COMPLIANCE STACK EMISSION TEST REPORT

NATURAL GAS-FIRED ALUMINUM REVERBERATORY FURNACE (EUMELTFURNACE)

Determination of Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans Emissions

Utilizing US EPA Methods 1, 2, 3, 4, and 23

Test Date(s): August 14-16, 2019
State Registration Number: B1686
Source Location: Kalamazoo, Michigan
Permit: EGLE Permit-to-Install (PTI) No. 113-09D

Prepared For:

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Prepared By:

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Test Plan: M049AS-573033-PP-20

STAC STACK TESTING ACCREDITATION COUNCIL

A2LA ACCREDITED TO ASTM D7036 ONLY CERT #3925.01

MONTROSE AIR QUALITY SERVICES

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TEST RESULTS SUMMARY

Source Name:	**Reverberatory Furnace**
Source ID Number:	**EUMELTFURNACE**
Control Device:	**Baghouse**
Test Date:	**August 14-16, 2019**
Sampling Location:	**Exhaust Stack**
Aluminum Charged (ton/hr)*	**14.1**
PCDD/PCDFs Emissions (grains/ton)	**0.0000014**
Permit Limit - PCDD/PCDF (grains/ton)	*0.00021*
Compliance Permit Limit Met (YES/NO)	*YES*
Permit No.	**EGLE Permit-to-Install No. 113-09D**

* Production data was provided by Kaiser Aluminum Fabricated Products, LLC personnel. See Table 3.1 for details

REVIEW AND CERTIFICATION

The results of the Compliance Test conducted on August 14-16, 2019 are a product of the application of the United States Environmental Protection Agency (US EPA) Stationary Source Sampling Methods listed in 40 CFR Part 60, Appendix A, that were in effect at the time of this test.

All work, calculations, and other activities and tasks performed and presented in this document were carried out by me or under my direction and supervision. I hereby certify that, to the best of my knowledge, Montrose operated in conformance with the requirements of the Montrose Quality Management System and ASTM D7036-04 during this test project.

Signature: _____ DP Date: 10-8-19

Name: Todd Wessel Title: Client Project Manager

I have reviewed, technically and editorially, details, calculations, results, conclusions, and other appropriate written materials contained herein. I hereby certify that, to the best of my knowledge, the presented material is authentic, accurate, and conforms to the requirements of the Montrose Quality Management System and ASTM D7036-04.

Signature: _____ Date: 10-8-19

Name: Randal Tysar Title: District Manager

1.0 INTRODUCTION

1.1 SUMMARY OF TEST PROGRAM

The Kaiser Aluminum Fabricated Products, LLC (State Registration Number: B1686), located in Kalamazoo, Michigan, contracted Montrose Air Quality Services, LLC (Montrose) of Detroit, Michigan, to conduct compliance stack emission testing for their Natural Gas-Fired Aluminum Reverberatory Furnace (EUMELTFURNACE). Testing was performed to demonstrate that the polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (PCDD/PCDF) emissions from EUMELTFURNACE would continue to meet the conditions of PTI No. 113-09D and NESHAP Subpart RRR at increased inlet operating temperatures to the baghouse. The testing was performed on August 14-16, 2019.

Sampling was performed at the EUMELTFURNACE Baghouse Exhaust Stack to determine the emissions of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (PCDD/PCDF). Testing was conducted during proposed normal operating conditions. During this test emissions from EUMELTFURNACE were controlled by a baghouse.

The test methods that were conducted during this test were US EPA Methods 1, 2, 3, 4, and 23.

1.2 KEY PERSONNEL

The key personnel who coordinated this test program (and their phone numbers) were:

- Matthew Sinkovitz, Kaiser Aluminum, 509-655-0383
- Tom Gasloli, Technical Programs Unit, Michigan Department of Environment, Great Lakes and Energy, 517-284-6778
- Todd Wessel QI, Senior Project Manager, Montrose, 248-548-7980

2.0 SUMMARY AND DISCUSSION OF TEST RESULTS

2.1 OBJECTIVES AND TEST MATRIX

The purpose of this test was to determine the emissions of PCDD/PCDF at the EUMELTFURNACE Baghouse Exhaust Stack during proposed normal operating conditions. Testing was performed as a compliance demonstration for EGLE PTI No.113-09D and NESHAP Subpart RRR.

The specific test objectives for this test are as follows:

- Measure the concentration of PCDD/PCDF at the EUMELTFURNACE Baghouse Exhaust Stack.
- Measure the actual and dry standard volumetric flow rate of the stack gas at the EUMELTFURNACE Baghouse Exhaust Stack.
- Utilize the above variables to determine the emissions of PCDD/PCDF at the EUMELTFURNACE Baghouse Exhaust Stack during proposed normal operating conditions.

Table 2.1 presents the sampling matrix log for this test.

2.2 FIELD TEST CHANGES AND PROBLEMS

No field test changes or problems occurred during the performance of this test that would bias the accuracy of the results of this test.

2.3 PRESENTATION OF RESULTS

A single sampling train was utilized during each run at the EUMELTFURNACE Baghouse Exhaust Stack to determine the emissions of PCDD/PCDF. This sampling train measured the stack gas volumetric flow rate, dry molecular weight, moisture content, and concentration of PCDD/PCDF.

Table 2.2 displays the emissions of PCDD/PCDF measured at the EUMELTFURNACE Baghouse Exhaust Stack during proposed normal operating conditions.

TABLE 2.1
SAMPLING MATRIX OF TEST METHODS UTILIZED

Date	Run No.	Sampling Location	US EPA METHODS 1/2 (Flow) Sampling Time / Duration (min)	US EPA METHOD 3 (Dry Molecular Wt.) Sampling Time / Duration (min)	US EPA METHOD 4 ($\%H_2O$) Sampling Time / Duration (min)	US EPA METHOD 23 (PCDD/PCDF) Sampling Time / Duration (min)
8/14/2019	1	EUMELTFURNACE EXHAUST STACK	11:45 - 16:14 / 252	11:45 - 16:14 / 252	11:45 - 16:14 / 252	11:45 - 16:14 / 252
8/15/2019	2	EUMELTFURNACE EXHAUST STACK	8:55 - 14:12 / 312	8:55 - 14:12 / 312	8:55 - 14:12 / 312	8:55 - 14:12 / 312
8/16/2019	3	EUMELTFURNACE EXHAUST STACK	8:10 - 13:45 / 325	8:10 - 13:45 / 325	8:10 - 13:45 / 325	8:10 - 13:45 / 325

All times are Eastern Daylight Time.

TABLE 2.2
EMISSION RESULTS

Parameter	EUMELTFURNACE EXHAUST STACK			
	Run 1	Run 2	Run 3	Average
Aluminum Charged (ton/hr)*	16.1	13.3	12.9	14.1
PCDD/PCDF emissions (grains/ton)†	0.0000023	0.00000089	0.00000088	0.0000014
PCDD/PCDF emissions (grains/hr)	0.000037	0.000012	0.000011	0.000020
TEQ Concentration of Detected PCDD/PCDF (ng/dscm)	0.14	0.045	0.043	0.077
Stack Gas Average Flow Rate (acfm)	16,134	15,991	14,838	15,654
Stack Gas Average Flow Rate (scfm)	10,988	11,003	10,308	10,766
Stack Gas Average Flow Rate (dscfm)	10,067	10,163	9,549	9,926
Stack Gas Average Velocity (fpm)	1,849	1,832	1,700	1,794
Stack Gas Average Static Pressure (in-H_2O)	-0.08	-0.08	-0.08	-0.08
Stack Gas Average Temperature (°F)	292	285	279	285
Stack Gas Percent by Volume Moisture (%H_2O)	8.38	7.64	7.37	7.80
Measured Stack Inner Diameter (in)			40	
Percent by Volume Carbon Dioxide in Stack Gas (%-dry)	4.33	4.50	4.50	4.44
Percent by Volume Oxygen in Stack Gas (%-dry)	17.67	17.50	17.50	17.56
Percent by Volume Nitrogen in Stack Gas (%-dry)	78.00	78.00	78.00	78.00

* Process data was provided by Kaiser Aluminum Fabricated Products, LLC personnel. See Table 3.1 for details.
† PCDD/DFs are expressed as 2,3,7,8-tetrachlorodibenzo(p)dioxin toxicity equivalent quotient per ton of feed or charge.

3.0 PLANT AND SAMPLING LOCATION DESCRIPTIONS

3.1 PROCESS DESCRIPTION AND OPERATION

Kaiser Aluminum Fabricated Products, LLC manufactures aluminum for various different applications. The Natural Gas-Fired Aluminum Reverberatory Furnace (EUMELTFURNACE) was in operation for this testing event. See Test Plan M049AS-573033-PP-20 Sections 1.b - 1.f located in Section D.4 of the Appendix for further description of the process and its operation.

Table 3.1 depicts the process data. Figure 3.1 depicts the process and sampling location schematic.

3.2 CONTROL EQUIPMENT DESCRIPTION

During this test, emissions from EUMELTFURNACE were controlled by a baghouse.

3.3 SAMPLING LOCATION(S)

The EUMELTFURNACE Baghouse Exhaust Stack had an inner diameter of 40.0-inches, was oriented in the vertical plane, and was accessed from a manlift. Two sampling ports were located 90° apart from one another at a location that met US EPA Method 1, Section 11.1.1 criteria. Prior to emissions sampling, the stack was traversed to verify the absence of cyclonic flow. An average yaw angle of 1.95° was measured. Therefore, the sampling location also met US EPA Method 1, Section 11.4.2 criteria. During emissions sampling, the stack was traversed for stack gas volumetric flow rate, dry molecular weight, moisture content, and PCDD/PCDF concentration determinations.

Figure 3.2 schematically illustrates the traverse point and sample port locations utilized.

3.4 PROCESS SAMPLING LOCATION(S)

The US EPA Reference Test Methods performed did not specifically require that process samples were to be taken during the performance of this testing event. It is in the best knowledge of Montrose that no process samples were obtained and therefore no process sampling location was identified in this report.

TABLE 3.1
PROCESS DATA

Date	Run No.	Cast No.	Duration (hr)	Painted (lb)	Clean (lb)	Alloys (lb)	Total (ton)	Total (ton/hr)
8/14/2019	1	110108	4.48	42,060	101,260	896	72.1	16.1
8/15/2019	2	110111	5.28	41,900	97,760	755	70.2	13.3
8/16/2019	3	110115	5.58	42,240	101,100	1,009	72.2	12.9

Process data was provided by Kaiser Aluminum Fabricated Products, LLC personnel.

FIGURE 3.1
EUMELTFURNACE PROCESS AND SAMPLING LOCATION SCHEMATIC

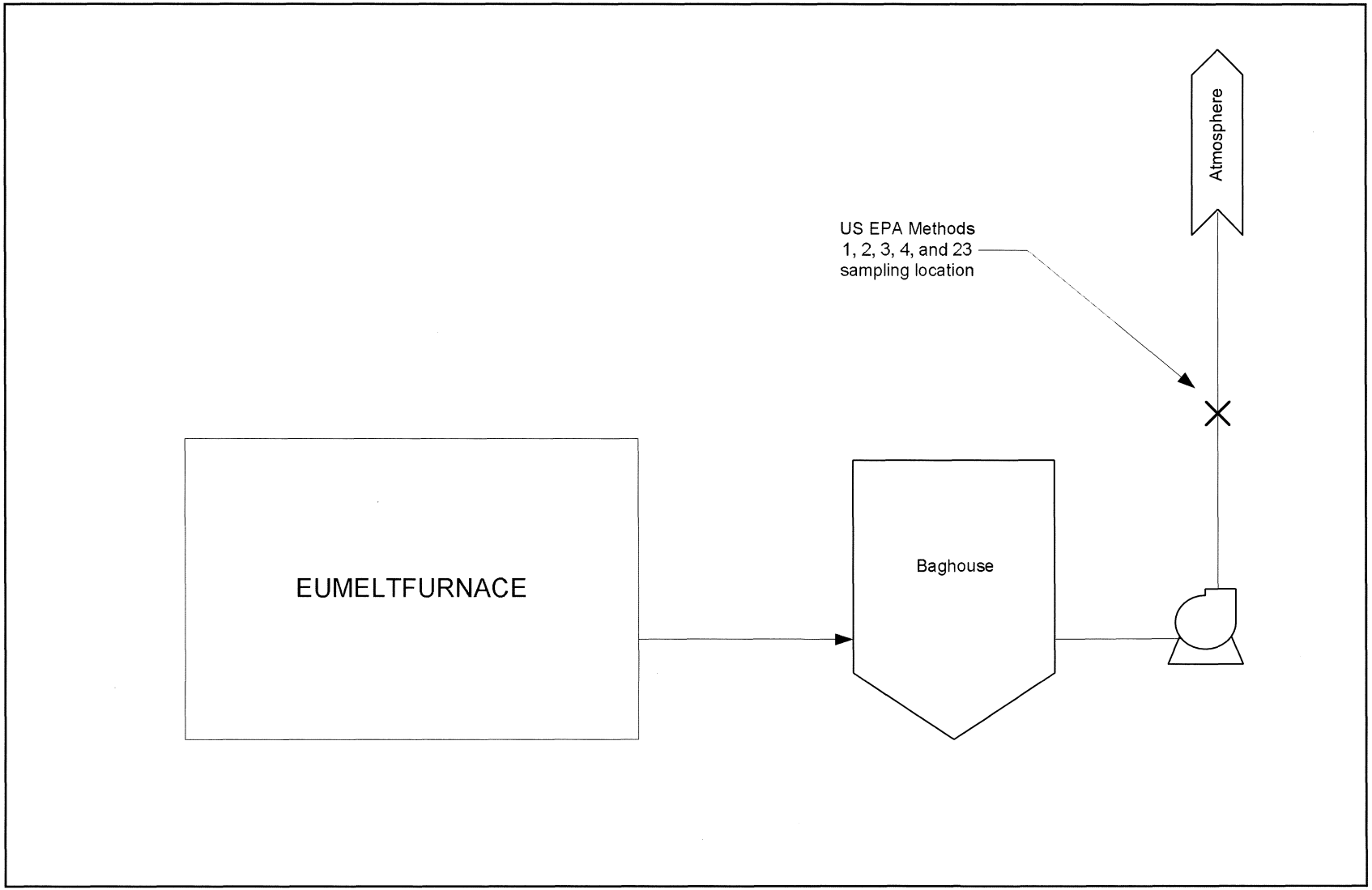
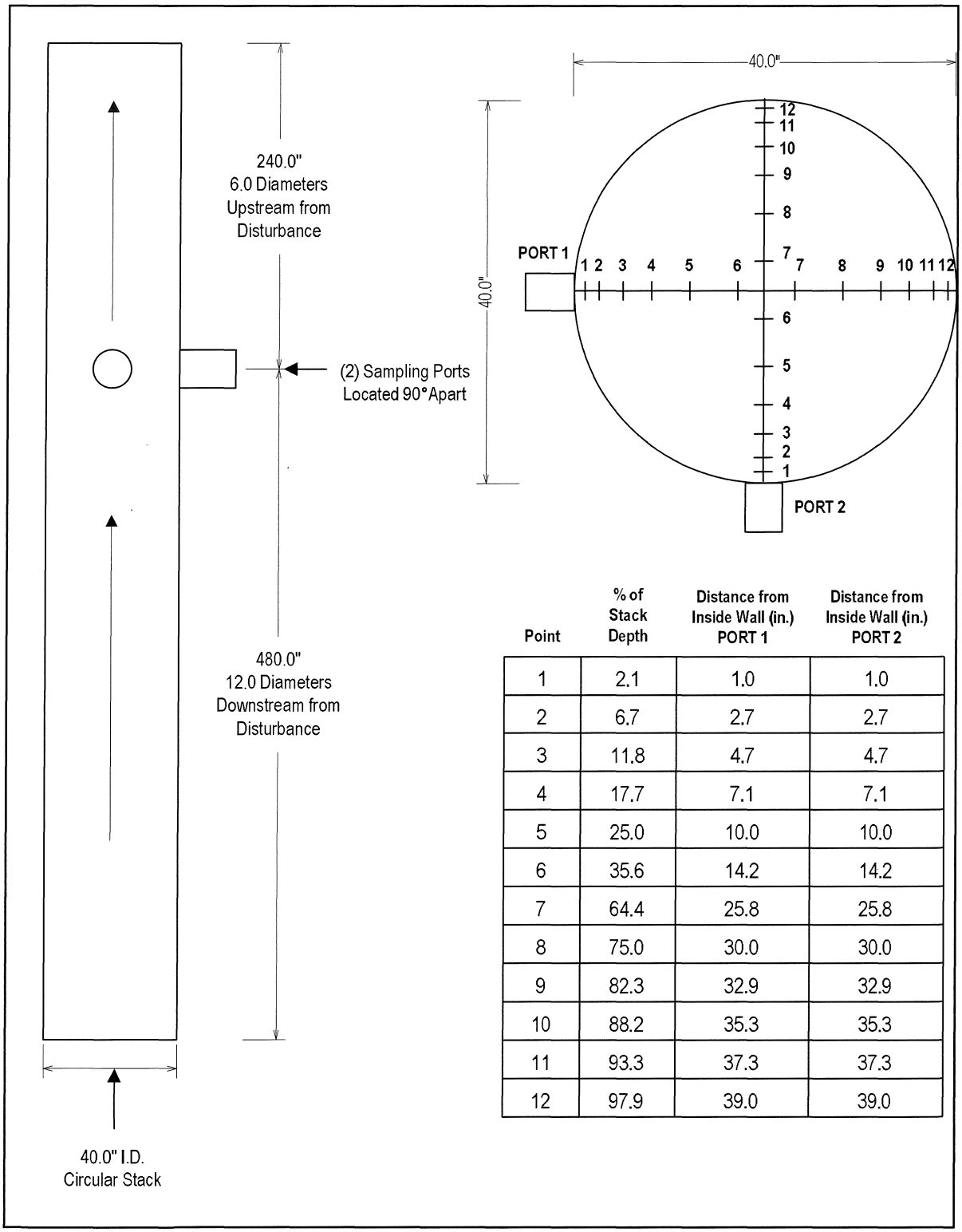


FIGURE 3.2
EUMELTFURNACE BAGHOUSE EXHAUST TRAVERSE POINT LOCATION DRAWING



Point	% of Stack Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2
1	2.1	1.0	1.0
2	6.7	2.7	2.7
3	11.8	4.7	4.7
4	17.7	7.1	7.1
5	25.0	10.0	10.0
6	35.6	14.2	14.2
7	64.4	25.8	25.8
8	75.0	30.0	30.0
9	82.3	32.9	32.9
10	88.2	35.3	35.3
11	93.3	37.3	37.3
12	97.9	39.0	39.0

4.0 SAMPLING AND ANALYTICAL PROCEDURES

4.1 TEST METHODS

4.1.1 US EPA Method 1: "Sample and Velocity Traverses for Stationary Sources"

Principle: To aid in the representative measurement of pollutant emissions and/or total volumetric flow rate from a stationary source, a measurement site where the effluent stream is flowing in a known direction is selected, and the cross-section of the stack is divided into a number of equal areas. A traverse point is then located within each of these equal areas. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.2 US EPA Method 2: "Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)"

Principle: The average gas velocity in a stack is determined from the gas density and from measurement of the average velocity head with a Type S (Stausscheibe or reverse type) pitot tube. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.3 US EPA Method 3: "Gas Analysis for the Determination of Dry Molecular Weight"

Principle: A gas sample is extracted from a stack by one of the following methods: (1) single-point, grab sampling; (2) single-point, integrated sampling; or (3) multi-point, integrated sampling. The gas sample is analyzed for percent CO_2, percent O_2, and if necessary, for percent CO. For dry molecular weight determination, either an Orsat or a Fyrite analyzer may be used for the analysis. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.4 US EPA Method 4: "Determination of Moisture Content in Stack Gases"

Principle: A gas sample is extracted at a constant rate from the source; moisture is removed from the sample stream and determined either volumetrically or gravimetrically. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.5 US EPA Method 23: "Determination of Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans From Stationary Sources"

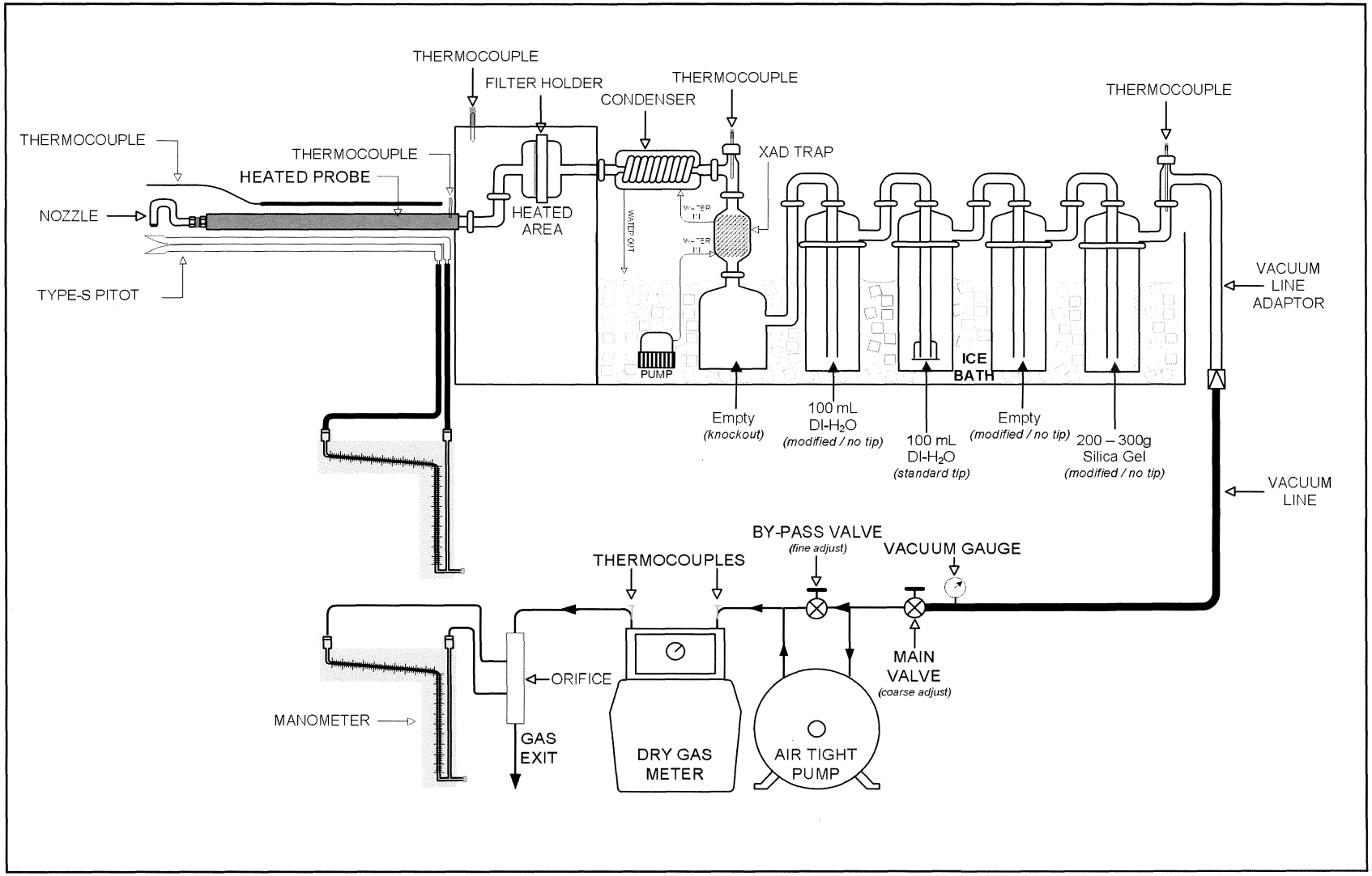
Principle: A sample is withdrawn from the gas stream isokinetically and collected in the sample probe on a glass fiber filter and on a packed column of adsorbent material. The sample cannot be separated into a particle vapor fraction. The PCDD's and PCDF's are extracted from the sample, separated by high resolution gas chromatography (HRGC), and measured by high resolution mass spectrometry (HGMS). This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

The sampling train utilized during this testing project is depicted in Figure 4.1.

4.2 PROCEDURES FOR OBTAINING PROCESS DATA

Process data was recorded by Kaiser Aluminum Fabricated Products, LLC personnel utilizing their typical record keeping procedures. Recorded process data was provided to Montrose personnel at the conclusion of this test event. The process data is located in Table 3.1 and in the Appendix.

FIGURE 4.1
US EPA METHOD 23 SAMPLING TRAIN SCHEMATIC



5.0 INTERNAL QA/QC ACTIVITIES

5.1 QA AUDITS

Tables 5.1 to 5.3 illustrate the QA audits that were performed during this test.

All meter boxes and sampling trains used during sampling performed within the requirements of their respective methods as is shown in Tables 5.1 and 5.2. All post-test leak checks were well below the applicable limit. Minimum metered volumes and percent isokinetics were also met where applicable.

Table 5.3 displays the US EPA Method 3 Fyrite Audits which were performed during this test in accordance with US EPA Method 3, Section 10.1 requirements. As shown, all Fyrite analyzer results were within ±0.5% of the respective Audit Gas concentrations.

5.2 QA/QC PROBLEMS

Montrose did not have a Qualified Individual (QI) for US EPA Method 23 onsite during the test event. However, Todd Wessel did complete the QI exam for US EPA Method 23 and received his QI certification on September 12, 2019.

5.3 QUALITY STATEMENT

Montrose is qualified to conduct this test program and has established a quality management system that led to accreditation with ASTM Standard D7036-04 (Standard Practice for Competence of Air Emission Testing Bodies). Montrose participates in annual functional assessments for conformance with D7036-04 which are conducted by the American Association for Laboratory Accreditation (A2LA). All testing performed by Montrose is supervised on site by at least one Qualified Individual (QI) as defined in D7036-04 Section 8.3.2. Data quality objectives for estimating measurement uncertainty within the documented limits in the test methods are met by using approved test protocols for each project as defined in D7036-04 Sections 7.2.1 and 12.10. Additional quality assurance information is presented in the report appendices.

TABLE 5.1
US EPA METHOD 23 SAMPLING TRAIN AUDIT RESULTS

Parameter	Run 1	Run 2	Run 3
Sampling Location	**EUMELTFURNACE EXHAUST STACK**		
Post-Test Leak Rate Observed (cfm)	0.008	0.003	0.005
Applicable Method Allowable Leak Rate (cfm)	0.020	0.020	0.020
Acceptable	Yes	Yes	Yes
Volume of Dry Gas Collected (dscf)	148.380	179.640	173.652
Recommended Volume of Dry Gas Collected (dscf)	21.000	21.000	21.000
Acceptable	Yes	Yes	Yes
Percent of Isokinetic Sampling Rate (%)	104.0	100.7	99.3
Applicable Method Allowable Isokinetic Sampling Rate (%)	100 ± 10	100 ± 10	100 ± 10
Acceptable	Yes	Yes	Yes

TABLE 5.2
US EPA METHOD 23 DRY GAS METER AUDIT RESULTS

Sampling Location	Pre-Test Dry Gas Meter Calibration Factor (Y)	Average Post-Test Dry Gas Meter Calibration Check Value (Yqa)	Post Test Dry Gas Meter Calibration Check Value Difference From Pre-Test Calibration Factor (%)	Applicable Method Allowable Difference (%)	Acceptable
EUMELTFURNACE EXHAUST STACK	0.9790	1.0221	-4.40%	5.00%	Yes

TABLE 5.3
US EPA METHOD 3 FYRITE AUDIT

Audit Date	**August 19, 2019**	
Audit Gas	**%CO_2**	**%O_2**
Audit Gas Concentration (%)	**10.1**	**10.1**
Fyrite Response 1 (%)	10.1	10.1
Fyrite Response 2 (%)	10.1	10.1
Fyrite Response 3 (%)	10.1	10.1
Average (%)	10.1	10.1
Average Within ±0.5%	Yes	Yes

Audit Gas Cylinder Number: CC469695