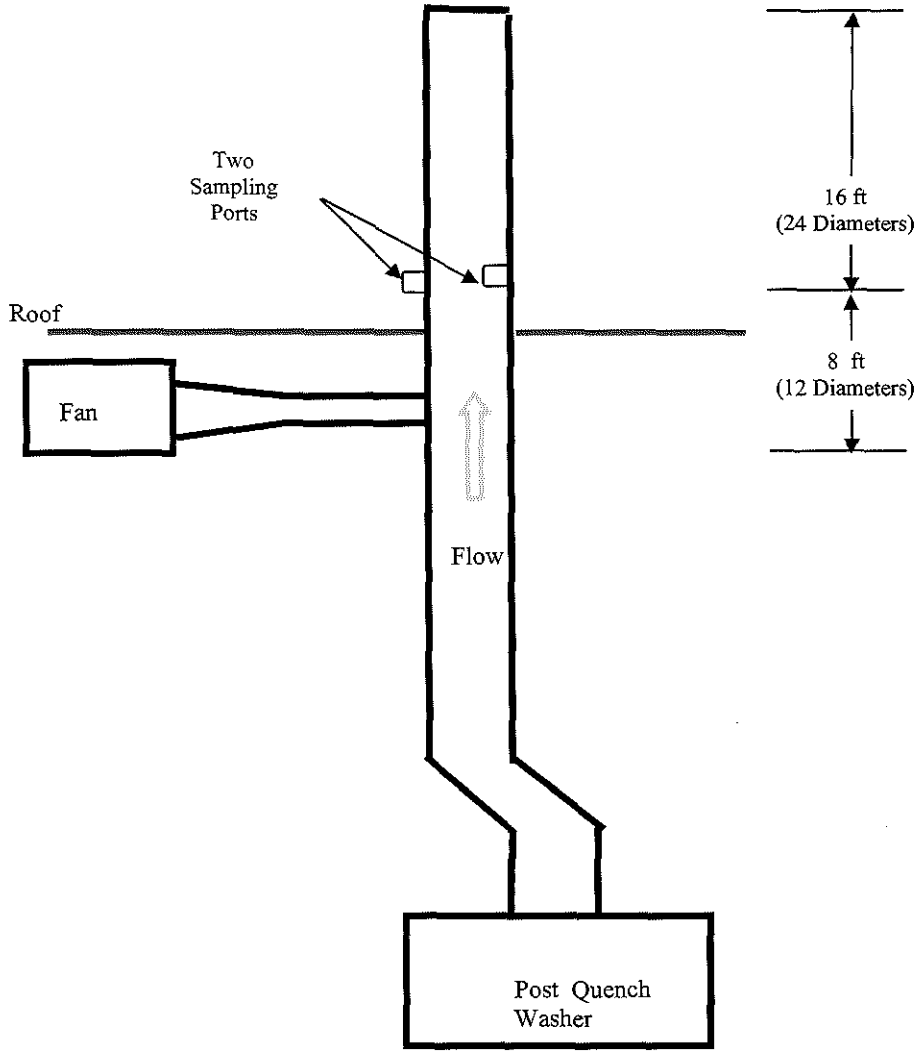
March 14, 2016



Traverse Point	Distance from Wall (in)
6	1.5
5	2.2
4	3.4
3	6.6
2	7.8
1	8.5



	Distance from Sampling Ports to Nearest Downstream Disturbance (ft)	Distance from Sampling Ports to Nearest Upstream Disturbance (ft)
Post Quench Washer Furnace Stack	~16 (24 diameters)	~8 (12 diameters)

Figure 2
Post Quench Washer Sampling Ports and Traverse Point Locations

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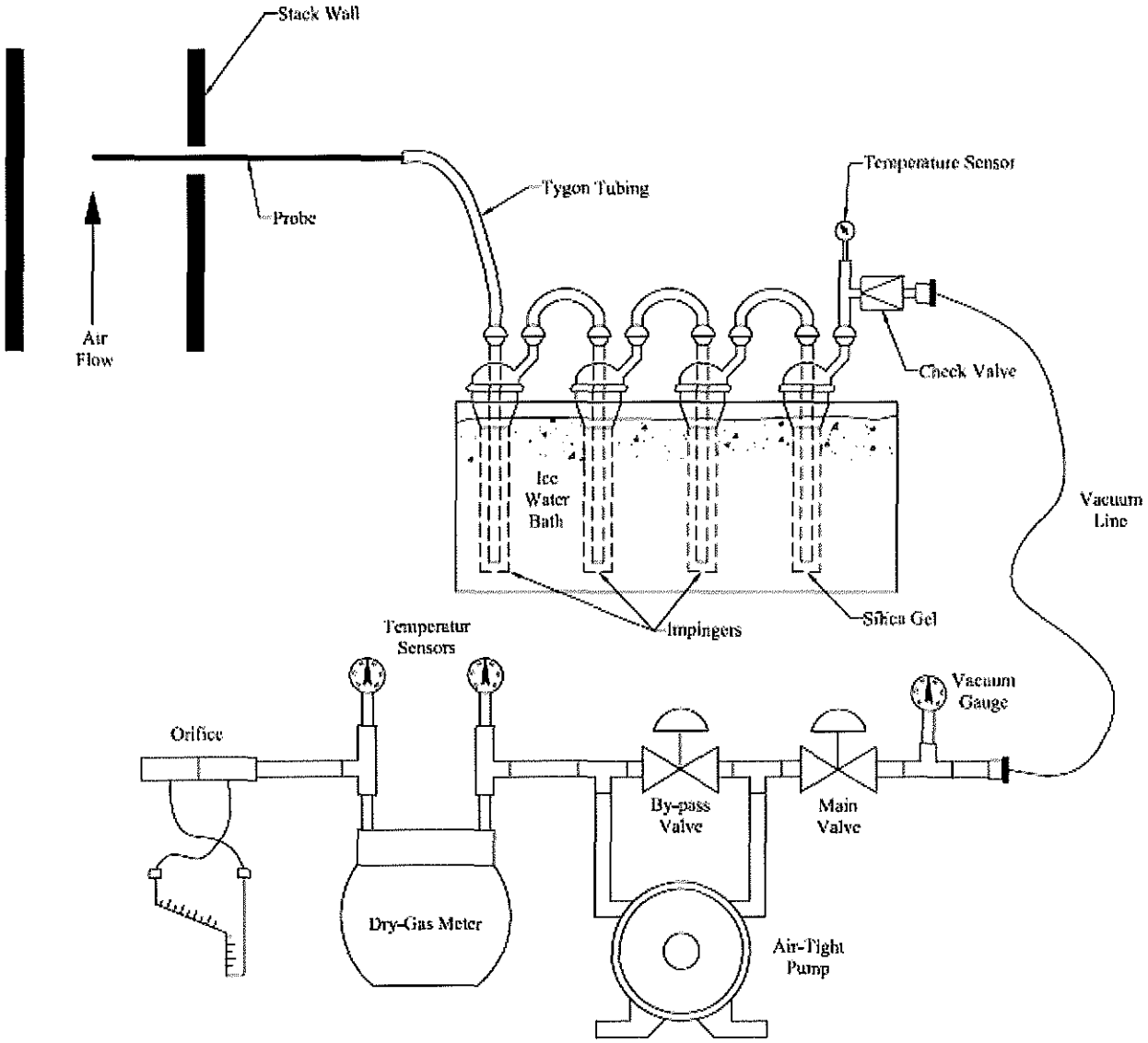

Figure 3
USEPA Method 4
Sampling Train

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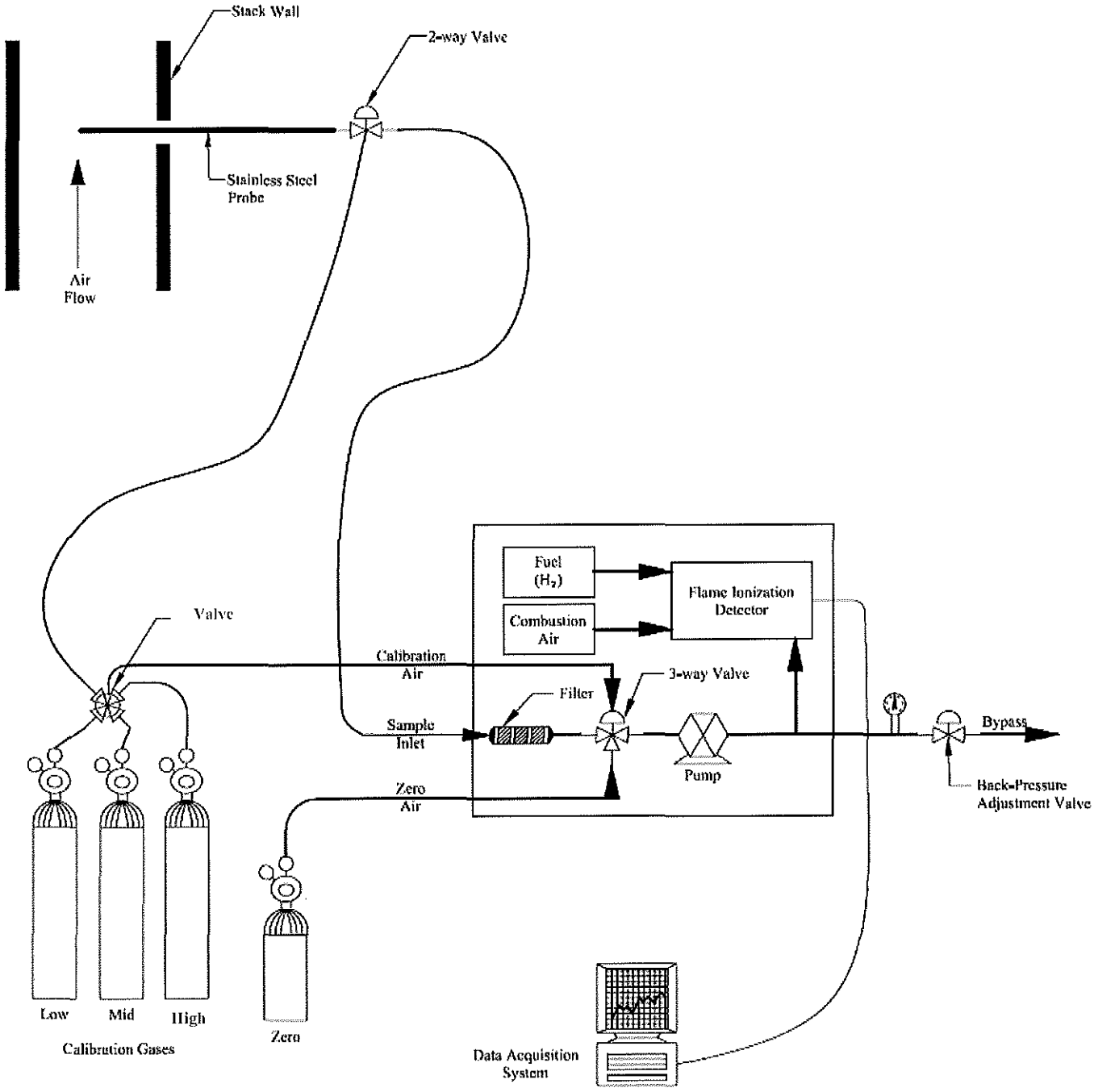

Figure 4
USEPA Method 25A
Sampling Train

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