FLA-JSS-14107-01-15-04

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PUGET SOUND CLEAN AIR AGENCY

Spectrum Glass

January 13, 2004

John Schantz
Inspector
Puget Sound Clean Air Agency
110 Union Street
Suite 500
Seattle, WA 98101-2038

Subject: Recent Source Test Report

Dear Mr. Schantz,

We have completed all of the requirements of the Notice of Violation Number 3-000187. In this, we were required to perform a source test on Furnace 2 and Furnace 4.

I am sending the report on this Performance Test as requested. This report includes tests on Furnace #2 and Furnace #4. We followed the source test plan submitted and approved by you prior to testing. The results show that we are well within the allowable limits of the Order of Approval number 6497. We also showed that we were within the limits of 40CFR Subpart CC. We believe this satisfies the corrective action order described in the Notice of Violation.

Thank-You for your guidance and assistance in helping us get this done. Please advise if you have any questions or comments.

Best Regards,

Larry Witsell
Glass Technologist
Spectrum Glass Company

Cc: Fred Austin
Shorty Seel
Sherry Van Mondfrans

14107

TRC
Customer-Focused Solutions

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PUGET SOUND CLEAN AIR AGENCY

EMISSION TEST REPORT

Particulate Matter & Opacity Emission Testing
#2 & #4 Glass Melting Furnaces

Date of Test: November 24, 2003

SPECTRUM GLASS COMPANY
Woodinville, Washington

Prepared for:

Spectrum Glass Company
24106 Snohomish-Woodinville Road
Woodinville, WA 98072-0646
(425) 483-6699

Prepared by:

TRC Environmental Corporation
19874 141st Place N.E.
Woodinville, WA 98072
(425) 489-1938

TRC Project #41613-0010-00000

January 9, 2004

TRC
Customer-Focused Solutions

EMISSION TEST REPORT

TRC PROJECT NO:	41613-0010-00000
TEST DATE:	November 24, 2003
TYPE OF TESTS:	Particulate Matter, Opacity
TESTED SOURCES:	#2 & #4 Furnaces
TEST SITE:	Spectrum Glass Company Woodinville, WA
PREPARED FOR:	Spectrum Glass Company 24106 Snohomish Woodinville Road Woodinville, WA 98072-0646 (425) 483-6699

REPORT CERTIFICATION

SUBMITTAL DATE

January 9, 2004

This project was carried out under my direction and supervision. To the best of my knowledge, the data presented in this report is accurate and complete.

Paul J. Clark
Field Team Leader
NW Air Measurements Manager

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SECTION 1
INTRODUCTION

Spectrum Glass Company operates a glass manufacturing facility in Woodinville, Washington. Spectrum Glass Company (Spectrum Glass) contracted TRC Environmental Corporation (TRC) in Woodinville, Washington to quantify particulate matter and opacity emissions at the #2 and #4 glass melting furnace stacks on November 24, 2003. The furnaces were tested while operating at their normal production rates using electrical power and natural gas to melt and refine glass. The production rates during these emission tests were approximately 1,050 and 950 kilograms per hour (kg/hr) for Furnaces #2 and #4, respectively. These emissions tests were performed to demonstrate compliance with the requirements of the Puget Sound Clean Air Agency (PSCAA).

All testing procedures were conducted in accordance with the guidelines published in the July 2001 edition of the US Environmental Protection Agency (EPA) document Title 40, Code of Federal Regulations, Part 60 (40CFR60), Appendix A, Methods 3A, 5, 9 and 22. Method 3A(modified) was performed to quantify Oxygen and Carbon Dioxide emissions for use in molecular weight calculations. Triplicate sixty (60) minute Method 5 tests were performed on each baghouse stack. Method 5 was performed to quantify particulate matter emissions. During daylight hours, Method 9 was performed to observe visible emissions (opacity). A total of eighteen (18) minutes of opacity readings was collected (6 minutes for each emissions test). During nighttime hours Method 22 was performed to observe visible emissions. A total of six (6) minutes of continuous opacity readings was collected for each emissions test. No visible emissions were observed during performance of Method 22.

The test program is summarized in Table 1.0.

Table 1.0
Source Test Parameters and Methodology

Source(s)	Test Parameters	Test Methodology
#2 & #4 Glass Melting Furnace Baghouse Stacks	Three (3) 60-minute tests for particulate matter	EPA Method 3A(modified) EPA Method 5
#2 & #4 Baghouse Stacks (18 mins. Each)	18 minutes of 15-second opacity readings OR	EPA Method 9
#2 Baghouse only	6 minutes of continuous observation for opacity	EPA Method 22

The source description, test procedures and quality assurance activities are described in the subsequent sections. All supporting field data, analytical reports, calibration records, and project participants are provided in appendices.

SECTION 2
SUMMARY OF TEST RESULTS

The test crew utilized the following EPA 40 CFR 60, Appendix A Reference Methods:

- Method 3A — Determination of Oxygen and Carbon Dioxide In Emissions from Stationary Sources (modified)
- Method 5 — Determination of Particulate Matter Emissions from Stationary Sources
- Method 9 — Visual Determination of the Opacity of Emissions From Stationary Sources
- Method 22 — Visual Determination of the Fugitive Emissions From Material Sources and Smoke Emissions From Flares

Particulate matter emission concentration results are reported in grains per dry standard cubic meter (gr/dscf). Particulate matter emission rates results for are reported in pounds per hour (lb/hr) and grams per kilograms (g/kg) of flat glass produced. Opacity emissions are reported in percent (%).

For this test program, particulate matter emission results were not blank-corrected.

Section 60.296 of Subpart CC in 40CFR60 allows for a zero production correction of 454 g/hr for flat glass. When this factor is subtracted from the measured particulate matter emissions, the results are then reported as zero.

A summary of the test results as compared to the emissions limits as specified by PSCAA and 40CFR60, Subpart CC is provided in Table 2.0.

Table 2.0

Summary of Average Results and Permit Limits

#2 & #4 Glass Melting Furnace Stacks

November 24, 2003

Spectrum Glass Company
Woodinville, Washington

Test Identification	Pollutant	Emission Unit	Run 1	Run 2	Run 3	Average	Permit Limit
FURNACE #2 Method 5	Particulate Matter	gr/dscf	0.003	0.006	0.004	0.004	*0.010*
		lb/hr	0.134	0.286	0.212	0.210	-
		g/kg	0.058	0.124	0.092	0.091	-
		g/kg	0.0	0.0	0.0	0.0	*0.225*[1]
	Volume of Gas Collected	dscf	56.756	41.924	41.302	46.601	*Minimum of 30.0 dscf*
Method 22	Visible Emissions	%	0	0	0	0	*0*
FURNACE #4 Method 5	Particulate Matter	gr/dscf	0.004	0.004	0.006	0.005	*0.010*
		lb/hr	0.164	0.158	0.226	0.182	-
		g/kg	0.078	0.076	0.108	0.087	-
		g/kg	0.0	0.0	0.0	0.0	*0.225*[1]
	Volume of Gas Collected	dscf	38.711	37.103	36.510	37.441	*Minimum of 30.0 dscf*
Method 9	Opacity	%	0	0	0	0	*0*

[1]Reported results reflect use of zero correction factor (454 g/hr subtracted from measured particulate matter) per Section 60.296 of 40CFR60, Subpart CC

SECTION 3
SOURCE PROCESS DESCRIPTION

Spectrum Glass Company operates two (2) glass melting furnaces fitted with baghouses for emission control devices (ECDs). Refer to Table 3.0 for process data recorded by the plant personnel during the emissions tests.

Table 3.0 Process Parameters

Parameter	Unit	Run 1	Run 2	Run 3	Average
FURNACE #2 Process Rate	pounds glass	2,573	2,496	2,611	2,560
Baghouse Pressure Drop	inches	4.9	4.9	4.9	4.9
Baghouse Inlet Temp	° F	252	252	252	252
Natural Gas Used	ft^3 natural gas	2,393.91	2,231.45	2,393.60	2339.65
FURNACE #4 Process Rate	pounds glass	2,199	2,164	2,199	2187
Baghouse Pressure Drop	inches	5.5	5.5	5.5	5.5
Baghouse Inlet Temp	° F	349	349	349	349
Natural Gas Used	ft^3 natural gas	2,561.58	2,231.45	2,393.60	2395.54

SECTION 4
SAMPLING AND ANALYTICAL PROCEDURES

All sampling and analytical procedures used in this test program were based on procedures published by the Environmental Protection Agency. These sampling and analytical procedures are contained in 40 CFR 60, Appendix A published by EPA. Copies of these methods are available from the EPA EMTIC electronic bulletin board or the Code of Federal Regulations.

4.1 OVERVIEW

This section describes the procedures that TRC followed during the field-sampling program. Throughout the program TRC followed *40 CFR Part 60, Appendix A* test methods.

The remainder of this section is divided into several subsections: Field Program Description, Pre-sampling Activities and Onsite Sampling Activities.

4.2 FIELD PROGRAM DESCRIPTION

TRC personnel conducted the field sampling and the following test methods from 40 CFR, Part 60, Appendix A were used:

- Method 3A — Determination of Oxygen and Carbon Dioxide In Emissions from Stationary Sources (modified)
- Method 5 — Determination of Particulate Matter Emissions from Stationary Sources
- Method 9 — Visual Determination of the Opacity of Emissions From Stationary Sources
- Method 22 — Visual Determination of the Fugitive Emissions From Material Sources and Smoke Emissions From Flares

4.3 TESTING METHODOLOGY

4.3.1 Traverse Point Location (EPA Method 1)

EPA Method 1 is performed as referenced by EPA Method 5. The procedures specified by EPA Method 1, "Sample and Velocity Traverses for Stationary Sources", were followed to determine the number and location of traverse points to be used for the stratification

testing and velocity traverses. The number of straight run stack diameters (equivalent diameters) upstream and downstream from the sample ports were used to determine the minimum number of traverse points required. Parallel or non-cyclonic gas stream flow was verified using a Type-S Pitot tube connected to an inclined-vertical oil manometer. The manometer has 0.01-inch gradations on the inclined scale and 0.10 inch gradations on the vertical scale. In practice, the Pitot tube is rotated so the planes of the face openings are perpendicular to the stack cross-sectional plane. This is referred to as the 0-degree reference position. A zero manometer reading obtained in this position indicates no cyclonic flow. If the manometer does not read zero, the Pitot tube is rotated up to a 90-degree yaw angle until a zero reading is obtained. The angle of rotation is measured to the nearest degree. All traverse points were examined in this fashion. If the average of all the rotation angles are less than 20 degrees, the reference method sampling ports was located at a point in the exhaust gas stream that is considered to be non-cyclonic.

The #2 Glass Melting Furnace stack has a 37-inch inside diameter (ID). The straight and unobstructed length of the stack before "B" the sample ports is approximately twenty feet (20') or 6.5 diameters and the straight and unobstructed distance after "A" the sample ports is approximately ten feet (10') feet or approximately 3.2 diameters. For this test program, the maximum number of traverse points or twenty four (24) traverse points were selected for sample collection to allow for sampling tow and one half (2.5) minutes per point to collect the samples over a sixty (60) minute sample period.

The #4 Glass Melting Furnace stack has a 40-inch inside diameter (ID). The straight and unobstructed length of the stack before "B" the sample ports is approximately thirty feet (30') or 9.0 diameters and the straight and unobstructed distance after "A" the sample ports is approximately ten feet (10') feet or approximately 3.0 diameters. For this test program, the maximum number of traverse points or twenty four (24) traverse points were selected for sample collection to allow for sampling two and one half (2.5) minutes per point to collect the samples over a sixty (60) minute sample period.

During the Method 5 tests at each furnace, the sample probe tip was moved to the minimum number of traverse points in each of the two (2) test ports, which are located 90 degrees apart, in each of the circular stacks. At each of the furnaces, 12-point traverses were performed in each of the two test ports at 2.1, 6.7, 11.8, 17.7, 25.0, 35.6, 64.4, 75.0, 82.3, 88.2, 93.3, and 97.9 percent of the stack diameter. A copy of each stack schematic with the actual traverse points used is included in the appendices of this report.

4.3.2 Stack Gas Velocity and Volumetric Flow Rate (EPA Method 2)

EPA Method 2 is included in EPA Method 5. The procedures delineated by EPA Method 2, "Determination of Stack Gas Velocity and Volumetric Flow Rate (Type-S Pitot tube)," were followed to determine the stack gas velocity and volumetric flow rate. From the results of the measurements taken in the preceding section to determine the number and location of traverse points, a velocity and temperature traverse was conducted for each test run. A Type-S Pitot tube and K-Type thermocouple was positioned at each traverse point, The Pitot tube differential pressure and exhaust gas temperature data was recorded on field data sheets. The Pitot tube was connected to an inclined-vertical oil manometer and the thermocouple was connected digital temperature readout. The Pitot tube, thermocouple and readout devices were calibrated in accordance with US EPA requirements prior to and after field use.

4.3.3 Oxygen and Carbon Dioxide Emissions (EPA Method 3A(modified))

Molecular weight of the stack gas was determined using a modified Method 3A. EPA Method 3A "Determination of Oxygen and Carbon Dioxide Concentrations In Emissions From Stationary Sources (Instrumental Analyzer Procedure)" was modified to incorporate the use of gas sample bags. A gas sample was collected into a tedlar bag during each test run. The gas samples were later analyzed using appropriate gas analyzers in the TRC lab.

4.3.4 Stack Gas Moisture Content

The moisture content of the stack gas was determined gravimetrically from the weight gain in each impinger from the Method 5 sampling trains.

4.3.5 Particulate Matter (EPA Method 5)

The EPA Method 5 sample train (Reference Figure 5.1) consisted of a stainless steel buttonhook nozzle attached to a heated glass lined stainless steal sheath probe. A thermocouple and S-type Pitot tube are permanently attached to the probe for measurement of stack gas temperature and velocity. Sample gas was drawn through the nozzle and probe and then through a heated glass fiber filter. The gas stream temperature across the filter was kept at 248 ± 25 °F.

Particulate matter collected on the filter, within the probe, and all connecting glassware from the filter holder top to the probe end was recovered, desiccated, and weighed to determine the total particulate catch. In the TRC laboratory, reagent and filter blanks was carried throughout the gravimetric analysis procedures. Each gravimetric sample was weighed to constant weights of ± 0.5 milligrams following desiccation in a cabinet desiccator. The Mettler AB204-S electronic balance used to obtain weights is set to a time integrating mode with a readability of 0.01 milligrams. The balance is calibrated prior to every weighing session. The balance is also certified by Mettler on an annual basis. For this project, a reagent blank was also analyzed in the same manner as the samples. For this test project, particulate matter emissions results were not blank-corrected.

Upon exiting the filter, the gas was drawn through a series of four impingers. The impinger system was as follows: 1st, 2nd, and 3rd contained 100 ml of Deionized (DI) H_2O and the 4th contained approximately 200g of silica gel. This apparatus comprised the back-half portion of the sampling train. Following the impinger system the gas was

drawn through a dry gas meter, a calibrated orifice, and a leak-free pump. Sampling was conducted isokinetically from sampling points pre-determined in EPA Method 1. A minimum of 60 minutes per test run was performed.

Leak checks on the particulate train were performed before and after each sampling run. All leak checks and leakage rates are documented on the relevant field test data sheets. Pre-run leak checks are not required by the method but are required by TRC. The pre-run leak check was performed at a minimum vacuum setting of 15 in. Hg. The acceptance criterion for the particulate train is a leak rate of 0.02 cfm at the highest vacuum obtained during the run. All leak rates must be within the method criteria in order to validate the test run.

4.3.6 Opacity Emissions (EPA Method 9)

During daylight hours EPA Method 9 opacity emissions observations were performed using procedures outlined in EPA Method 9. The observer stood at a distance sufficient to provide a clear view of the emissions with the sun oriented in the 140° sector to his back. The line of vision was perpendicular to the plume direction, and did not include more than one plume diameter. During each test, the time, estimated distance to the emission location, approximate wind direction, estimated wind speed, description of the sky condition (presence and color of clouds), and plume background were recorded on a field data sheet at the time opacity readings are initiated and completed. A total of 18 minutes of 15-second visible observations were collected at the baghouse stack before and after the emissions tests were performed.

4.3.7 Opacity Emissions (EPA Method 22)

During nighttime hours EPA Method 22 opacity emissions observations were performed using procedures outlined in EPA Method 22. The observer stood at a distance sufficient to provide a clear view of the emissions. The line of vision was perpendicular to the

to provide a clear view of the emissions. The line of vision was perpendicular to the plume direction, and did not include more than one plume diameter. When Method 9 opacity readings were unable to be performed due to nighttime hours a total of 6 minutes of continuous visible observations were collected during each test.

SECTION 5
QUALITY ASSURANCE

5.1 OVERVIEW

TRC Environmental Corporation management is fully committed to an effective Quality Assurance/Quality Control Program whose objective is the delivery of a quality product. For much of TRC's work, that product is data resulting from field measurements, sampling and analysis activities, engineering assessments, and the analysis of gathered data for planning purposes. The Quality Assurance Program works to provide complete, precise, accurate and representative data in a timely manner for each project, considering both the project's needs and budget constraints.

This section highlights the specific QA/QC procedures that were followed on this Test Program.

5.2 FIELD QUALITY CONTROL SUMMARY

5.2.1 Reagent Certifications

All reagents used for this project conform to the specifications established by the Committee on Analytical Reagents or the American Chemical Society (ACS), or the best available grade. Included in the appendices of this report are copies of the pertinent reagent certifications.

5.3 DATA REDUCTION, VALIDATION, AND REPORTING

Specific QC measures are used to ensure the generation of reliable data from sampling activities. Proper collection and organization of accurate information followed by clear and concise reporting of the data is a primary goal in all projects.

5.3.1 Data Validation

TRC supervisory and QC personnel use validation methods and criteria, appropriate to the type of data and the purpose of the measurement. Records of all data are maintained, including that judged to be an "outlying" or spurious value. The persons validating the data had sufficient knowledge of the technical work to identify questionable values.

The Field Team Leader and/or the QC Coordinator based on their review of the adherence to an approved sampling protocol and written sample collection procedure validate Field sampling data.

The following criteria was used to evaluate the field sampling data:

- Use of approved test procedures;
- Proper operation of the process being tested;
- Use of properly operating and calibrated equipment;
- Leak checks conducted before and after test.

5.3.2 Data Reporting

All data was reported in standard units depending on the measurement and the ultimate use of the data.

The bulk of the data was computer processed and reported as follows:

Exhaust Gas Stream

1. Stack exhaust
    a. Stack exhaust flow rates (reported in dscfm and acfm)
    b. Stack exhaust moisture content
2. Gas Diluents and Pollutants
    a. Particulate Matter – gr/dscf, lb/hr
    b. Opacity - %

APPENDIX A

COMPUTER PRINTOUTS OF RESULTS

TRC

TEST DATA SUMMARIES

Client: Spectrum Glass Company
Location: Woodinville, Washington
Unit: Furnace #2

EPA Method 5 w/PSCAA Back-Half - Particulate Matter & Condensible Particulate Matter

	Run 1	Run 2	Run 3
Dates:	11/24/03	11/24/03	11/24/03
Barometric Pressures:	29.77	29.77	29.77

TABLE OF CONTENTS:

Data Sheet
Run Sheet - Run 1
Run Sheet - Run 2
Run Sheet - Run 3

Calculation Sheet

PM Calcs

Sampling Data Summary					
Parameter	Run 1	Run 2	Run 3		Average
Total Sampling Time, Min.	60	60	60		60
Stack Gas Oxygen Content, O2%	20.0	20.0	20.0		20.0
Stack Gas Carbon Dioxide Content, CO2%	4.0	4.0	4.0		4.0
Gas Sample Volume at Standard Conditions, cu. ft.	56.576	41.924	41.302		46.601
cu. m.	1.602	1.187	1.169		1.319
Dry Stack Gas Flow Rate (Dry, STP), dscf/min	6,103	5,968	5,862		5,978
dscm/min	173	169	166		169

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19874 141st Place N.E.
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Phone: (425) 489-1938
Fax: (425) 489-9564

Project Number **41613-0010-00000**

TRC Environmental Corp.

EMISSION MEASUREMENTS DEPARTMENT

19874 141st Place N.E.
Woodinville, WA 98072
Phone: (425) 489-1938
Fax: (425) 489-9564

CLIENT:	Spectrum Glass Company	DATE:	11/24/03
LOCATION:	Woodinville, Washington	PROJECT NO.:	41613-0010-00000
UNIT:	Furnace #2	PERSONNEL:	DCT/MLE

Data Input Sheet

The table below contains the results of testing and calculations performed by TRC on the date(s) listed.

EPA Method 5 w/PSCAA Back-Half - Particulate Matter & Condensible Particulate Matter

Parameter	SYMBOL	UNITS				
Test Number			Run 1	Run 2	Run 3	
Test Date			11/24/03	11/24/03	11/24/03	
Start Time			1601	1725	1852	
Stop Time			1708	1830	2000	**Average**
Stack Diameter	ds	inches	37	37	37	
Nozzle Diameter	dn	inches	0.456	0.402	0.402	
Barometric Pressure	Pbar	inches Hg	29.77	29.77	29.77	29.77
Stack Static Pressure	Pg	inches H_2O	-0.50	-0.50	-0.50	-0.50
Pitot Coefficient	cp	none	0.84	0.84	0.84	0.84
Meter Calibration Factor	Y	none	0.992	0.992	0.992	
	DH@	none	1.719	1.719	1.719	
Stack Gas Oxygen Content	O_2	percent	20.0	20.0	20.0	20.0
Stack Gas Carbon Dioxide Content	CO_2	percent	4.0	4.0	4.0	4.0
Net Moisture Gain (Impingers w/SiGel)	Ww	grams	31.2	22.7	22.7	25.5
Average Stack Temperature	ts	degrees F	167.5	154.7	146.0	156.1
Average Meter Temperature	tm	degrees F	58.9	63.6	68.3	63.6
Avg Delta H	dH	inches H_2O	2.825	1.523	1.487	1.945
Average Square Root Delta H	ASR dH	inches H_2O	1.670	1.231	1.211	1.371
Avg Velocity Head	dP	inches H_2O	0.081	0.070	0.070	0.074
Average Square Root Delta P	ASR dP	inches H_2O	0.274	0.265	0.258	0.265
Gas Sample Volume	Vm	cubic feet	55.941	41.964	41.713	46.539
Total Sampling Time	min	minutes	60	60	60	

TRC Environmental Corp.

EMISSION MEASUREMENTS DEPARTMENT

19874 141st Place N.E.
Woodinville, WA 98072
Phone: (425) 489-1938
Fax: (425) 489-9564

CLIENT:	Spectrum Glass Company	DATE:	11/24/03
LOCATION:	Woodinville, Washington	PROJECT NO.:	41613-0010-00000
UNIT:	Furnace #2	PERSONNEL:	DCT/MLE

Field Data Run Sheets

The table below contains the results of testing and calculations performed by TRC on the date(s) listed.

EPA Method 5 w/PSCAA Back-Half - Particulate Matter & Condensible Particulate Matter

RUN NO: Run 1
Minutes per point: 2.5
number of points: 24

PAGE ONE OF ONE
OPERATOR: Doug Towne

POINT NUMBER	TIME	DGM READING INITIAL	VEL. Dp (in. H_2O)	Sqrt Dp	DIFF PRESS. DH	DIFF PRESS. Sqrt.	STACK TEMP. (°F)	DRY GAS METER TEMP (°F) INLET	DRY GAS METER TEMP (°F) OUTLET
B 1	0	78.459	0.09	0.300	3.20	1.789	161	57	56
2	3		0.08	0.283	2.90	1.703	164	56	56
3	5		0.09	0.300	3.20	1.789	166	57	56
4	8		0.10	0.316	3.60	1.897	166	57	56
5	10		0.13	0.361	4.00	2.000	170	58	51
6	13		0.12	0.346	3.90	1.975	172	58	56
7	15		0.10	0.316	3.50	1.871	173	59	56
8	18		0.10	0.316	3.50	1.871	173	59	56
9	20		0.11	0.332	3.80	1.949	174	60	57
10	23		0.05	0.224	1.80	1.342	172	60	57
11	25		0.05	0.224	1.80	1.342	171	60	57
12	28		0.05	0.224	1.80	1.342	170	61	58
A 1	30		0.08	0.080	2.80	1.673	165	60	59
2	33		0.08	0.283	2.80	1.673	169	60	60
3	35		0.08	0.283	2.80	1.673	169	61	60
4	38		0.07	0.265	2.50	1.581	169	61	60
5	40		0.08	0.283	2.80	1.673	169	61	59
6	43		0.08	0.283	2.80	1.673	167	61	59
7	45		0.06	0.245	2.10	1.449	166	62	59
8	48		0.07	0.265	2.50	1.581	165	62	59
9	50		0.07	0.265	2.50	1.581	164	63	59
10	53		0.06	0.245	2.20	1.483	163	63	59
11	55		0.07	0.265	2.50	1.581	161	63	60
12	58		0.07	0.265	2.50	1.581	160	63	60
	60	134.400							
	Total	Total	Avg.	Avg.	Avg.	Avg.	Avg.		Avg.
	60	55.941	0.08	0.274	2.825	1.670	167.5		58.9

Impinger Gain

impinger 1:	709.4	705.9	3.50
impinger 2:	704.5	692.8	11.70
impinger 3:	718.0	715.7	2.30
impinger 4:	974.0	960.3	13.70
impinger 5:	0.0	0.0	0.00
Trap:	0.0	0.0	0.00
impinger 7:	0.0	0.0	0.00
			31.20

O_2: 20.0
CO_2: 4.0

Start Time: 1601
Stop Time: 1708

Static Pressure (Port A):
Static Pressure (Port B):
Static Pressure (Avg.): -0.5

TRC Environmental Corp.

EMISSION MEASUREMENTS DEPARTMENT

19874 141st Place N.E.
Woodinville, WA 98072
Phone: (425) 489-1938
Fax: (425) 489-9564

CLIENT:	Spectrum Glass Company	DATE:	11/24/03
LOCATION:	Woodinville, Washington	PROJECT NO.:	41613-0010-00000
UNIT:	Furnace #2	PERSONNEL:	DCT/MLE

Field Data Run Sheets

The table below contains the results of testing and calculations performed by TRC on the date(s) listed.

EPA Method 5 w/PSCAA Back-Half - Particulate Matter & Condensible Particulate Matter

RUN NO: Run 2
Minutes per point: 2.5
number of points: 24

PAGE ONE OF ONE
OPERATOR: Doug Towne

POINT NUMBER	TIME	DGM READING INITIAL	VEL. Dp (in. H_2O)	Sqrt Dp	DIFF PRESS. DH	DIFF PRESS. Sqrt.	STACK TEMP. (°F)	DRY GAS METER TEMP (°F) INLET	DRY GAS METER TEMP (°F) OUTLET
A 1	0	134.610	0.07	0.265	1.50	1.225	166	58	58
2	3		0.07	0.265	1.50	1.225	164	58	58
3	5		0.07	0.265	1.50	1.225	160	58	58
4	8		0.07	0.265	1.50	1.225	154	60	58
5	10		0.07	0.265	1.50	1.225	153	61	58
6	13		0.07	0.265	1.50	1.225	153	63	58
7	15		0.07	0.265	1.50	1.225	152	64	58
8	18		0.07	0.265	1.50	1.225	152	65	59
9	20		0.07	0.265	1.50	1.225	152	66	60
10	23		0.06	0.245	1.30	1.140	151	67	60
11	25		0.06	0.245	1.30	1.140	151	67	61
12	28		0.07	0.265	1.50	1.225	151	68	61
B 1	30		0.04	0.200	0.84	0.917	147	65	62
2	33		0.06	0.245	1.30	1.140	153	65	63
3	35		0.07	0.265	1.52	1.233	154	66	63
4	38		0.07	0.265	1.51	1.229	155	68	63
5	40		0.08	0.283	1.72	1.311	157	69	63
6	43		0.07	0.265	1.51	1.229	159	69	63
7	45		0.07	0.265	1.51	1.229	156	70	64
8	48		0.07	0.265	1.51	1.229	156	70	64
9	50		0.09	0.300	2.00	1.414	155	71	65
10	53		0.08	0.283	1.74	1.319	154	71	65
11	55		0.08	0.283	1.80	1.342	154	71	65
12	58		0.09	0.300	2.00	1.414	154	71	65
	60	176.574							
	Total	Total	Avg.	Avg.	Avg.	Avg.	Avg.		Avg.
	60	41.964	0.07	0.265	1.523	1.231	154.7		63.6

Impinger Gain			
impinger 1:	714.9	709.2	5.70
impinger 2:	702.9	695.6	7.30
impinger 3:	705.1	703.9	1.20
impinger 4:	863.3	854.8	8.50
impinger 5:	0.0	0.0	0.00
Trap:	0.0	0.0	0.00
impinger 7:	0.0	0.0	0.00
			22.70

O_2: 20.0
CO_2: 4.0

Start Time: 1725
Stop Time: 1830

Static Pressure: -0.5

TRC Environmental Corp.

EMISSION MEASUREMENTS DEPARTMENT

19874 141st Place N.E.
Woodinville, WA 98072
Phone: (425) 489-1938
Fax: (425) 489-9564

CLIENT:	Spectrum Glass Company	DATE:	11/24/03
LOCATION:	Woodinville, Washington	PROJECT NO.:	41613-0010-00000
UNIT:	Furnace #2	PERSONNEL:	DCT/MLE

Field Data Run Sheets

The table below contains the results of testing and calculations performed by TRC on the date(s) listed.

EPA Method 5 w/PSCAA Back-Half - Particulate Matter & Condensible Particulate Matter

RUN NO: Run 3
Minutes per point: 2.5
number of points: 24

PAGE ONE OF ONE
OPERATOR: Doug Towne

POINT NUMBER	TIME	DGM READING INITIAL	VEL. Dp (in. H_2O)	Sqrt Dp	DIFF PRESS. DH	DIFF PRESS. Sqrt.	STACK TEMP. (°F)	DRY GAS METER TEMP (°F) INLET	DRY GAS METER TEMP (°F) OUTLET
B 1	0	176.649	0.05	0.224	1.10	1.049	151	65	65
2	3		0.04	0.200	0.87	0.933	150	65	65
3	5		0.04	0.200	0.88	0.938	147	65	65
4	8		0.04	0.200	0.88	0.938	147	66	65
5	10		0.07	0.265	1.55	1.245	148	68	65
6	13		0.07	0.265	1.55	1.245	147	69	65
7	15		0.06	0.245	1.30	1.140	147	70	65
8	18		0.08	0.283	1.75	1.323	147	71	65
9	20		0.09	0.300	1.95	1.396	146	71	65
10	23		0.09	0.300	2.00	1.414	146	72	65
11	25		0.09	0.300	2.00	1.414	146	72	66
12	28		0.09	0.300	2.00	1.414	146	72	66
A 1	30		0.07	0.265	1.55	1.245	144	70	66
2	33		0.07	0.265	1.55	1.245	144	70	66
3	35		0.07	0.265	1.55	1.245	144	71	66
4	38		0.07	0.265	1.55	1.245	144	71	66
5	40		0.07	0.265	1.55	1.245	146	72	66
6	43		0.07	0.265	1.55	1.245	146	73	66
7	45		0.07	0.265	1.55	1.245	146	73	67
8	48		0.07	0.265	1.55	1.245	145	74	67
9	50		0.06	0.245	1.30	1.140	145	74	67
10	53		0.06	0.245	1.30	1.140	144	74	67
11	55		0.07	0.265	1.55	1.245	144	74	67
12	58		0.06	0.245	1.30	1.140	144	74	68
	60	218.362							
	Total	Total	Avg.	Avg.	Avg.	Avg.	Avg.		Avg.
	60	41.713	0.07	0.258	1.487	1.211	146.0		68.3

Impinger Gain

Impinger 1:	714.2	708.7	5.50
Impinger 2:	698.6	691.2	7.40
Impinger 3:	712.9	711.6	1.30
Impinger 4:	841.5	833.0	8.50
Impinger 5:	0.0	0.0	0.00
Trap:	0.0	0.0	0.00
Impinger 7:	0.0	0.0	0.00
			22.70

O_2: 20.0
CO_2: 4.0

Start Time: 1852
Stop Time: 2000

Static Pressure (Port A):
Static Pressure (Port B):
Static Pressure (Avg.): -0.5

TRC Environmental Corp.

EMISSION MEASUREMENTS DEPARTMENT

19874 141st Place N.E.
Woodinville, WA 98072
Phone: (425) 489-1938
Fax: (425) 489-9564

CLIENT:	Spectrum Glass Company	DATE:	11/24/03
LOCATION:	Woodinville, Washington	PROJECT NO.:	41613-0010-00000
UNIT:	Furnace #2	PERSONNEL:	DCT/MLE

Calculation Sheet

The table below contains the results of testing and calculations performed by TRC on the date(s) listed.

EPA Method 5 w/PSCAA Back-Half - Particulate Matter & Condensible Particulate Matter

Parameter	SYMBOL	UNITS				
Test Number			Run 1	Run 2	Run 3	
Test Date			11/24/03	11/24/03	11/24/03	
Start Time			1601	1725	1852	
Stop Time			1708	1830	2000	
Calculated Data						**Average**
Nozzle Area, An=3.14159*(dn/2)^2	An	square inches	0.1633	0.1269	0.1269	0.1391
Stack Area,As=3.14159*((Ds/12)/2)^2	As	square feet	7.47	7.47	7.47	7.47
Avg Stack Temperature, Ts=ts+460	Ts	degrees Rankin	627.5	614.7	606.0	616.1
Meter Pressure, Pm=Pb+Dh/13.6	Pm	inches Hg	29.98	29.88	29.88	29.91
Avg Meter Temperature, Tm=tm+460	Tm	degrees Rankin	518.9	523.6	528.3	523.6
Gas Sample Volume at Standard Conditions,	Vm(std)	cubic feet	56.576	41.924	41.302	46.601
Vm(std)= 528/29.92*Y*Vm*Pm/Tm		cubic meters	1.602	1.187	1.169	1.319
Net Moisture Gain (Impingers w/SiGel)	Ww	grams	31.2	22.7	22.7	25.5
Volume of Water Vapor, Vw(std)= 0.04715*Wlc	Vw(std)	cubic feet	1.471	1.070	1.070	1.204
Moisture Fraction, Bws = Vw(Std)/(Vm(Std)+Vw(Std))*100	Bws	percent	2.53%	2.49%	2.53%	2.52%
Dry Stack Gas Molecular Weight, Md = (0.32*O2)+(0.44*CO2)+(0.28*(100-(O2+CO2)))	Mwd	g/g-mole	29.44	29.44	29.44	29.44
Wet Stack Gas Molecular Weight Mw = Md* (1-Bws)+(18*(Bws))	Mws	g/g-mole	29.15	29.16	29.15	29.15
Absolute Stack Pressure, Ps = Pbar + Pg/13.6	Ps	inches Hg	29.73	29.73	29.73	29.73
Stack Gas Velocity Vs= 85.49*Cp*ASRdP*((Ts)/((Ps)*(Mw)))^0.5	Vs	ft/sec	16.71	16.00	15.50	16.07
Vsm = 0.3048* Vs	Vsm	m/sec	5.09	4.88	4.73	4.90
Actual Stack Gas Flow Rate, Qa = 60*Vs*As	Qa	acf/min	7488	7170	6946	7201
Stack Gas Flow Rate (STP), Qsw = 528/29.92 * Qa * (Ps/Ts)	Qsw	scf/min	6262	6120	6014	6132
Dry Stack Gas Flow Rate (Dry, STP),	Qsd	dscf/min	6103	5968	5862	5978
Qsd = 528/29.92 * Qa * (1-Bws)* (Ps/Ts)		dscm/min	173	169	166	169
Isokinetic Rate, I=100*As*Vm(std)/min*(An/144)*Qsd	I	percent	101.72	99.18	99.48	100.13
Meter Calibration (Alternate Method) Yqa=Min/Vm*((0.0319*Tm*29)/(DH@*(Pbar+dH/13.6)*Md))^0.5 *ASRdH	Yqa	none	1.0074	0.9958	0.9907	0.9979
Meter Quality Assurance/Quality Control Check =100*(Y-Yqa)/Y		% Difference	-1.6%	-0.4%	0.1%	-0.6% PASS

Sampling Data Summary

Parameter	SYMBOL	UNITS	Run 1	Run 2	Run 3	Average
Total Sampling Time	min	minutes	60	60	60	60
Stack Gas Oxygen Content	O_2	%	20.0	20.0	20.0	20.0
Stack Gas Carbon Dioxide Content	CO_2	%	4.0	4.0	4.0	4.0
Gas Sample Volume at Standard Conditions,	Vm(std)	cu. ft.	56.576	41.924	41.302	46.601
		cu. m.	1.602	1.187	1.169	1.319
Dry Stack Gas Flow Rate (Dry, STP),	Qsd	dscf/min	6103	5968	5862	5978
		dscm/min	173	169	166	169

TRC Environmental Corp. EMISSION MEASUREMENTS DEPARTMENT

19874 141st Place N.E.
Woodinville, WA 98072
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CLIENT:	Spectrum Glass Company	DATE:	11/24/03
LOCATION:	Woodinville, Washington	PROJECT NO.:	41613-0010-00000
UNIT:	Furnace #2	PERSONNEL:	DCT/MLE

Particulate Emission Calculation Sheet

The table below contains the results of testing and calculations performed by TRC on the date(s) listed.

EPA Method 5 w/PSCAA Back-Half - Particulate Matter & Condensible Particulate Matter

Sampling Data Summary

Parameter	SYMBOL	UNITS	Run 1	Run 2	Run 3	Average
Total Sampling Time	min	minutes	60	60	60	60
Stack Gas Oxygen Content	O_2	percent	20.0	20.0	20.0	20.0
Stack Gas Carbon Dioxide Content	CO_2	percent	4.0	4.0	4.0	4.0
Gas Sample Volume at Standard Conditions,	Vm(std)	cubic feet	56.576	41.924	41.302	46.601
		cubic meters	1.602	1.187	1.169	1.319
Dry Stack Gas Flow Rate (Dry, STP),	Qsd	dscf/min	6103	5968	5862	5978
		dscm/min	172.8	169.0	165.9	169.2

Process Data Summary

Parameter	UNITS	Run 1	Run 2	Run 3	Average
Production Time	minutes	67	65	68	67
Glass Production	pounds	2,573	2,496	2,611	2,560
Glass Production Rate	kg/hr	1,046	1,046	1,046	1,046
Zero Production Rate Correction - Subpart CC (Zero Used to Prevent Negs.)	g/hr	0	0	0	0
Fuel Usage	cubic feet	2393.91	2231.45	2393.60	2339.65

Particulate Emissions Summary

Parameter	UNITS	Run 1	Run 2	Run 3	Average
Front-Half Particulate Matter (PM) Emissions					
Filter #	---	#110060	#110061	#110063	
Tare Weight of Filter	grams	0.3822	0.3813	0.3581	
Final Weight of Filter	grams	0.3822	0.3813	0.3582	
Net Weight of Particulate Matter	grams	0.0000	0.0000	0.0001	
Probe Rinse Section - Beaker #	---	#109	#508	#104	
Tare Weight of Beaker	grams	66.8768	66.9267	67.1173	
Final Weight of Beaker	grams	66.8809	66.9340	67.1217	
Net Weight of Particulate Matter	grams	0.0041	0.0073	0.0044	
Sample Volume	milliliters	30	30	30	
Weight/Volume of Acetone Blank	mg/ml	0.0000	0.0000	0.0000	
Net Weight of Particulate Matter due to Acetone	grams	0.0000	0.0000	0.0000	
Total Front-Half Particulate Matter	grams	0.0041	0.0073	0.0045	
Back-Half Condensible Particulate Matter (CPM) Emissions					
Organic Section - Beaker #	---	#53	#55	#71	
Tare Weight of Beaker	grams	65.1259	67.2222	68.7585	
Final Weight of Beaker	grams	65.1297	67.2281	68.7626	
Net Weight of Particulate Matter	grams	0.0038	0.0059	0.0041	
Sample Volume	milliliters	180	205	180	
Weight/Volume of CH_2Cl_2 Blank	mg/ml	0.0000	0.0000	0.0000	
Net Weight of Particulate Matter due to CH_2Cl_2	grams	0.0000	0.0000	0.0000	
Inorganic Section - Beaker #	---	#519	#522	#201	
Tare Weight of Beaker	grams	108.9628	108.9934	111.6543	
Final Weight of Beaker	grams	108.9643	108.9954	111.6570	
Net Weight of Particulate Matter	grams	0.0015	0.0020	0.0027	
Volume of Impinger Contents	milliliters	490	410	430	
Weight/Volume of DI H_2O Blank	mg/ml	0.0000	0.0000	0.0000	
Weight/Volume of Particulate Matter Due to DI H_2O	grams	0.0000	0.0000	0.0000	
Total Back-Half Particulate Matter	grams	0.0053	0.0079	0.0068	
Total PM & CPM Emissions					
Total Net Weight of PM & CPM	mg	9.4	15.2	11.3	12.0
Emission Concentration	g/dscm	0.006	0.013	0.010	0.009
Emission Concentration	gr/dscf	0.003	0.006	0.004	0.004
Emission Rate (Per 40CFR60 Subpart CC w/o Zero Flat Glass Correction)	g/kg	0.058	0.124	0.092	0.091
Emission Rate	lb/hr	0.134	0.286	0.212	0.210
Emission Rate (assumes 24 hour per day operation)	lb/day	3.21	6.85	5.08	5.05

TRC

TEST DATA SUMMARIES

Client: Spectrum Glass Company
Location: Woodinville, Washington
Unit: Furnace #4

EPA Method 5 w/PSCAA Back-Half - Particulate Matter & Condensible Particulate Matter

	Run 1	Run 2	Run 3
Dates:	11/24/03	11/24/03	11/24/03
Barometric Pressures:	29.77	29.77	29.77

TABLE OF CONTENTS:

Data Sheet
Run Sheet - Run 1
Run Sheet - Run 2
Run Sheet - Run 3

Calculation Sheet

PM Calcs

Sampling Data Summary					
Parameter	Run 1	Run 2	Run 3		Average
Total Sampling Time, Min.	60	60	60		60
Stack Gas Oxygen Content, O2%	20.0	20.0	20.0		20.0
Stack Gas Carbon Dioxide Content, CO2%	4.0	4.0	4.0		4.0
Gas Sample Volume at Standard Conditions, cu. ft.	38.711	37.103	36.510		37.441
cu. m.	1.096	1.050	1.034		1.060
Dry Stack Gas Flow Rate (Dry, STP), dscf/min	4,712	4,674	4,692		4,693
dscm/min	133	132	133		133

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Phone: (425) 489-1938
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Project Number **41613-0010-00000**

TRC Environmental Corp.

EMISSION MEASUREMENTS DEPARTMENT

19874 141st Place N.E.
Woodinville, WA 98072
Phone: (425) 489-1938
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CLIENT:	Spectrum Glass Company	DATE:	11/24/03
LOCATION:	Woodinville, Washington	PROJECT NO.:	41613-0010-00000
UNIT:	Furnace #4	PERSONNEL:	PJC/MLE

Data Input Sheet

The table below contains the results of testing and calculations performed by TRC on the date(s) listed.

EPA Method 5 w/PSCAA Back-Half - Particulate Matter & Condensible Particulate Matter

Parameter	SYMBOL	UNITS				
Test Number			Run 1	Run 2	Run 3	
Test Date			11/24/03	11/24/03	11/24/03	
Start Time			1601	1010	1852	
Stop Time			1708	1112	2000	**Average**
Stack Diameter	ds	inches	40	40	40	
Nozzle Diameter	dn	inches	0.456	0.456	0.456	
Barometric Pressure	Pbar	inches Hg	29.77	29.77	29.77	29.77
Stack Static Pressure	Pg	inches H_2O	-0.09	-0.09	-0.08	-0.09
Pitot Coefficient	cp	none	0.84	0.84	0.84	0.84
Meter Calibration Factor	Y	none	0.992	0.992	0.992	
	DH@	none	1.719	1.719	1.719	
Stack Gas Oxygen Content	O_2	percent	20.0	20.0	20.0	20.0
Stack Gas Carbon Dioxide Content	CO_2	percent	4.0	4.0	4.0	4.0
Net Moisture Gain (Impingers w/SiGel)	Ww	grams	43.4	43.8	42.0	43.1
Average Stack Temperature	ts	degrees F	225.5	221.3	225.8	224.2
Average Meter Temperature	tm	degrees F	56.5	60.3	60.4	59.1
Avg Delta H	dH	inches H_2O	1.258	1.175	1.198	1.210
Average Square Root Delta H	ASR dH	inches H_2O	1.121	1.081	1.092	1.098
Avg Velocity Head	dP	inches H_2O	0.039	0.037	0.037	0.037
Average Square Root Delta P	ASR dP	inches H_2O	0.193	0.191	0.192	0.192
Gas Sample Volume	Vm	cubic feet	38.248	36.935	36.347	37.177
Total Sampling Time	min	minutes	60	60	60	

TRC Environmental Corp.

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CLIENT:	Spectrum Glass Company	DATE:	11/24/03
LOCATION:	Woodinville, Washington	PROJECT NO.:	41613-0010-00000
UNIT:	Furnace #4	PERSONNEL:	PJC/MLE

Field Data Run Sheets

The table below contains the results of testing and calculations performed by TRC on the date(s) listed.

EPA Method 5 w/PSCAA Back-Half - Particulate Matter & Condensible Particulate Matter

RUN NO: Run 1
Minutes per point: 2.5
number of points: 24

PAGE ONE OF ONE
OPERATOR: Paul Clark

POINT NUMBER	TIME	DGM READING INITIAL	VEL. Dp (in. H_2O)	Sqrt Dp	DIFF PRESS. DH	DIFF PRESS. Sqrt.	STACK TEMP. (°F)	DRY GAS METER TEMP (°F) INLET	DRY GAS METER TEMP (°F) OUTLET
B 1	0	931.945	0.04	0.200	1.30	1.140	220	52	52
2	3		0.04	0.200	1.30	1.140	224	51	51
3	5		0.04	0.200	1.30	1.140	226	52	52
4	8		0.04	0.200	1.30	1.140	227	55	53
5	10		0.04	0.200	1.30	1.140	227	57	54
6	13		0.04	0.200	1.30	1.140	227	58	55
7	15		0.04	0.200	1.30	1.140	227	57	54
8	18		0.04	0.200	1.30	1.140	227	58	54
9	20		0.04	0.200	1.30	1.140	227	57	54
10	23		0.04	0.200	1.30	1.140	227	57	54
11	25		0.04	0.200	1.30	1.140	225	57	54
12	28		0.04	0.200	1.30	1.140	225	57	54
A 1	30		0.03	0.080	0.96	0.980	223	58	55
2	33		0.03	0.173	0.96	0.980	224	58	56
3	35		0.04	0.200	1.30	1.140	226	60	56
4	38		0.04	0.200	1.30	1.140	226	60	56
5	40		0.04	0.200	1.30	1.140	226	60	57
6	43		0.04	0.200	1.30	1.140	227	60	58
7	45		0.04	0.200	1.30	1.140	227	60	57
8	48		0.04	0.200	1.30	1.140	227	60	57
9	50		0.04	0.200	1.30	1.140	226	61	58
10	53		0.04	0.200	1.30	1.140	226	61	58
11	55		0.04	0.200	1.30	1.140	223	61	58
12	58		0.03	0.173	0.98	0.990	221	61	58
	60	970.193							
	Total	Total	Avg.	Avg.	Avg.	Avg.	Avg.		Avg.
	60	38.248	0.04	0.193	1.256	1.121	225.5		56.5

Impinger Gain

impinger 1:	724.8	705.6	19.20
impinger 2:	709.1	697.7	11.40
impinger 3:	714.0	711.5	2.50
impinger 4:	902.1	891.8	10.30
impinger 5:	0.0	0.0	0.00
Trap:	0.0	0.0	0.00
impinger 7:	0.0	0.0	0.00
			43.40

O_2: 20.0
CO_2: 4.0

Start Time: 0850
Stop Time: 0953

Static Pressure (Port A):
Static Pressure (Port B):
Static Pressure (Avg.): -0.09

TRC Environmental Corp.

EMISSION MEASUREMENTS DEPARTMENT

19874 141st Place N.E.
Woodinville, WA 98072
Phone: (425) 489-1938
Fax: (425) 489-9564

CLIENT:	Spectrum Glass Company	DATE:	11/24/03
LOCATION:	Woodinville, Washington	PROJECT NO.:	41613-0010-00000
UNIT:	Furnace #4	PERSONNEL:	PJC/MLE

Field Data Run Sheets

The table below contains the results of testing and calculations performed by TRC on the date(s) listed.

EPA Method 5 w/PSCAA Back-Half - Particulate Matter & Condensible Particulate Matter

RUN NO: Run 2
Minutes per point: 2.5
number of points: 24

PAGE ONE OF ONE
OPERATOR: Matt Ellis

POINT NUMBER	TIME	DGM READING INITIAL	VEL. Dp (in. H_2O)	Sqrt Dp	DIFF PRESS. DH	DIFF PRESS. Sqrt.	STACK TEMP. (°F)	DRY GAS METER TEMP (°F) INLET	DRY GAS METER TEMP (°F) OUTLET
A 12	0	970.328	0.04	0.200	1.30	1.140	219	57	57
11	3		0.04	0.200	1.30	1.140	219	57	57
10	5		0.04	0.200	0.93	0.964	224	58	57
9	8		0.03	0.173	0.96	0.980	226	59	57
8	10		0.04	0.200	1.30	1.140	227	59	57
7	13		0.03	0.173	0.96	0.980	227	60	57
6	15		0.04	0.200	1.30	1.140	227	60	57
5	18		0.04	0.200	1.30	1.140	227	61	57
4	20		0.04	0.200	1.30	1.140	220	61	58
3	23		0.04	0.200	1.30	1.140	217	62	58
2	25		0.04	0.200	1.30	1.140	216	63	58
1	28		0.04	0.200	1.30	1.140	216	63	60
B 12	30		0.03	0.173	0.98	0.990	220	61	60
11	33		0.03	0.173	0.97	0.985	223	62	60
10	35		0.03	0.173	0.97	0.985	223	62	60
9	38		0.03	0.173	0.97	0.985	223	62	60
8	40		0.04	0.200	1.30	1.140	225	63	61
7	43		0.04	0.200	1.30	1.140	227	64	61
6	45		0.04	0.200	1.30	1.140	225	65	61
5	48		0.04	0.200	1.30	1.140	225	64	61
4	50		0.03	0.173	0.98	0.990	217	64	61
3	53		0.03	0.173	0.98	0.990	217	63	61
2	55		0.04	0.200	1.30	1.140	211	62	64
1	58		0.04	0.200	1.30	1.140	211	61	61
	60	1007.263							
	Total	Total	Avg.	Avg.	Avg.	Avg.	Avg.		Avg.
	60	36.935	0.04	0.191	1.175	1.081	221.3		60.3

Impinger Gain			
impinger 1:	725.5	704.2	21.30
impinger 2:	701.5	691.5	10.00
impinger 3:	716.9	714.7	2.20
impinger 4:	938.4	928.1	10.30
impinger 5:	0.0	0.0	0.00
Trap:	0.0	0.0	0.00
impinger 7:	0.0	0.0	0.00
			43.80

O_2: 20.0
CO_2: 4.0

Start Time: 1010
Stop Time: 1112

Static Pressure: -0.09

TRC Environmental Corp.

EMISSION MEASUREMENTS DEPARTMENT

19874 141st Place N.E.
Woodinville, WA 98072
Phone: (425) 489-1938
Fax: (425) 489-9564

CLIENT:	Spectrum Glass Company	DATE:	11/24/03
LOCATION:	Woodinville, Washington	PROJECT NO.:	41613-0010-00000
UNIT:	Furnace #4	PERSONNEL:	PJC/MLE

Field Data Run Sheets

The table below contains the results of testing and calculations performed by TRC on the date(s) listed.

EPA Method 5 w/PSCAA Back-Half - Particulate Matter & Condensible Particulate Matter

RUN NO: Run 3
Minutes per point: 2.5
number of points: 24

PAGE ONE OF ONE
OPERATOR: Matt Ellis

POINT NUMBER	TIME	DGM READING INITIAL	VEL. Dp (in. H_2O)	Sqrt Dp	DIFF PRESS. DH	DIFF PRESS. Sqrt.	STACK TEMP. (°F)	DRY GAS METER TEMP (°F) INLET	DRY GAS METER TEMP (°F) OUTLET
SW 12	0	1007.313	0.04	0.200	1.30	1.140	220	58	58
11	3		0.04	0.200	1.30	1.140	224	59	60
10	5		0.04	0.200	1.30	1.140	226	60	60
9	8		0.04	0.200	1.30	1.140	226	61	60
8	10		0.04	0.200	1.30	1.140	226	62	60
7	13		0.04	0.200	1.30	1.140	226	62	60
6	15		0.04	0.200	1.30	1.140	226	62	60
5	18		0.03	0.173	0.97	0.985	226	63	60
4	20		0.04	0.200	1.30	1.140	227	64	61
3	23		0.04	0.200	1.30	1.140	226	62	60
2	25		0.03	0.173	0.97	0.985	226	62	60
1	28		0.03	0.173	0.97	0.985	226	62	60
NW 12	30		0.03	0.173	0.97	0.985	225	60	60
11	33		0.03	0.173	0.97	0.985	224	60	60
10	35		0.04	0.200	1.30	1.140	224	60	60
9	38		0.04	0.200	1.30	1.140	224	60	60
8	40		0.03	0.173	0.97	0.985	227	60	59
7	43		0.04	0.200	1.25	1.118	229	60	60
6	45		0.04	0.200	1.25	1.118	229	60	60
5	48		0.04	0.200	1.25	1.118	229	61	60
4	50		0.04	0.200	1.30	1.140	229	61	60
3	53		0.04	0.200	1.30	1.140	227	61	59
2	55		0.04	0.200	1.30	1.140	224	61	59
1	58		0.03	0.173	0.97	0.985	222	61	59
	60	1043.660							
	Total	Total	Avg.	Avg.	Avg.	Avg.	Avg.		Avg.
	60	36.347	0.04	0.192	1.198	1.092	225.8		60.4

Impinger Gain			
Impinger 1:	709.0	702.2	6.80
Impinger 2:	701.7	693.5	8.20
Impinger 3:	720.8	707.7	13.10
Impinger 4:	854.8	840.9	13.90
Impinger 5:	0.0	0.0	0.00
Trap:	0.0	0.0	0.00
Impinger 7:	0.0	0.0	0.00
			42.00

O_2: 20.0
CO_2: 4.0

Start Time: 1852
Stop Time: 2000

Static Pressure (Port A):
Static Pressure (Port B):
Static Pressure (Avg.): -0.08

TRC Environmental Corp.

EMISSION MEASUREMENTS DEPARTMENT

19874 141st Place N.E.
Woodinville, WA 98072
Phone: (425) 489-1938
Fax: (425) 489-9564

CLIENT:	Spectrum Glass Company	DATE: 11/24/03	
LOCATION:	Woodinville, Washington	PROJECT NO.: 41613-0010-00000	
UNIT:	Furnace #4	PERSONNEL: PJC/MLE	

Calculation Sheet

The table below contains the results of testing and calculations performed by TRC on the date(s) listed.

EPA Method 5 w/PSCAA Back-Half - Particulate Matter & Condensible Particulate Matter

Parameter	SYMBOL	UNITS				
Test Number			Run 1	Run 2	Run 3	
Test Date			11/24/03	11/24/03	11/24/03	
Start Time			1601	1010	1852	
Stop Time			1708	1112	2000	
Calculated Data						**Average**
Nozzle Area, An=3.14159*(dn/2)^2	An	square inches	0.1633	0.1633	0.1633	0.1633
Stack Area,As=3.14159*((Ds/12)/2)^2	As	square feet	8.73	8.73	8.73	8.73
Avg Stack Temperature, Ts=ts+460	Ts	degrees Rankin	685.5	681.3	685.8	684.2
Meter Pressure, Pm=Pb+Dh/13.6	Pm	inches Hg	29.86	29.86	29.86	29.86
Avg Meter Temperature, Tm=tm+460	Tm	degrees Rankin	516.5	520.3	520.4	519.1
Gas Sample Volume at Standard Conditions,	Vm(std)	cubic feet	38.711	37.103	36.510	37.441
Vm(std)= 528/29.92*Y*Vm*Pm/Tm		cubic meters	1.096	1.050	1.034	1.060
Net Moisture Gain (Impingers w/SiGel)	Ww	grams	43.4	43.8	42.0	43.1
Volume of Water Vapor, Vw(std)= 0.04715*Wlc	Vw(std)	cubic feet	2.046	2.065	1.980	2.031
Moisture Fraction, Bws = Vw(Std)/(Vm(Std)+Vw(Std))*100	Bws	percent	5.02%	5.27%	5.14%	5.15%
Dry Stack Gas Molecular Weight, Md = (0.32*O2)+(0.44*CO2)+(0.28*(100-(O2+CO2)))	Mwd	g/g-mole	29.44	29.44	29.44	29.44
Wet Stack Gas Molecular Weight Mw = Md* (1-Bws)+(18*(Bws))	Mws	g/g-mole	28.87	28.84	28.85	28.85
Absolute Stack Pressure, Ps = Pbar + Pg/13.6	Ps	inches Hg	29.76	29.76	29.76	29.76
Stack Gas Velocity Vs= 85.49*Cp*ASRdP*((Ts)/((Ps)*(Mw)))^0.5	Vs	ft/sec	12.36	12.22	12.33	12.31
Vsm = 0.3048* Vs	Vsm	m/sec	3.77	3.73	3.76	3.75
Actual Stack Gas Flow Rate, Qa = 60*Vs*As	Qa	acf/min	6474	6401	6458	6444
Stack Gas Flow Rate (STP), Qsw = 528/29.92 * Qa * (Ps/Ts)	Qsw	scf/min	4961	4934	4946	4947
Dry Stack Gas Flow Rate (Dry, STP),	Qsd	dscf/min	4712	4674	4692	4693
Qsd = 528/29.92 * Qa * (1-Bws)* (Ps/Ts)		dscm/min	133	132	133	133
Isokinetic Rate, I=100*As*Vm(std)/min*(An/144)*Qsd	I	percent	105.36	101.80	99.80	102.32
Meter Calibration (Alternate Method) Yqa=Min/Vm*((0.0319*Tm*29)/(DH@*(Pbar+dH/13.6)*Md))^0.5 *ASRdH	Yqa	none	0.9884	0.9914	1.0176	0.9991
Meter Quality Assurance/Quality Control Check =100*(Y-Yqa)/Y		% Difference	0.4%	0.1%	-2.6%	-0.7% PASS

Sampling Data Summary

Parameter	SYMBOL	UNITS	Run 1	Run 2	Run 3	Average
Total Sampling Time	min	minutes	60	60	60	60
Stack Gas Oxygen Content	O_2	%	20.0	20.0	20.0	20.0
Stack Gas Carbon Dioxide Content	CO_2	%	4.0	4.0	4.0	4.0
Gas Sample Volume at Standard Conditions,	Vm(std)	cu. ft.	38.711	37.103	36.510	37.441
		cu. m.	1.096	1.050	1.034	1.060
Dry Stack Gas Flow Rate (Dry, STP),	Qsd	dscf/min	4712	4674	4692	4693
		dscm/min	133	132	133	133

TRC Environmental Corp.

EMISSION MEASUREMENTS DEPARTMENT

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Fax: (425) 489-9564

CLIENT:	Spectrum Glass Company	DATE:	11/24/03
LOCATION:	Woodinville, Washington	PROJECT NO.:	41613-0010-00000
UNIT:	Furnace #4	PERSONNEL:	PJC/MLE

Particulate Emission Calculation Sheet

The table below contains the results of testing and calculations performed by TRC on the date(s) listed.

EPA Method 5 w/PSCAA Back-Half - Particulate Matter & Condensible Particulate Matter

Sampling Data Summary

Parameter	SYMBOL	UNITS	Run 1	Run 2	Run 3	Average
Total Sampling Time	min	minutes	60	60	60	60
Stack Gas Oxygen Content	O_2	percent	20.0	20.0	20.0	20.0
Stack Gas Carbon Dioxide Content	CO_2	percent	4.0	4.0	4.0	4.0
Gas Sample Volume at Standard Conditions,	Vm(std)	cubic feet	38.711	37.103	36.510	37.441
		cubic meters	1.096	1.050	1.034	1.060
Dry Stack Gas Flow Rate (Dry, STP),	Qsd	dscf/min	4712	4674	4692	4693
		dscm/min	133.4	132.3	132.8	132.8

Process Data Summary

Parameter	UNITS	Run 1	Run 2	Run 3	Average
Production Time	minutes	63	62	63	63
Glass Production	pounds	2199	2164	2199	2187
Glass Production Rate	kg/hr	950.8	950.8	950.8	950.8
Zero Production Rate Correction - Subpart CC (Zero Used to Prevent Negs.)	g/hr	0	0	0	0
Fuel Usage	cubic feet	2561.58	2231.45	2393.60	2395.54

Particulate Emissions Summary

Parameter	UNITS	Run 1	Run 2	Run 3	Average
Front-Half Particulate Matter (PM) Emissions					
Filter #	---	#110056	#110057	#110058	
Tare Weight of Filter	grams	0.3859	0.3851	0.3843	
Final Weight of Filter	grams	0.3859	0.3851	0.3843	
Net Weight of Particulate Matter	grams	0.0000	0.0000	0.0000	
Probe Rinse Section - Beaker #	---	#106	#110	#111	
Tare Weight of Beaker	grams	66.8984	65.3105	67.0751	
Final Weight of Beaker	grams	66.9058	65.3150	67.0823	
Net Weight of Particulate Matter	grams	0.0074	0.0045	0.0072	
Sample Volume	milliliters	40	40	40	
Weight/Volume of Acetone Blank	mg/ml	0.0000	0.0000	0.0000	
Net Weight of Particulate Matter due to Acetone	grams	0.0000	0.0000	0.0000	
Total Front-Half Particulate Matter	grams	0.0074	0.0045	0.0072	
Back-Half Condensible Particulate Matter (CPM) Emissions					
Organic Section - Beaker #	---	#100	#101	#102	
Tare Weight of Beaker	grams	67.1051	65.4323	67.2011	
Final Weight of Beaker	grams	67.1076	65.4363	67.2040	
Net Weight of Particulate Matter	grams	0.0025	0.0040	0.0029	
Sample Volume	milliliters	190	210	175	
Weight/Volume of CH_2Cl_2 Blank	mg/ml	0.0000	0.0000	0.0000	
Net Weight of Particulate Matter due to CH_2Cl_2	grams	0.0000	0.0000	0.0000	
Inorganic Section - Beaker #	---	#203	#204	#205	
Tare Weight of Beaker	grams	109.7129	110.9983	111.6707	
Final Weight of Beaker	grams	109.7132	110.9993	111.6739	
Net Weight of Particulate Matter	grams	0.0003	0.0010	0.0032	
Volume of Impinger Contents	milliliters	400	380	445	
Weight/Volume of DI H_2O Blank	mg/ml	0.0000	0.0000	0.0000	
Weight/Volume of Particulate Matter Due to DI H_2O	grams	0.0000	0.0000	0.0000	
Total Back-Half Particulate Matter	grams	0.0028	0.0050	0.0061	
Total PM & CPM Emissions					
Total Net Weight of PM & CPM	mg	10.2	9.5	13.3	11.0
Emission Concentration	g/dscm	0.009	0.009	0.013	0.010
Emission Concentration	gr/dscf	0.004	0.004	0.006	0.005
Emission Rate (Per 40CFR60 Subpart CC w/o Zero Flat Glass Correction)	g/kg	0.078	0.076	0.108	0.087
Emission Rate	lb/hr	0.164	0.158	0.226	0.182
Emission Rate (assumes 24 hour per day operation)	lb/day	3.93	3.79	5.41	4.38

APPENDIX B

SPECTRUM GLASS COMPANY PROCESS DATA

	Spectrum Glass Process Data- Furnace 4				F Daytank					Date: 11/24/2003		
Time	F4 Draw at Hood	F4 Draw at Crossover	F4 Damper Position	F4 burner Output %	Fd/t Draw at Hood	Fd/t Damper Position	Fd/t burner Output %	Baghouse Temp.	Outlet Temp.	Frequency	Blower Static Press.	Drop across Bags (dp)
1A	0.40	0.60	Open	38	DFR	DFR	DFR	348	274	45.0	6.50	5.20
2A	0.35	0.60	Open	34	DFR	DFR	DFR	348	274	45.0	6.50	5.20
3A	0.35	0.60	Open	38	DFR	DFR	DFR	363	279	45.0	6.50	5.30
4A	0.40	0.60	Open	0	DFR	DFR	DFR	379	289	45.0	6.50	5.30
5A	0.35	0.60	1/2 Open	40	DFR	DFR	DFR	350	271	45.0	6.50	5.25
6A	0.35	0.50	1/2 Open	49	DFR	DFR	DFR	349	271	45.0	6.50	5.35
7A	0.35	0.50	1/2 Open	50	DFR	DFR	DFR	348	269	45.0	6.50	5.45
8A	0.35	0.50	1/2 Open	52	DFR	DFR	DFR	349	269	45.0	6.50	5.50
9A	0.35	0.50	1/2 Open	47	DFR	DFR	DFR	348	267	45.0	6.50	5.50
10A	0.35	0.50	1/2 Open	51	DFR	DFR	DFR	348	269	45.0	6.50	5.50
11A	0.35	0.50	1/2 Open	53	DFR	DFR	DFR	350	269	45.0	6.50	5.50
12P	0.35	0.50	1/2 Open	56	DFR	DFR	DFR	349	270	45.0	6.50	5.50
1P	0.35	0.50	3/4 Open	100	DFR	DFR	DFR	349	270	45.0	6.75	5.50
2P	0.35	0.50	1/2 Open	100	DFR	DFR	DFR	350	273	45.0	7.00	5.50
3P	0.40	0.50	1/2 Open	100	DFR	DFR	DFR	350	270	45.0	7.00	5.50
4P	0.35	0.50	1/2 Open	100	DFR	DFR	DFR	349	271	45.0	7.00	5.50
5P	0.35	0.50	1/2 Open	100	DFR	DFR	DFR	347	270	45.0	6.90	5.50
6P	0.35	0.50	1/2 Open	100	DFR	DFR	DFR	349	269	45.0	6.90	5.50
7P	0.35	0.50	5/8 Open	100	DFR	DFR	DFR	349	266	45.0	6.90	5.50
8P	0.35	0.50	5/8 Open	100	DFR	DFR	DFR	349	268	45.0	6.50	5.60
9P	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10P	0.35	0.50	Open	34	DFR	DFR	DFR	349	262	45.0	6.50	5.60
11P	0.35	0.50	Open	29	DFR	DFR	DFR	348	261	45.0	6.50	5.60
12A	0.35	0.50	Open	29	DFR	DFR	DFR	348	261	45.0	6.50	5.60
							Average	351	270			
							Standard Deviation	6.7	5.7			

Furnace No. 4 Sum 9-Noon	
9 to Noon Avgs	11/24/2003
BH DP	Temp in °F
5.50	349

Spectrum Glass Process Recordings					Date: 11/24/03		
Time	Frequency	Inlet Temp.	Drop Across Bags (dp)	Blower Static Press.	F2 Burner Output %	F2 Damper Position	F2 Hood Draw
1:00 AM	37.4	213	4.90	7.5	100	1/2 Open	0.75
2:00 AM	38.2	226	5.00	7.5	100	1/2 Open	0.75
3:00 AM	38.5	225	5.00	7.5	100	1/2 Open	0.75
4:00 AM	38.1	234	5.00	7.5	100	1/2 Open	0.75
5:00 AM	35.1	230	4.10	6.5	100	1/2 Open	0.9
6:00 AM	36.6	212	4.50	7.0	100	1/2 Open	0.9
7:00 AM	37.3	191	4.50	7.0	40	1/2 Open	0.9
8:00 AM	36.8	176	5.00	7.2	17	1/2 Open	0.9
9:00 AM	36.7	202	4.80	7.2	19	Open	0.9
10:00 AM	38.6	264	5.00	7.2	45	Open	0.9
11:00 AM	38.6	270	5.00	7.3	49	Open	0.9
12:00 PM	38.9	273	5.00	7.3	45	Open	0.9
1:00 PM	38.6	263	5.00	7.5	0	Open	0.75
2:00 PM	38.5	240	5.00	7.5	0	Open	0.75
3:00 PM	38.2	229	5.00	7.5	64	1/2 Open	0.75
4:00 PM	37.8	238	4.75	7.5	45	1/2 Open	0.75
5:00 PM	37.2	216	4.75	7.5	46	1/2 Open	0.75
6:00 PM	35.4	211	4.25	6.5	49	1/2 Open	0.75
7:00 PM	36.0	210	4.25	6.5	45	1/2 Open	0.75
8:00 PM	36.4	208	4.25	6.5	49	1/2 Open	0.75
9:00 PM	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10:00 PM	34.5	214	4.00	6.5	100	1/2 Open	0.75
11:00 PM	35.1	216	4.00	6.5	100	1/2 Open	0.75
12:00 AM	34.8	206	4.00	6.5	100	1/2 Open	0.75
		225	Average				
		24.3	Standard Deviation				

Furnace No. 2 Summary	
4 to 8 PM Avgs	11/24/2003
BH DP	Temp in °F
4.45	217

APPENDIX C

MANUAL CALCULATIONS & FIELD DATA

EPA Methods 1, 2, 3A, 4 & 5 Example Calculations

Client: SPECTRUM GLASS COMPANY
Location: Woodinville, WA
Site Location: #2 Furnace
Run #: 2
Date: 11-24-03

Nomenclature:

A_d = cross-sectional area of stack, ft.^{2}
A_n = cross-sectional area of nozzle, ft^2
B_{ws} = water vapor in the gas stream, proportion by volume
C_p = pitot tube coefficient, dimensionless
K_p = pitot tube constant = 85.49 ft/sec $\sqrt{\frac{(\text{lb/lb-mole})(\text{inches Hg})}{(^\circ\text{R})(\text{inches } H_2O)}}$
M_d = molecular weight of stack gas, dry basis, lb./lb.-mole
M_s = molecular weight of stack gas, wet basis, lb./lb.-mole
$= M_d(1 - B_{ws}) + 18(B_{ws})$
$\sqrt{\Delta P}_{avg}$ = average velocity head of stack gas, $\sqrt{\text{inches } H_2O}$
P_s = absolute stack gas pressure, inches Hg
P_{static} = static pressure of the stack, inches H_2O
P_{std} = standard absolute pressure, 29.92 inches Hg
Q_{std} = stack flow rate, dscfh
θ = sample time, minutes
T_s = average stack temperature, °F
T_{std} = standard absolute temperature, 528°R
$T_{s(avg)}$ = Average absolute stack temperature, °R = 460 + T_s
V_{mstd} = corrected meter volume, dscf
V_S = average stack gas velocity, ft./sec.
V_{lc} = volume of water gain in the impingers, ml

1. Volume of metered sample gas at standard conditions:

$$P_{meter} = P_{bar} + \frac{\Delta H}{13.6} = \underline{29.77} + \frac{\underline{1.523}}{13.6} = \underline{29.88} \text{ inches Hg}$$

$$V_{m(std)} = \frac{(V_m)(T_{std})(P_{meter})(Y)}{(T_m + 460)(P_{std})}$$

$$V_{m(std)} = \frac{(41.964)(528)(29.88)(0.992)}{(\underline{63.6} + 460)(29.92)} = \underline{41.924} \text{ dscf}$$

2. Moisture Content:

$V_{w(std)} = (0.04707\ ft^3/gram\ water)(V_{lc})$ 1 gram water ≡ 1 ml water

$V_{w(std)} = (0.04707)(\underline{22.7}) = \underline{1.0685}$ scf

$$B_{ws} = \frac{V_{w(std)}}{V_{w(std)} + V_{m(std)}}$$

$$B_{ws} = \frac{\underline{1.0685}}{\underline{1.0685} + \underline{41.924}} = \underline{0.0249}$$ water vapor fraction

0.0249 × 100% = 2.49% moisture

3. Molecular Weight:

Dry:

$M_d = (0.44 * \%CO_2) + (0.32 * \%O_2) + [0.28 * (100 - \%CO_2 - \%O_2)]$

$= (0.44 * (\underline{4.0}) + (0.32 * (\underline{20.0}) + 0.28 * (100 - \underline{4.0} - \underline{20.0})$

$= \underline{29.44}$ lb/lb-mole

Wet:

$M_w = M_d * (1 - B_{ws}) + [18 * (B_{ws})]$

$= (\underline{29.44}) * (1 - \underline{0.0249}) + [18 * (\underline{0.0249})]$

$= \underline{29.16}$ lb/lb-mole

4. Average Velocity of Stack Gas:

$$V_s = K_p * C_p * \sqrt{\Delta P_{avg}} \sqrt{\frac{T_{s(avg)}}{M_w * P_s}}$$

$$P_s = P_{bar} + \frac{P_{static}}{13.6}$$

$$P_s = \underline{29.77} + \frac{\underline{-0.50}}{13.6} = \underline{29.73}$$

$$V_s = 85.49 * \underline{0.84} * \underline{0.265} \sqrt{\frac{\underline{614.7}}{\underline{29.16} * \underline{29.73}}} = \underline{16.00}$$ ft/sec

as gr/dscf:

0.0154 = conversion of mg to grains (gr)
1/7000 = conversion of grains to pounds
M_n = weight of particulate in mg

$$C_s = \frac{0.0154 * M_n}{V_{m(std)}} = \frac{0.0154 * 15.2}{41.924} = \underline{0.006} \text{ gr/dscf}$$

as gr/dscf @ 7% O_2:

$$C_s = \frac{(C_s \text{ as gr/dscf}) * (20.9 - 7)}{(20.9 - O_{2\,measured})} = \frac{____ * 13.9}{(20.9 - ____)}$$

$$= \underline{NA} \text{ gr/dscf @ 7\% } O_2$$

as g/kg

E = Emission Rate of particulate matter, g/kg
C_s = concentration of particulate matter, g/dscm
Q_{std} = volumetric flow rate, dscm/hr
A = zero production rate correction, 454 g/hr for flat glass (per Subpart CC)
P = glass production rate, kg/hr

$$\left[15.2 \text{ mg} \times \frac{1 \text{ mg}}{1000 \text{ g}} \times \frac{1}{1.187 \text{ dscm}}\right]$$

$$E = (C_s Q_{std} - A)/P = \frac{0.013 \text{ g/dscm} * 10140 \text{ dscm/hr} - \phi \text{ g/hr}}{1045.1 \text{ kg/hr}}$$

used zero (ϕ) for this calculation

$$= \underline{0.124} \text{ g/kg}$$

$$\frac{\text{dscm}}{\text{hr}} = 169.0 \frac{\text{dscm}}{\text{min}} \times 60 \frac{\text{min}}{\text{hr}} = 10140 \frac{\text{dscm}}{\text{hr}}$$

as lb/hour:

$$C_s = \frac{(C_s \text{ as gr/dscf}) * Q_{std} * 60}{7000} = \frac{0.006 * 5968 * 60}{7000}$$

$$= \underline{0.286} \text{ lb/hour}$$

as lb/day

$\underline{0.286}$ lb/hr * _____ hr/day = $\underline{6.85}$ lb/day

$$\frac{\text{kg}}{\text{hr}} = 2496 \text{ lbs glass production} \times \frac{1 \text{ kg}}{2.204622 \text{ lb}} \times \frac{1}{65 \text{ min}} \times 60 \frac{\text{min}}{\text{hr}} = 1045.1 \frac{\text{kg}}{\text{hr}}$$

g/kg using Subpart CC zero production correction

$$\frac{0.013 \text{ g/dscm} \times 10140 \text{ dscm/hr} - 454 \text{ g/hr}}{1045.1 \text{ kg/hr}} = 0.0 \text{ g/kg}$$

5. Stack Gas Volumetric Flow Rate (standard conditions, dry basis):

$$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$$

Q_s acfm = 16.00 $\frac{ft}{sec}$ x 7.47 ft^2 x 60 $\frac{min}{hr}$ = 7170 acfm

$$Q_{std} = \left(\frac{528}{29.92}\right) * \underline{7170} * \left(\frac{29.73}{614.7}\right) * (1 - \underline{0.0249}) = \underline{5968}\ dscfm$$

6. Percent Isokinetic:

$$I = 100 * \frac{A_s * V_{m(std)}}{\theta * A_n/144 * Q_{sd}}$$

$$I = 100 * \frac{7.47 * 41.924}{60 * 0.1269/144 * 5968}$$

I = 99.18 percent

7. Total Particulate (Front-half & Back-half) Calculations:

0.0 g Filter

0.0073 g Probe Rinse Section
< 0.0 >g Acetone Blank (____g x 1000 g/mg/_____mL) x _____ mL sample volume

0.0059 g Organic Section
<_____>g CH_2Cl_2 Blank (____g x 1000 g/mg/_____mL) x _____ mL sample volume

0.0020 g Inorganic + Acetone Rinse Section
< 0.0 >g H_2O Blank (____g x 1000 g/mg/_____mL) x _____ mL sample volume
< 0.0 >g Acetone Blank (____g x 1000 g/mg/_____mL) x _____ mL sample volume

0.0152 g TOTAL Particulate Matter x 1000 $\frac{g}{mg}$ = 15.2 mg

TRAVERSE POINT LOCATION FOR CIRCULAR AND RECTANGULAR DUCTS

Project No.: 41613 0010 00000

Client: Spectrum Glass

Date: 11-24-03

Sampling Location: Furnace # 2

Internal Stack Diameter: 37"

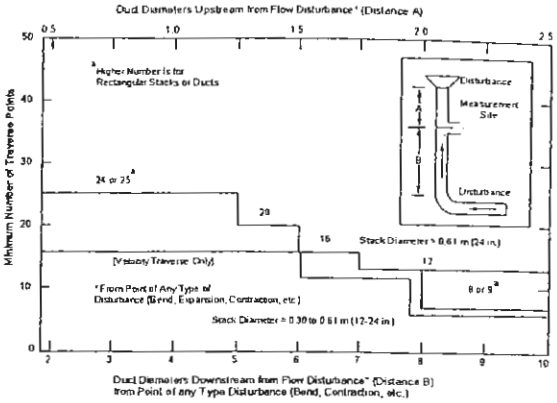
Nipple Length: ——

Total Stack Diameter: 37"

Nearest Upstream Disturbance (A):

Nearest Downstream Disturbance (B):

Calculator:



Rectangular Duct Equivalent Diameter Determination = $\frac{2 \times L \times W}{L + W}$

Traverse Point Number	1 Fraction of Stack ID (1/100)	2 Stack ID	3 Traverse Point (1 x 2 = Point)	4 Nipple Length	5 Traverse Point Inside of Far Wall to Outside of Port Nipple (3 + 4 = Point)
1	.021	37.0	.78		
2	.067	"	2.48		
3	.118	"	4.37		
4	.177	"	6.55		
5	.250	"	9.25		
6	.356	"	13.17		
7	.644	"	23.83		
8	.750	"	27.75		
9	.823	"	30.45		
10	.882	"	32.63		
11	.933	"	34.52		
12	.979	"	36.22		
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					

Location of Traverse Points in Circular Stacks
(Percent of stack diameter from inside wall to traverse point)

	Number of traverse points on a diameter											
	2	4	6	8	10	12	14	16	18	20	22	24
1	14.6	5..7	4.4	3.2	2.6	2.1	1.3	1.6	1.4	1.3	1.1	1.1
2	85.4	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3		75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4		93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5			85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6			95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7				89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8				96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9					91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10					97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11						93.3	85.4	78.0	70.4	61.2	39.3	32.3
12						97.9	90.1	83.1	76.4	69.4	60.7	39.8
13							94.3	87.5	81.2	75.0	68.5	60.2
14							98.2	91.5	85.4	79.6	73.8	67.7
15								95.1	89.1	83.5	78.2	72.8
16								98.4	92.5	87.1	82.0	77.0
17									95.6	90.3	85.4	80.6
18									98.6	93.3	88.4	83.9
19										96.1	91.3	86.8
20										98.7	94.3	89.5
21											96.5	92.1
22											98.9	94.5
23												96.8
24												98.9

Location of Traverse Points in Rectangular Stacks

	Number of traverse points on a diameter										
	2	3	4	5	6	7	8	9	10	11	24
1	25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2
2	75.0	50.0	37.5	30.0	25.0	21.4	18.8	15.7	15.0	13.6	12.5
3		83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8
4			87.5	70.0	58.3	50.0	43.8	38.9	35.0	31.8	29.2
5				90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5
6					91.7	78.6	68.8	61.1	55.0	50.0	45.8
7						92.9	81.3	72.2	65.0	59.1	54.2
8							93.8	83.3	75.0	68.2	62.5
9								94.4	85.0	77.3	70.8
10									95.0	85.4	79.2
11										95.5	87.5
12											95.8

TRC ENVIRONMENTAL CORPORATION - ISOKINETIC FLUE GAS SAMPLING DATA SHEET

Sheet 1 of 2

Project No.:	41613-0010-00000
Client:	Spectrum Glass
Facility:	Woodinville, WA
Source:	Furnace #2
Sample Location:	Baghouse exhaust
Stack Diameter:	37" Φ
Date:	11/24/2003
Run No.:	1
Operator:	Doug Towne
Meterbox No.:	28579
Meterbox ΔH@:	1.719
Y Factor	0.992

Impinger Weights

	Initial	Final	Weight gain
Imp # 1	705.9	709.4	
Imp # 2	692.8	704.5	
Imp # 3	715.7	718.0	2.3
Imp # ~~4~~	~~961.2~~		
Imp # ~~5~~ 4	960.3	974.0	
Imp # 6			
Total			31.2

DCT 11 24 03

Train Prepared By:	Paul Clark
Pitot Number and Side:	P1-A
Pitot Tube Cp:	0.85
Filter No.:	110060
Ambient Temp., °F:	57
Bar. Pressure, In. Hg.:	29.77
Assumed Moisture, %:	
Heater Box Setting, °F:	248
Nozzle # / Diam., In.:	GA-7/ 0.456
Probe Length / Material:	5 Ft Eff. Glass
Probe Heater Setting, °F:	248

Method 5

Point	Clock Time 24-hr	Clock Time Min.	Dry Gas Meter, (ft^3)	Pitot, ΔP In. H_2O	Orifice ΔH, In. H_2O Desired	Orifice ΔH, In. H_2O Actual	Pump Vacuum, In. Hg	Temperatures °F Stack	Probe	Filter Box	Imp Temp	XAD Cond	Meter Inlet	Meter Outlet	Filter Outlet	Heated Jumper
A	1601	0	78.459	0.09	3.24	3.2	7.5	161	255	251	47	NA	57	56	NA	NA
2		2.5	80.86	0.08	2.87	2.9	7	164	255	249	43		56	56		
3		5	83.25	0.09	3.21	3.2	7	166	247	250	40		57	56		
4		~~7.5~~ 7.5	85.76	0.1	3.57	3.6	8	166	256	252	39		57	56		
5		10	88.30	0.13	4.62	~~3.6~~ 4.640	8.5	170	247	251	41		58	51		
6		12.5	91.05	0.12	4.27	~~3.6~~ 3.9	8	172	255	251	43		58	56		
7		15	93.75	0.1	3.5	3.5	8	173	253	253	44		59	56		
8		17.5	96.51	0.1	3.5	3.5	8	173	247	251	44		59	56		
9		20	99.08	0.11	3.88	3.8	8	174	247	255	44		60	57		
10		22.5	101.76	0.05	1.77	1.8	5	172	247	252	45		60	57		
11		25	103.78	0.05	1.78	1.8	5	171	252	251	45		60	57		
12		27.5	105.72	0.05	1.78	1.8	5	170	246	249	44		61	58		
		30	107.648													

Train Leak Check:

Before Test: 0.002 Ft^3 in 60 Seconds at 15 In. Hg.

After Test: 0.000 Ft^3 in 60 Seconds at 9 In. Hg.

Comments:

	Initial	Final	Port	Static Pressure			
			A				
Pitot Tube Leak Check	✓	✓	Inches H_2O	-0.5			
ORSAT Train Leak Check	✓	✓	Inches Hg				

Silica Gel Condition: Port A [illegible] Port B [illegible] Port C ____ Port D ____

TRC Environmental Corp.

TRC ENVIRONMENTAL CORPORATION - ISOKINETIC FLUE GAS SAMPLING DATA SHEET

Project No.:	41613-0010-00000	Date:	11-24-03	Sheet 2 of 2	
Client:	Spectrum Glass	Run No.:	1		
Facility:	Woodinville, WA	Sample Location:	Furnace #2		
Source:	Furnace #2	Operator:	DC Turner		

Point	Clock Time 24-hr	Clock Time Min.	Dry Gas Meter, (ft^3)	Pitot, ΔP In. H_2O	Orifice ΔH, In. H_2O Desired	Orifice ΔH, In. H_2O Actual	Pump Vacuum, In. Hg	Temperatures °F Stack	Probe	Filter Box	Imp Temp	XAD Cond	Meter Inlet	Meter Outlet	Filter Outlet	Heated Jumper
B 1	1658	30	107.648	0.08	2.83	2.8	6	165	252	251	44	NA	60	59	NA	NA
2		32.5	109.75	0.08	2.81	2.8	6	169	249	250	45		60	60		
3		35	112.08	0.08	2.81	2.8	6	169	255	249	42		61	60		
4		37.5	114.41	0.07	2.46	2.5	5.5	169	249	249	41		61	60		
5		40	116.66	0.08	2.81	2.8	6	169	255	250	41		61	59		
6		42.5	118.77	0.08	2.82	2.8	6	167	246	251	42		61	59		
7		45	121.30	0.06	2.11	2.1	5	166	255	251	43		62	59		
8		47.5	123.40	0.07	2.48	2.55	5.5	165	244	249	43		62	59		
9		50	125.65	0.07	2.49	2.5	5.5	164	249	249	43		63	59		
10		52.5	127.82	0.06	2.14	2.2	5	165	255	249	42		63	59		
11		55	129.94	0.07	2.51	2.5	5.5	161	246	252	44		63	60		
12		57.5	132.21	0.07	2.51	2.5	5.5	166	252	251	44		63	60		
	1708	60	134.400													
		Total	55.941	ft^3	Avg	2.825		167.5						58.9		

Train Leak Check During Test:

Comments:

					Meter Reading Stop	Meter Reading Restart
Before Test:	Ft^3 in	Seconds at	In. Hg.		ft^3	ft^3
After Test:	Ft^3 in	Seconds at	In. Hg.		ft^3	ft^3

TRC ENVIRONMENTAL CORPORATION - ISOKINETIC FLUE GAS SAMPLING DATA SHEET

Sheet 1 of 2

Project No.:	41613-0010-00000
Client:	Spectrum Glass
Facility:	Woodinville, WA
Source:	Furnace #2
Sample Location:	Baghouse exhaust
Stack Diameter:	37" Ø
Date:	11/24/2003
Run No.:	—
Operator:	Doug Towne
Meterbox No.:	28579
Meterbox ΔH@:	1.719
Y Factor	0.992

Impinger Weights

	Initial	Final	Weight gain
Imp # 1	709.2	714.9	5.7
Imp # 2	695.6	702.9	7.3
Imp # 3	763.9	765.1	1.2
Imp # 4	854.8	863.3	8.5
Imp # 5			
Imp # 6			
Total			22.7

Train Prepared By:	Paul Clark
Pitot Number and Side:	P1-A
Pitot Tube Cp:	0.85
Filter No.:	[illegible]
Ambient Temp., °F:	58
Bar. Pressure, In. Hg.:	29.77
Assumed Moisture, %:	4
Heater Box Setting, °F:	248
Nozzle # / Diam., In.:	~~GA-7/0.456~~ 686 .402
Probe Length / Material:	5 Ft Eff. Glass
Probe Heater Setting, °F:	248

Method 5

Point	Clock Time 24-hr	Clock Time Min.	Dry Gas Meter, (ft³)	Pitot, ΔP In. H_2O	Orifice ΔH, In. H_2O Desired	Orifice ΔH, In. H_2O Actual	Pump Vacuum, In. Hg	Temperatures °F Stack	Probe	Filter Box	Imp Temp	XAD Cond	Meter Inlet	Meter Outlet	Filter Outlet	Heated Jumper
A-1	1725	0	134.610	.07	1.49	1.50	4	166	249	254	42	N/A	58	58	N/A	N/A
2		2.5	136.250	.07	1.49	1.50	4	164	248	251	41		58	58		
3		5	137.950	.07	1.49	1.50	4	160	248	249	41		58	58		
4		7.5	139.710	.07	1.51	1.50	4	154	251	249	42		60	58		
5		10	141.465	.07	1.52	1.50	4	153	251	254	43		61	58		
6		12.5	143.280	.07	1.52	1.50	4	153	250	252	43		63	58		
7		15	145.025	.07	1.52	1.50	4	152	253	253	43		64	58		
8		17.5	146.800	.07	1.52	1.50	4	152	249	252	43		65	59		
9		20	148.570	.07	1.52	1.50	4	152	248	252	43		66	60		
10		22.5	150.550	.06	1.30	1.30	3.5	151	250	252	43		67	60		
11		25	152.005	.06	1.30	1.30	3.5	151	246	250	43		67	61		
12		27.5	153.645	.07	1.52	1.50	4	151	253	250	43		68	61		
500	1755	30	155.337													

Train Leak Check:

Before Test: 0.001 Ft^3 in 60 Seconds at 15 In. Hg.

After Test: 0.001 Ft^3 in 60 Seconds at 6 In. Hg.

Comments:

	Initial	Final	Port	Static Pressure A			
Pitot Tube Leak Check	✓	✓	Inches H_2O	-0.5			
ORSAT Train Leak Check	✓	✓	Inches Hg				

Silica Gel Condition: Port A ____ Port B ____ Port C ____ Port D ____

TRC Environmental Corp.

TRC ENVIRONMENTAL CORPORATION - ISOKINETIC FLUE GAS SAMPLING DATA SHEET

Project No.: 41613-0010-00000
Client: Spectrum Glass
Facility: Woodinville, WA
Source: Furnace #2

Date: 11.24.03
Run No.: 2
Sample Location: Furnace #2
Operator: DC Towne

Sheet 2 of 2

Point	Clock Time 24-hr	Clock Time Min.	Dry Gas Meter, (ft^3)	Pitot, ΔP In. H_2O	Orifice ΔH, In. H_2O Desired	Orifice ΔH, In. H_2O Actual	Pump Vacuum, In. Hg	Temperatures °F Stack	Probe	Filter Box	Imp Temp	XAD Cond	Meter Inlet	Meter Outlet	Filter Outlet	Heated Jumper
B1	1800	30	155.337	0.04	0.84	.84	3	147	252	252	25/43	NA	65	62	NA	NA
2		32.5	156.642	0.06	1.29	1.3	4	153	248	249	41		65	63		
3		35	158.285	0.07	1.519	1.52	4	154	247	252	40		66	63		
4		37.5	159.945	0.07	1.512	1.51	4	155	255	252	40		68	63		
5		40	161.650	0.08	1.72	1.72	4.5	157	248	252	41		69	63		
6		42.5	163.470	0.07	1.51	1.51	4.5	159	248	249	41		69	63		
7		45	165.270	0.07	1.51	1.51	4	156	251	251	41		70	64		
8		47.5	167.080	0.07	1.51	1.51	4	156	249	249	41		70	64		
9		50	168.830	0.09	1.95	2.0	5	155	246	249	41		71	65		
10		52.5	170.790	0.08	1.74	1.74	4.5	154	251	250	42		71	65		
11		55	172.700	0.08	1.75	1.8	4.5	154	249	249	43		71	65		
12		57.5	175.585	0.09	1.97	2.0	5	154	245	250	43		71	65		
	1830	60	176.574													
		TOTAL	41.964	ft^3	Avg	1.523		154.7						63.6		

Train Leak Check During Test:

Meter Reading: Stop / Restart

Before Test: _____ Ft^3 in _____ Seconds at _____ In. Hg. _____ ft^3 _____ ft^3

After Test: _____ Ft^3 in _____ Seconds at _____ In. Hg. _____ ft^3 _____ ft^3

Comments:

TRC ENVIRONMENTAL CORPORATION - ISOKINETIC FLUE GAS SAMPLING DATA SHEET

Sheet 1 of 2

Project No.:	41613-0010-00000
Client:	Spectrum Glass
Facility:	Woodinville, WA
Source:	Furnace #2
Sample Location:	Baghouse exhaust
Stack Diameter:	37" Ø
Date:	11/24/2003
Run No.:	3
Operator:	Doug Towne
Meterbox No.:	28579
Meterbox ΔH@:	1.719
Y Factor	0.992

Impinger Weights

	Initial	Final	Weight gain
Imp # 1	708.7	714.2	5.5
Imp # 2	[illegible]	168.6	7.4
Imp # 3	711.6	712.9	1.3
Imp # 4	835.0	841.5	2.5
Imp # 5			
Imp # 6			
Total			22.7

Train Prepared By:	Paul Clark
Pitot Number and Side:	P1-A
Pitot Tube Cp:	0.85
Filter No.:	110065
Ambient Temp., °F:	65
Bar. Pressure, In. Hg.:	29.77
Assumed Moisture, %:	4
Heater Box Setting, °F:	248
Nozzle # / Diam., In.:	03-6 ~~GA-7/0.456~~ 0.402
Probe Length / Material:	5 Ft Eff. Glass
Probe Heater Setting, °F:	248

Method 5

Point	Clock Time 24-hr	Clock Time Min.	Dry Gas Meter, (ft³)	Pitot, ΔP In. H₂O	Orifice ΔH, In. H₂O Desired	Orifice ΔH, In. H₂O Actual	Pump Vacuum, In. Hg	Temperatures °F Stack	Probe	Filter Box	Imp Temp	XAD Cond	Meter Inlet	Meter Outlet	Filter Outlet	Heated Jumper
S1	1852	0	176.649	0.05	1.09	1.1	3.5	151	245	248	46	NA	65	65	NA	NA
2		2.5	176.175	0.04	0.87	0.87	3	150	251	249	43		65	65		
3		5	179.500	0.04	0.88	0.88	3	147	248	253	41		65	65		
4		7.5	180.900	0.04	0.88	0.88	3	147	248	251	41		66	65		
5		10	182.260	0.07	1.53	1.55	4	148	245	254	41		65	65		
6		12.5	183.935	0.07	1.53	1.55	4	147	251	248	41		69	65		
7		15	185.705	0.06	1.31	1.30	4	147	249	248	41		70	65		
8		17.5	187.410	0.08	1.75	1.75	4.5	147	247	247	42		71	65		
9		20	189.235	0.09	1.97	1.95	5	146	251	248	42		71	65		
10		22.5	191.240	0.09	1.98	2.0	5	146	250	246	42		72	65		
11		25	193.330	0.09	1.98	2.0	5	146	251	257	43		72	66		
12		27.5	195.185	0.09	1.98	2.0	5	146	251	250	43		72	66		
S2	1922	30	197.162	[illegible]	Change											
[illegible]	1930	30	197.162	0.07	1.54	1.55	4.5	144	253	248	43		70	66		

Train Leak Check:

Before Test: 0.002 Ft³ in 60 Seconds at 15 In. Hg.

After Test: 0.000 Ft³ in 60 Seconds at 6 In. Hg.

Comments:

	Initial	Final	Static Pressure
Pitot Tube Leak Check	✓	✓	Port A
ORSAT Train Leak Check	✓	✓	Inches H₂O -0.5
			Inches Hg

Silica Gel Condition: Port A Blue Port B Blue Port C Port D

TRC Environmental Corp.

TRC ENVIRONMENTAL CORPORATION - ISOKINETIC FLUE GAS SAMPLING DATA SHEET

Project No.:	41613-0010-00000	Date:	11 24 03	Sheet 2 of 2	
Client:	Spectrum Glass	Run No.:	3		
Facility:	Woodinville, WA	Sample Location:	Furnace #2		
Source:	Furnace #2	Operator:	[illegible]		

Point	Clock Time 24-hr	Clock Time Min.	Dry Gas Meter, (ft^3)	Pitot, ΔP In. H_2O	Orifice ΔH, In. H_2O Desired	Orifice ΔH, In. H_2O Actual	Pump Vacuum, In. Hg	Temperatures °F Stack	Probe	Filter Box	Imp Temp	XAD Cond	Meter Inlet	Meter Outlet	Filter Outlet	Heated Jumper
A 2		32.5	199.000	0.07	1.54	1.55	4	144	251	251	43	NA	70	66	NA	NA
3		35	200.840	0.07	1.54	1.55	4	144	249	250	43		71	66		
4		37.5	202.580	0.07	1.54	1.55	4	144	250	250	43		71	66		
5		40	204.350	0.07	1.54	1.55	4	146	249	249	44		72	66		
6		42.5	206.080	0.07	1.54	1.55	4	146	248	251	44		73	66		
7		45	208.810	0.07	1.54	1.55	4	146	250	253	44		73	66		
8		47.5	209.7[illegible]	0.07	1.54	1.55	4	145	249	249	43		74	67		
9		50	211.555	0.06	1.32	1.30	3.5	145	248	251	43		74	67		
10		52.5	213.210	0.06	1.32	1.30	3.5	144	248	252	43		74	67		
11		55	214.875	0.07	1.54	1.55	4	144	247	249	43		74	67		
12		57.5	216.540	0.06	1.32	1.30	4	144	250	250	43	✓	74	68	✓	✓
End	2000	60	218.362													
		TOTAL	41.713	ft^3	AVG	1.487		146.0						68.3		

Train Leak Check During Test:

						Meter Reading Stop	Meter Reading Restart
Before Test:	Ft^3 in		Seconds at		In. Hg.	ft^3	ft^3
After Test:	Ft^3 in		Seconds at		In. Hg.	ft^3	ft^3

Comments:

24100 Snohomish - Woodinville Rd

CITY	STATE	ZIP
Woodinville	WA	98072

PHONE (KEY CONTACT):

SOURCE ID NUMBER: Furnace #4

PROCESS EQUIPMENT: Batch Glass Furnace — OPERATING MODE: Normal

CONTROL EQUIPMENT: ~~BX~~ DCT Baghouse — OPERATING MODE: Normal

DESCRIBE EMISSION POINT: Stack Exhaust

HEIGHT ABOVE GROUND LEVEL: 50'

HEIGHT RELATIVE TO OBSERVER: Start 20' End 20'

DISTANCE FROM OBSERVER: Start 75' End 75'

DIRECTION FROM OBSERVER: Start North End North

DESCRIBE EMISSIONS: Start Clear End Clear

EMISSION COLOR: Start None End None

IF WATER DROPLET PLUME: Attached ☐ NA Detached ☐

POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: Start No plume End No plume

DESCRIBE PLUME BACKGROUND: Start Partly Cloudy (Sky) End Partly Cloudy

BACKGROUND COLOR: Start White/Blue End White/Blue

SKY CONDITIONS: Start Partly Cloudy End Partly Cloudy

WIND SPEED: Start 5-10 mph End 5-10 mph

WIND DIRECTION: Start End

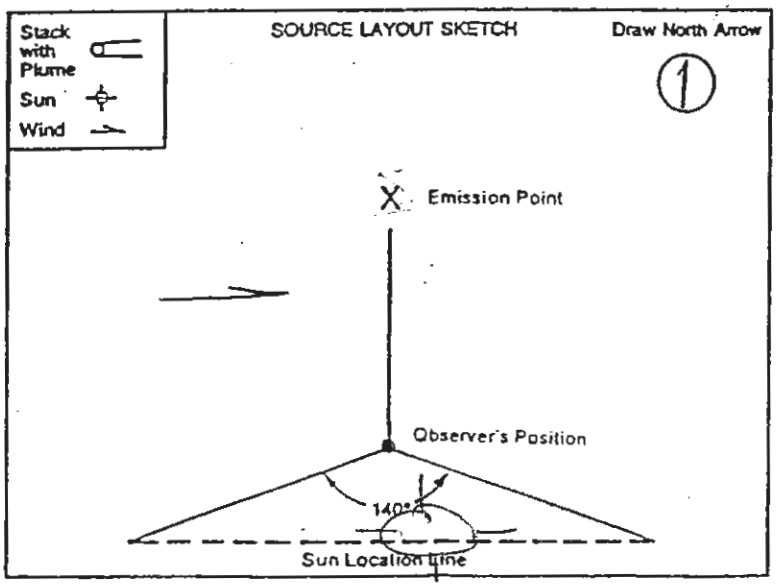
AMBIENT TEMP: Start NA End NA

WET BULB TEMP: NA

RH, percent: NA

SOURCE LAYOUT SKETCH

Draw North Arrow



ADDITIONAL INFORMATION

MIN	0	15	30	45	COMMENTS
1	0	0	0	0	Run #1 - Start: 0900
2	0	0	0	0	
3	0	0	0	0	
4	0	0	0	0	
5	0	0	0	0	
6	0	0	0	0	End: 0906
7					
8					
9	0	0	0	0	Run #2 - Start: 1030
10	0	0	0	0	
11	0	0	0	0	
12	0	0	0	0	
13	0	0	0	0	
14	0	0	0	0	End: 1036
15					
16	~~0~~	~~0~~	~~0~~	~~0~~	~~DCT~~ Run #3 2
17	0	0	0	0	Start: 1202
18	0	0	0	0	
19	0	0	0	0	
20	0	0	0	0	
21	0	0	0	0	
22	0	0	0	0	End: 1208
23					
24					
25					
26					
27					
28					
29					
30					

OBSERVER'S NAME (PRINT): Douglas C Towne

OBSERVER'S SIGNATURE: Towne — DATE: 11-24-03

ORGANIZATION: TRC Environmental

CERTIFIED BY: Yakima Clean Air Auth. — DATE:

CONTINUED ON VEO FORM NUMBER

TRAVERSE POINT LOCATION FOR CIRCULAR AND RECTANGULAR DUCTS

Project No.: 41613-0010-00000

Client: Spectrum Glass

Date: 11-24-03

Sampling Location: Furnace #4

Internal Stack Diameter: 40"

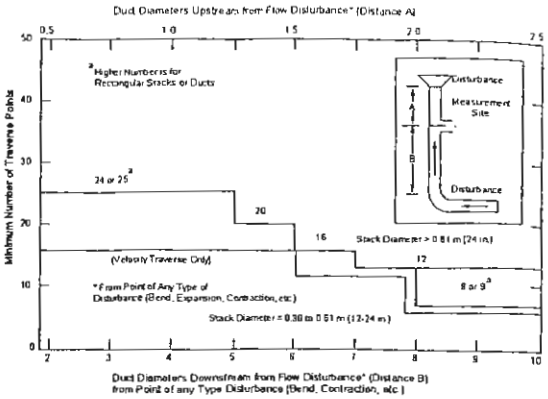
Nipple Length: 2.75"

Total Stack Diameter: 42.75"

Nearest Upstream Disturbance (A):

Nearest Downstream Disturbance (B):

Calculator:



Rectangular Duct Equivalent Diameter Determination = $\frac{2 \times L \times W}{L + W}$

Traverse Point Number	1 Fraction of Stack ID $\frac{(1)}{100}$	2 Stack ID	3 Traverse Point (1 x 2 = Point)	4 Nipple Length	5 Traverse Point Inside of Far Wall to Outside of Port Nipple (3 + 4 = Point)
1	.021	40.0	.84	2.75	3.59
2	.067	"	2.56	"	5.31
3	.118	"	4.72	"	7.47
4	.177	"	7.08	"	9.83
5	.250	"	10.0	"	12.75
6	.356	"	14.24	"	16.99
7	.644	"	25.76	"	28.51
8	.750	"	30.0	"	32.75
9	.823	"	32.92	"	35.67
10	.882	"	35.28	"	38.03
11	.933	"	37.32	"	40.07
12	.979	"	39.16	"	41.91
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					

Location of Traverse Points in Circular Stacks
[Percent of stack diameter from inside wall to traverse point]

	Number of traverse points on a diameter											
	2	4	6	8	10	12	14	16	18	20	22	24
1	14.6	5..7	4.4	3.2	2.6	2.1	1.3	1.6	1.4	1.3	1.1	1.1
2	85.4	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3		75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4		93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5			85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6			95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7				89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8				96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9					91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10					97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11						93.3	85.4	78.0	70.4	61.2	39.3	32.3
12						97.9	90.1	83.1	76.4	69.4	60.7	39.8
13							94.3	87.5	81.2	75.0	68.5	60.2
14							98.2	91.5	85.4	79.6	73.8	67.7
15								95.1	89.1	83.5	78.2	72.8
16								98.4	92.5	87.1	82.0	77.0
17									95.6	90.3	85.4	80.6
18									98.6	93.3	88.4	83.9
19										96.1	91.3	86.8
20										98.7	94.3	89.5
21											96.5	92.1
22											98.9	94.5
23												96.8
24												98.9

Location of Traverse Points in Rectangular Stacks

	Number of traverse points on a diameter										
	2	3	4	5	6	7	8	9	10	11	24
1	25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2
2	75.0	50.0	37.5	30.0	25.0	21.4	18.8	15.7	15.0	13.6	12.5
3		83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8
4			87.5	70.0	58.3	50.0	43.8	38.9	35.0	31.8	29.2
5				90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5
6					91.7	78.6	68.8	61.1	55.0	50.0	45.8
7						92.9	81.3	72.2	65.0	59.1	54.2
8							93.8	83.3	75.0	68.2	62.5
9								94.4	85.0	77.3	70.8
10									95.0	85.4	79.2
11										95.5	87.5
12											95.8

TRC ENVIRONMENTAL CORPORATION - ISOKINETIC FLUE GAS SAMPLING DATA SHEET

Sheet 1 of 2

Project No.:	41613-0010-00000
Client:	Spectrum Glass
Facility:	Woodinville, WA
Source:	Furnace #4
Sample Location:	Baghouse exhaust
Stack Diameter:	40" Φ
Date:	11/24/2003
Run No.:	1
Operator:	~~Matt Ellis~~ Paul Clark
Meterbox No.:	28579
Meterbox ΔH@:	1.719
Y Factor	0.992

Impinger Weights

	Initial	Final	Weight gain
Imp # 1	705.6	724.8	
Imp # 2	697.7	709.1	
Imp # 3	711.5	714.0	
Imp # 4	891.8	902.1	
Imp # 5			
Imp # 6			
Total			43.4

Train Prepared By:	Paul Clark
Pitot Number and Side:	P1-A
Pitot Tube Cp:	0.85
Filter No.:	11 0056
Ambient Temp., °F:	~ 68
Bar. Pressure, In. Hg.:	29.77
Assumed Moisture, %:	0
Heater Box Setting, °F:	248
Nozzle # / Diam., In.:	GA-7/ 0.456
Probe Length / Material:	5 Ft Eff. Glass
Probe Heater Setting, °F:	248

Method 5

Point	Clock Time 24-hr	Clock Time Min.	Dry Gas Meter, (ft³)	Pitot, ΔP In. H₂O	Orifice ΔH, In. H₂O Desired	Orifice ΔH, In. H₂O Actual	Pump Vacuum, In. Hg	Temperatures °F Stack	Probe	Filter Box	Imp Temp	XAD Cond	Meter Inlet	Meter Outlet	Filter Outlet	Heated Jumper
A-1	0850	0	931.945	0.04	1.28	1.30	5	226	251	254	52	~68	52	52	~68	~68
2		2.5	933.457	0.04	1.28	1.30	5	224	249	252	43		51	51		
3		5	935.075	0.04	1.28	1.30	5	226	248	251	40		52	52		
4		7.5	936.680	0.04	1.28	1.30	5	227	248	252	41		53	53		
5		10	938.200	0.04	1.28	1.30	5	227	248	252	43		57	54		
6		12.5	940.045	0.04	1.28	1.30	5	227	249	251	44		55	55		
7		15	941.640	0.04	1.28	1.30	5	227	251	251	44		57	54		
8		17.5	943.235	0.04	1.28	1.30	5	227	256	252	45		58	54		
9		20	944.860	0.04	1.28	1.30	5	227	254	251	44		57	54		
10		22.5	946.500	0.04	1.28	1.30	5	227	253	249	44		57	54		
11		25	948.080	0.04	1.28	1.30	5	225	250	254	44		57	54		
12		27.5	949.610	0.04	1.28	1.30	5	225	249	252	45		57	54		
STOP	0920	30	951.346	?	change											
B-1	0923	30	951.346	0.03	0.46	0.46	4	223	249	252	46		57	55		

Train Leak Check:

Before Test: 0.000 Ft³ in 60 Seconds at 15 In. Hg.

After Test: 0.000 Ft³ in 60 Seconds at 0 In. Hg.

Comments: Vol 344mL

	Initial	Final	Port	A	Static Pressure		
Pitot Tube Leak Check	✓	✓	Inches H₂O	-0.04			
ORSAT Train Leak Check	✓	✓	Inches Hg				

Silica Gel Condition: Port A Blue Port B Blue Port C Port D

TRC Environmental Corp.

TRC ENVIRONMENTAL CORPORATION - ISOKINETIC FLUE GAS SAMPLING DATA SHEET

Project No.: 41613-0010-00000
Client: Spectrum Glass
Facility: Woodinville, WA
Source: Furnace #4

Date: 11-24-03
Run No.: 12-1
Sample Location: Baghouse outlet
Operator: Phil Clark

Sheet 2 of 2

Point	Clock Time 24-hr	Clock Time Min.	Dry Gas Meter, (ft^3)	Pitot, ΔP In. H_2O	Orifice ΔH, In. H_2O Desired	Orifice ΔH, In. H_2O Actual	Pump Vacuum, In. Hg	Temperatures °F Stack	Probe	Filter Box	Imp Temp	XAD Cond	Meter Inlet	Meter Outlet	Filter Outlet	Heated Jumper
B-2		32.5	952.750	.03	0.96	0.96	4	224	245	253	44	n/a	58	56	n/a	n/a
3		35	954.130	.04	1.28	1.30	4.5	226	249	246	43		58	56		
4		37.5	955.745	.04	1.28	1.30	4.5	226	253	248	43		60	56		
5		40	957.315	.04	1.29	1.30	4.5	226	250	247	43		60	57		
6		42.5	959.000	.04	1.29	1.30	4.5	227	249	246	43		60	58		
7		45	960.620	.04	1.29	1.30	4.5	227	244	246	44		60	57		
8		47.5	962.190	.04	1.29	1.30	4.5	227	245	246	44		60	57		
9		50	963.630	.04	1.29	1.30	4.5	226	246	251	44		61	58		
10		52.5	965.780	.04	1.29	1.30	4.5	226	243	249	44		61	58		
11		55	967.250	.04	1.29	1.30	4.5	223	253	244	44		61	58		
12		57.5	968.780	.03	0.98	0.98	4	221	251	250	45	✓	61	58	✓	✓
Start	0953	60	970.193													
		TOTAL	38.248	ft3	Avg	1.258		225.5						56.5		

Train Leak Check During Test:

Meter Reading — Stop / Restart

Before Test: _____ Ft^3 in _____ Seconds at _____ In. Hg. _____ ft^3 _____ ft^3

After Test: _____ Ft^3 in _____ Seconds at _____ In. Hg. _____ ft^3 _____ ft^3

Comments:

TRC ENVIRONMENTAL CORPORATION - ISOKINETIC FLUE GAS SAMPLING DATA SHEET

Sheet 1 of 2

Project No.:	41613-0010-00000
Client:	Spectrum Glass
Facility:	Woodinville, WA
Source:	Furnace #4
Sample Location:	Baghouse exhaust
Stack Diameter:	40" Φ
Date:	11/24/2003
Run No.:	2
Operator:	Matt Ellis
Meterbox No.:	28579
Meterbox ΔH@:	1.719
Y Factor	0.992

Impinger Weights

	Initial	Final	Weight gain
Imp # 1	704.2	725.5	
Imp # 2	691.5	701.5	
Imp # 3	714.7	716.9	
Imp # 4	928.1	938.4	
Imp # 5			
Imp # 6			
Total			43.8

Train Prepared By:	Paul Clark
Pitot Number and Side:	P1-A
Pitot Tube Cp:	0.85
Filter No.:	1005 8
Ambient Temp., °F:	
Bar. Pressure, In. Hg.:	29.71
Assumed Moisture, %:	4
Heater Box Setting, °F:	248
Nozzle # / Diam., In.:	GA-7/ 0.456
Probe Length / Material:	5 Ft Eff. Glass
Probe Heater Setting, °F:	248

Method 5

Point	Clock Time 24-hr	Clock Time Min.	Dry Gas Meter, (ft^3)	Pitot, ΔP In. H_2O	Orifice ΔH, In. H_2O Desired	Orifice ΔH, In. H_2O Actual	Pump Vacuum, In. Hg	Temperatures °F Stack	Probe	Filter Box	Imp Temp	XAD Cond	Meter Inlet	Meter Outlet	Filter Outlet	Heated Jumper
A12	1010	00	970.528	0.04	1.28	1.3	4	219	245	245	48	N/A	57	57		N/A
11		02	972.300	0.04	1.28	1.3	4	219	245	250	48		57	57		
10		5	974.050	0.04	0.933	0.93	4	224	251	251	48		58	57		
9		7.5	975.350	0.03	0.96	0.96	4	226	244	250	48		59	57		
8		10	976.450	0.04	1.28	1.3	4	227	248	250	48		59	57		
7		12.5	977.850	0.03	0.965	0.96	4	227	250	250	48		60	57		
6		15	979.395	0.04	1.28	1.3	4	227	250	251	47		60	57		
5		17.5	980.995	0.04	1.29	1.3	4	229	250	251	47		61	57		
4		20	982.400	0.04	1.28	1.3	4	220	250	249	45		61	58		
3		22.5	985.300	0.04	1.3	1.3	4	217	250	249	45		62	58		
2		25	986.095	0.04	1.3	1.3	4	216	250	250	45		63	58		
1		27.5	987.500	0.04	1.3	1.3	4	216	250	251	45		63	60		
Stop	1040	30	987.129	0.0	Port Change											
B12		35	989.129	0.03	0.98	0.98	4	220	250	251	45		61	60		

Train Leak Check:

Before Test: 0.001 Ft^3 in 60 Seconds at 15 In. Hg.

After Test: 0.001 Ft^3 in 60 Seconds at 5 In. Hg.

Comments: Vol 384 mls.
Vol 350 mls total

	Initial	Final	Port	Static Pressure A			
Pitot Tube Leak Check	✓	✓	Inches H_2O	-0.09			
ORSAT Train Leak Check	✓	✓	Inches Hg				

Silica Gel Condition: Port A Blue Port B Blue
Port C Port D

TRC Environmental Corp.

TRC ENVIRONMENTAL CORPORATION - ISOKINETIC FLUE GAS SAMPLING DATA SHEET

Project No.: 02398-0040-00003
Client: Spectrum Glass
Facility: Woodinville, WA
Source: Furnace ~~#2~~ 4

Date: 24-Nov-03
Run No.: 2
Sample Location: Furnace #2 baghouse exhaust
Operator: ~~Doug Towne~~ M. E. Ils

Sheet 2 of 2

TRAIN METHOD: Method 5

Point	Clock Time 24-hr	Clock Time Min.	Dry Gas Meter, (ft^3)	Pitot, ΔP In. H_2O	Orifice ΔH, In. H_2O Desired	Orifice ΔH, In. H_2O Actual	Pump Vacuum, In. Hg	Temperatures °F Stack	Probe	Filter Box	Imp Temp	XAD Cond	Meter Inlet	Meter Outlet	Filter Outlet	Heated Jumper
11	1050	25	990.450	0.03	0.97	0.97	4	223	250	252	42	NA	62	60	NA	
10		5	991.995	0.03	0.97	0.97	4	223	251	252	42		62	60		
9		7.5	993.450	0.03	0.97	0.97	4	223	250	251	44		62	60		
8		10	994.700	0.04	1.29	1.3	4	225	250	251	44		63	61		
7		12.5	996.350	0.04	1.29	1.3	4	227	250	251	44		64	61		
6		15	998.150	0.04	1.29	1.3	4	225	250	253	44		65	61		
5		17.5	999.550	0.04	1.29	1.3	4	225	248	253	43		64	61		
4		20	000.995	0.03	0.98	0.98	4	217	248	253	43		64	61		
3		22.5	002.850	0.03	0.98	0.98	4	217	250	252	43		63	61		
2		25	004.300	0.04	1.31	1.3	4	211	250	252	44		62	61		
1		27.5	005.605	0.04	1.31	1.3	4	211	250	252	44		61	61		
END	1112	30	007.263													
		TOTAL	36.935	ft^3	Avg	1.175		221.3						60.3		

Train Leak Check During Test:

Before Test: ___ Ft^3 in ___ Seconds at ___ In. Hg. Meter Reading Stop ___ ft^3 Restart ___ ft^3

After Test: ___ Ft^3 in ___ Seconds at ___ In. Hg. ___ ft^3 ___ ft^3

Comments:

TRC ENVIRONMENTAL CORPORATION - ISOKINETIC FLUE GAS SAMPLING DATA SHEET

Sheet 1 of 2

Project No.:	41613-0010-00000
Client:	Spectrum Glass
Facility:	Woodinville, WA
Source:	Furnace #4
Sample Location:	Baghouse exhaust
Stack Diameter:	
Date:	11/24/2003
Run No.:	3
Operator:	Matt Ellis
Meterbox No.:	28579
Meterbox ΔH@:	1.719
Y Factor	0.992

Impinger Weights

	Initial	Final	Weight gain
Imp # 1	702.2	704.0	
Imp # 2	693.5	701.7	
Imp # 3	707.7	726.8	
Imp # 4	840.9	884.8	
Imp # 5			
Imp # 6			
Total			42.0

Train Prepared By:	Paul Clark
Pitot Number and Side:	P1-A
Pitot Tube Cp:	0.85
Filter No.:	110058
Ambient Temp., °F:	
Bar. Pressure, In. Hg.:	29.77
Assumed Moisture, %:	4
Heater Box Setting, °F:	248
Nozzle # / Diam., In.:	GA-7/ 0.456
Probe Length / Material:	5 Ft Eff. Glass
Probe Heater Setting, °F:	248

Method 5

Point	Clock Time 24-hr	Clock Time Min.	Dry Gas Meter, (ft^3)	Pitot, ΔP In. H_2O	Orifice ΔH, In. H_2O Desired	Orifice ΔH, In. H_2O Actual	Pump Vacuum, In. Hg	Temperatures °F Stack	Probe	Filter Box	Imp Temp	XAD Cond	Meter Inlet	Meter Outlet	Filter Outlet	Heated Jumper
A 12	1129	00	007.313	0.04	1.3	1.3	4	220	250	245	47	NA	58	58	NA	
11		2.5	009.450	0.04	1.3	1.3	4	224	250	245	47		59	60		
10		5	010.850	0.04	1.29	1.3	4	226	250	245	46		60	60		
9		7.5	012.875	0.04	1.29	1.3	4	226	250	245	44		61	60		
8		10	014.880	0.04	1.29	1.3	4	226	250	247	44		62	60		
7		12.5	015.775	0.04	1.29	1.3	4	226	252	247	43		62	60		
6		15	017.300	0.04	1.29	1.3	4	226	252	247	43		62	60		
5		17.5	018.040	0.03	0.97	0.97	4	226	250	248	43		63	60		
4		20	020.250	0.04	1.29	1.3	4	227	250	248	43		64	61		
3		22.5	022.000	0.04	1.29	1.3	4	226	250	250	42		62	60		
2		25	023.300	0.03	0.97	0.97	4	226	250	250	42		62	60		
1		27.5	024.550	0.03	0.97	0.97	4	226	250	250	42		62	60		
Stop	1159	30	025.910				Stop for Port change									
B 12	1202	00	025.910	0.03	0.97	0.97	4	225	250	250	42		60	60		

Train Leak Check:

Before Test: 0.000 Ft^3 in 60 Seconds at 15 In. Hg.

After Test: 0.000 Ft^3 in 60 Seconds at 7 In. Hg.

Comments:

	Initial	Final
Pitot Tube Leak Check	✓	✓
ORSAT Train Leak Check	✓	✓

Static Pressure

Port	5A			
Inches H_2O	-0.03	/	/	/
Inches Hg		/	/	/

Silica Gel Condition: Port A Blue Port B Blue Port C / Port D /

IsoDataSheet with moisture, Page 1

TRC Environmental Corp.

TRC ENVIRONMENTAL CORPORATION - ISOKINETIC FLUE GAS SAMPLING DATA SHEET

Project No.:	41613-0010-00000	Date:	11/24/03	Sheet 2 of 2	
Client:	Spectrum Glass	Run No.:	3		
Facility:	Woodinville, WA	Sample Location:	Baghouse exhaust		
Source:	Furnace #4	Operator:	M.T. Ellis		

Point	Clock Time 24-hr	Clock Time Min.	Dry Gas Meter, (ft^3)	Pitot, ΔP In. H_2O	Orifice ΔH, In. H_2O Desired	Orifice ΔH, In. H_2O Actual	Pump Vacuum, In. Hg	Temperatures °F Stack	Probe	Filter Box	Imp Temp	XAD Cond	Meter Inlet	Meter Outlet	Filter Outlet	Heated Jumper
11	1204	0/52.5	027.500	0.03	0.97	0.97	4	224	250	248	45	NA	60	60	N/A	
10		5	029.100	0.04	1.29	1.3	4	224	249	248	45		60	60		
9		7.5	030.000	0.04	1.29	1.3	4	224	249	248	45		60	60		
8		10	031.435	0.03	0.97	0.97	4	227	248	245	45		60	59		
7		12.5	032.780	0.04	1.26	1.25	4	229	248	250	45		60	60		
6		15	034.330	0.04	1.26	1.25	4	229	249	250	46		60	60		
5		17.5	035.950	0.04	1.30	1.30	4	229	248	255	47		61	60		
4		20	037.465	0.04	1.28	1.30	4	229	248	253	47		61	60		
3		22.5	039.000	0.04	1.28	1.30	4	227	249	253	47		61	59		
2		25	040.700	0.04	1.28	1.30	4	224	249	250	47		61	59		
1		27.5	042.300	0.03	0.97	0.97	4	222	250	250	47		61	59		
END	1232	30	043.600													
		TOTAL	36.347	ft^3		1.198		225.8						60.4		

Train Leak Check During Test:

Before Test: / Ft^3 in / Seconds at / In. Hg.

After Test: / Ft^3 in / Seconds at / In. Hg.

Meter Reading: Stop / ft^3; Restart / ft^3

Comments:

24106 Snohomish - Woodinville KV

CITY	STATE	ZIP
Woodinville	WA	98072

PHONE (KEY CONTACT)	SOURCE ID NUMBER
	Furnace #2

PROCESS EQUIPMENT	OPERATING MODE
Batch Glass Furnace	Normal
CONTROL EQUIPMENT	**OPERATING MODE**

DESCRIBE EMISSION POINT: Stack Exit

HEIGHT ABOVE GROUND LEVEL	HEIGHT RELATIVE TO OBSERVER
35 ft	Start 10 ft End 10 ft
DISTANCE FROM OBSERVER	**DIRECTION FROM OBSERVER**
Start 75 ft End 75 ft	Start N End N

DESCRIBE EMISSIONS: Start Clear End Clear

EMISSION COLOR	IF WATER DROPLET PLUME
Start None End None	Attached ☐ N/A Detached ☐

POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: Start No Plume End No plume

DESCRIBE PLUME BACKGROUND: Start Sky End Sky

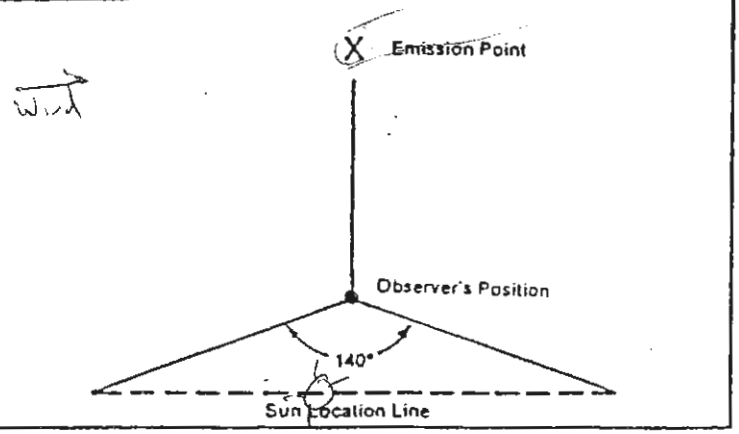
BACKGROUND COLOR	SKY CONDITIONS
Start White-Blue End Same	Start Partly Cloudy End Partly Cloudy
WIND SPEED	**WIND DIRECTION**
Start 5-10 mph End 5-10 mph	Start E End E

AMBIENT TEMP	WET BULB TEMP	RH, percent
Start N/A End N/A	N/A	N/A

SOURCE LAYOUT SKETCH

Stack with Plume
Sun
Wind

Draw North Arrow



ADDITIONAL INFORMATION

MIN	0	15	30	45	COMMENTS
1	0	0	0	0	Start 1600
2	0	0	0	0	
3	0	0	0	0	
4	0	0	0	0	
5	0	0	0	0	
6	0	0	0	0	
7	0	0	0	0	
8	0	0	0	0	
9	0	0	0	0	
10	0	0	0	0	
11	0	0	0	0	
12	0	0	0	0	
13	0	0	0	0	
14	0	0	0	0	
15	0	0	0	0	
16	0	0	0	0	
17	0	0	0	0	
18	0	0	0	0	End 1618
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

OBSERVER'S NAME (PRINT)	
Pat Clark	
OBSERVER'S SIGNATURE	**DATE**
[signature]	11/24/03
ORGANIZATION	
TRC	
CERTIFIED BY	**DATE**
VCAA	

CONTINUED ON VEO FORM NUMBER

TRC Method 5/202 Data Sheet-Gravimetric Particulate Analysis

Client Name/Facility: Spectrum Glass Company Job No: 41613-0010-00000
City/State: Woodinville, WA Analytical Balance ID NO. 1121031038
Analyst: Paul Clark

Run Identification	units	Furnace #2 run # 1	Furnace #2 run # 2	Furnace #2 run # 3
Filter Analysis				
Filter Appearance				
Filter ID		110060	110061	110063
Filter Tare Weight	g	0.3822	0.3813	0.3581
Weight #1: Date/Time 12-19/1130	g	0.3820	0.3810	0.3580
Weight #2: Date/Time 12-22/0930	g	0.3821	0.3810	0.3582
Weight #3: Date/Time	g	—	—	—
PM On Filter	g			
Acetone Rinse Analysis				
Dried PM Rinse Appearance				
Any Loss? If Yes, Estimate Amount	g			
Sample Volume	mL	30 ~1	30	30
Beaker ID		109	508	104
Beaker Tare	g	66.8765	66.9267	67.1173
Weight #1: Date/Time 12-22/0945	g	66.8796	66.9322	67.1206
Weight #2: Date/Time 12-23/0945	g	66.8808	66.9337	67.1219
Weight #3: Date/Time 12-23/1630	g	66.8809	66.9340	67.1217
Weight #4: Date/Time	g	—	—	—
PM in Acetone Rinse	g			
Total Front-Half PM	mg			
Organic Fraction				
Dried PM Appearance				
Any Loss? If Yes, Estimate Amount	g			
Sample Volume	mL	30 ~1(a) 150 ~1(meoh)	45/160	30/150
Beaker ID	g	53	55	71
Beaker Tare	g	~~[illegible]~~ 65.1259	67.2222	68.7585
Weight #1: Date/Time 12-23/1000	g	65.1288	67.2268	68.7628
Weight #2: Date/Time 12-23/1615	g	65.1301	67.2285	68.7626
Weight #3: Date/Time 12-24/1100	g	65.1297	67.2281	—
Weight #4: Date/Time	g	—	—	
PM in Organic Fraction	g			
Inorganic Fraction Analysis				
Dried PM Appearance				
Any Loss? If Yes, Estimate Amount	g			
Sample Volume	mL	490	410	430
Beaker ID		519	522	201
Beaker Tare	g	108.9628	108.9934	111.6543
Weight #1: Date/Time 12-22/0955	g	108.9627	108.9933	111.8650
Weight #2: Date/Time 12-23/0950	g	108.9639	108.9950	111.6570
Weight #3: Date/Time 12-23/1605	g	108.9643	108.9954	111.6570
Weight #4: Date/Time	g	—	—	—
PM in Inorganic Fraction	g			
Total Back-Half PM	g			
Total FH & BH PM	g			

QA/QC Check Completeness _____ Legibility _____ Accuracy _____
Specifications _____ Reasonableness _____

Checked by: _____(sign) _____(print) Date:_____
(Lab Supervisor or QA Manager)

TRC Method 5/202 Data Sheet-Gravimetric Particulate Analysis

Client Name/Facility: Spectrum Glass Company Job No: 41613-0010-00000
City/State: Woodinville, WA Analytical Balance ID NO. 1121031038
Analyst: Paul Clark

Run Identification	units	Furnace #4 run # 1	Furnace #4 run # 2	Furnace #4 run # 3
Filter Analysis				
Filter Appearance				
Filter ID		110056	110057	110058
Filter Tare Weight	g	0.3859	0.3851	0.3843
Weight #1: Date/Time 12-19/1130	g	0.3857	0.3850	0.3840
Weight #2: Date/Time 12-22/0932	g	0.3858	0.3850	0.3841
Weight #3: Date/Time	g			
PM On Filter	g			

Acetone Rinse Analysis				
Dried PM Rinse Appearance				
Any Loss? If Yes, Estimate Amount	g			
Sample Volume	mL	40	40	40
Beaker ID		106	110	111
Beaker Tare	g	66.8984	65.3105	67.0751
Weight #1: Date/Time 12-22/0945	g	66.9060	65.3150	67.0819
Weight #2: Date/Time 12-23/0945	g	66.9058	65.3150	67.0823
Weight #3: Date/Time	g			
Weight #4: Date/Time	g			
PM in Acetone Rinse	g			

Total Front-Half PM	mg			

Organic Fraction				
Dried PM Appearance				
Any Loss? If Yes, Estimate Amount	g			
Sample Volume	mL	40/150	60/150	25/150
Beaker ID	g	100	101	102
Beaker Tare	g	67.1051	65.4323	67.2011
Weight #1: Date/Time 12-23/1000	g	67.1069	65.4354	67.2040
Weight #2: Date/Time 12-23/1615	g	67.1080	65.4365	67.2040
Weight #3: Date/Time 12-24/1100	g	67.1076	65.4363	—
Weight #4: Date/Time	g			
PM in Organic Fraction	g			

Inorganic Fraction Analysis				
Dried PM Appearance				
Any Loss? If Yes, Estimate Amount	g			
Sample Volume	mL	400	380	445
Beaker ID		203	204	205
Beaker Tare	g	109.7129	110.9983	111.6707
Weight #1: Date/Time 12-22/0955	g	109.7128	110.9945	111.8739
Weight #2: Date/Time 12-23/0959	g	109.7132	110.9997	111.6737
Weight #3: Date/Time 12-23/1605	g	—	110.9993	111.6739
Weight #4: Date/Time	g			
PM in Inorganic Fraction	g			
Total Back-Half PM	g			
Total FH & BH PM	g			

QA/QC Check Completeness _____ Legibility _____ Accuracy _____
Specifications _____ Reasonableness _____

Checked by: _____(sign) _____(print) Date:_____
(Lab Supervisor or QA Manager)

TRC

Method 5/202 Data Sheet-Gravimetric Particulate Analysis

Client Name/Facility: Spectrum Glass Company
Job No: 41613-0010-00000
City/State: Woodinville, WA
Analytical Balance ID NO. 1121031038
Analyst: Paul Clark

Run Identification	units	1	2	Average
Acetone Reagent Blank Analysis				
Sample Volume	mL	100		
Beaker ID		107		
Beaker Tare	g	65.2248		
Weight #1: Date/Time 12-23/1000	g	65.2291		
Weight #2: Date/Time 12-23/1609	g	65.2288		
Weight #3: Date/Time	g	—		
Weight #4: Date/Time	g			
Acetone Blank Weight	g			
Wt./Vol of Acetone Blank	mg/mL			
CH_2Cl_2 Reagent Blank Analysis				
Sample Volume	mL	150		
Beaker ID		108		
Beaker Tare	g	65.0435		
Weight #1: Date/Time 12-23/1020	g	65.0485		
Weight #2: Date/Time 12-23/1609	g	65.0484		
Weight #3: Date/Time	g	—		
Weight #4: Date/Time	g			
CH_2Cl_2 Weight Blank	g			
Wt./Vol of CH_2Cl_2 Blank	mg/mL			
DI H_2O Reagent Blank Analysis				
Sample Volume	mL	400		
Beaker ID		212		
Beaker Tare	g	110.2026		
Weight #1: Date/Time 12-22/0955	g	110.2046		
Weight #2: Date/Time 12-23/0950	g	110.2049		
Weight #3: Date/Time	g	—		
Weight #4: Date/Time	g			
DI H2O Blank Weight	g			
Wt./Vol of DI H_2O Blank	mg/mL			

QA/QC Check Completeness _____ Legibility _____ Accuracy _____
Specifications _____ Reasonableness _____

Checked by: _____(sign) _____(print) Date:_____
(Lab Supervisor or QA Manager)

TRC

Method 5/202 Data Sheet-Gravimetric Particulate Analysis

Client Name/Facility: Spectrum Glass Company
Job No: 41613-0010-00000
City/State: Woodinville, WA
Analytical Balance ID NO. 1121031038
Analyst: Paul Clark

Run Identification	units	Furnace #2 run C-1	Furnace #4 run C-1	
Filter Analysis				
Filter Appearance				
Filter ID		110055	110059	
Filter Tare Weight	g	0.3847	0.3863	
Weight #1: Date/Time 12-14/1130	g	0.3845	0.3860	
Weight #2: Date/Time 12-21/0930	g	0.3846	0.3862	
Weight #3: Date/Time	g	—	—	
PM On Filter	g			

Acetone Rinse Analysis				
Dried PM Rinse Appearance				
Any Loss? If Yes, Estimate Amount	g			
Sample Volume	mL	30	35	
Beaker ID		105	511	
Beaker Tare	g	65.2323	68.8070	
Weight #1: Date/Time 12-22/0945	g	65.2386	68.8150	
Weight #2: Date/Time 12-23/0945	g	65.2399	68.8158	
Weight #3: Date/Time 12-24/1100	g	65.2396	68.8156	
Weight #4: Date/Time	g	—	—	
PM in Acetone Rinse	g			
Total Front-Half PM	mg			

Organic Fraction				
Dried PM Appearance				
Any Loss? If Yes, Estimate Amount	g			
Sample Volume	mL	25/200	45/200	
Beaker ID	g	506	103	
Beaker Tare	g	66.8493	65.0812	
Weight #1: Date/Time 12-23/1000	g	66.8523	65.0870	
Weight #2: Date/Time 12-23/1615	g	66.8525	65.0874	
Weight #3: Date/Time	g	—	—	
Weight #4: Date/Time	g			
PM in Organic Fraction	g			

Inorganic Fraction Analysis				
Dried PM Appearance				
Any Loss? If Yes, Estimate Amount	g			
Sample Volume	mL	470	420	
Beaker ID		702	209	
Beaker Tare	g	109.6982	114.7390	
Weight #1: Date/Time 12-22/0955	g	109.6986	114.7392	
Weight #2: Date/Time 12-23/0956	g	109.6999	114.7407	
Weight #3: Date/Time 12-23/1605	g	109.7000	114.7404	
Weight #4: Date/Time	g	—	—	
PM in Inorganic Fraction	g			
Total Back-Half PM	g			
Total FH & BH PM	g			

QA/QC Check Completeness _____ Legibility _____ Accuracy _____
Specifications _____ Reasonableness _____

Checked by: _____(sign) _____(print) Date:_____
(Lab Supervisor or QA Manager)

APPENDIX D

EQUIPMENT CALIBRATION INFORMATION

APEX INSTRUMENTS SOURCE TESTING EQUIPMENT

S-TYPE PITOT TUBE CALIBRATION SHEET

Reference USEPA Reference Method 2 (40CFR60, App. A, Meth. 2)

PITOT SERIAL#	P1-A	CALIBRATION DATE:	30-Oct-03
PITOT TYPE:		BAROMETRIC PRESSURE:	759.00 mm Hg
STD. PITOT TYPE:		STATIC PRESSURE	-40.6 mm H_2O
Cp(std):		BLOCKAGE %:	n/a
CALIBRATED BY:		CORRECTION FACTOR:	

	SIDE "A" CALIBRATION			
RUN NO.	Pstd mm H_2O	P(s) mm H2O	Cp(s)	DEVIATION Cp(s) - avg.Cp(s)
1	19.4	26.4	0.849	-0.001
2	19.4	26.4	0.849	-0.001
3	19.4	26.2	0.852	0.002
		AVERAGE	0.850	

	SIDE "B" CALIBRATION			
RUN NO.	Pstd mm H_2O	P(s) mm H_2O	Cp(s)	DEVIATION Cp(s) - avg.Cp(s)
1	19.4	25.6	0.8618	0.002
2	19.4	25.8	0.8585	-0.001
3	19.4	25.8	0.8585	-0.001
		AVERAGE	0.860	

OVERALL AVERAGE 0.855

ACCEPTANCE CRITERIA

AVG. ICp (A) - AVG. Cp (B)I	-0.0098	must be less than or equal to 0.01
Standard Deviation A =	0.0019	must be less than or equal to 0.01
Standard Deviation B =	0.0019	must be less than or equal to 0.01

If each of the above criteria are met the overall avg. Cp (Side A or Side B) may be used.

I certify that the above pitot tube was tested in accordance with the US EPA Method 2 standards.
See the Code of Federal Regulations, Title 40, Pat 60, Appendix A, Method 2, Item 4.

Signature _____ Date 10-30-03

TEMPERATURE DISPLAY CALIBRATION

Meter Console Number: **28579**

Reference Calibrator Make: **ALTEK** Model: **22TC** Serial No.: **10931602**

Operator: **M. Ellis** Date: **2/1/03**

Pretest

Thermocouple Number	Reference Temp #1	Meter temp	Criteria
T.C. # 1	100	100	0.000
T.C. #2	100	101	-0.179
T.C. #3	100	101	-0.179
T.C. #4	100	100	0.000
T.C.#5	100	100	0.000

Thermocouple Number	Reference Temp #2	Meter temp	Criteria
T.C. # 1	200	201	-0.152
T.C. #2	200	202	-0.303
T.C. #3	200	202	-0.303
T.C. #4	200	201	-0.152
T.C.#5	200	201	-0.152

Thermocouple Number	Reference Temp #3	Meter temp	Criteria
T.C. # 1	300	300	0.000
T.C. #2	300	301	-0.132
T.C. #3	300	301	-0.132
T.C. #4	300	300	0.000
T.C.#5	300	300	0.000

Thermocouple Number	Reference Temp #4	Meter temp	Criteria
T.C. # 1	400	399	0.116
T.C. #2	400	400	0.000
T.C. #3	400	400	0.000
T.C. #4	400	399	0.116
T.C.#5	400	399	0.116

Criteria: Percent differense between the Reference Tempature and the Average Tempature can only be + or - 1.5% R.

Equation:

$$\frac{(\text{Ref. Temp.} + 460) - (\text{Temp. Reading} + 460) \times 100}{(\text{Ref. Temp.} + 460)}$$

SAMPLING NOZZLE CALIBRATION

Date	Nozzle No.	Diameter (in.) a	b	c	Average (DN)	Calibrated By	Caliper No.	QA Check if DN is OK
10/29/03	GA-2	0.151	0.151	0.150	0.151	PJC	CE1	DCJ
	GA-3	0.210	0.210	0.210	0.210	PJC	CE1	DCJ
	GA-4	0.270	0.269	0.270	0.270	PJC	CE1	DCJ
	GA-6	0.397	0.396	0.396	0.396	PJC	CE1	DCJ
	GA-7	0.456	0.456	0.456	0.456	PJC	CE1	DCJ
	GA-8	0.530	0.530	0.530	0.530	PJC	CE1	DCJ
	GB-2	0.145	0.145	0.146	0.145	PJC	CE1	DCJ
	GB-3	0.210	0.209	0.210	0.210	PJC	CE1	DCJ
	GB-4	0.267	0.269	0.268	0.268	PJC	CE1	DCJ
	GB-5	0.334	0.334	0.334	0.334	PJC	CE1	DCJ
	GB-6	0.401	0.402	0.403	0.402	PJC	CE1	DCJ
	GB-7	0.446	0.448	0.447	0.448	PJC	CE1	DCJ
	GB-8	0.525	0.525	0.525	0.525	PJC	CE1	DCJ
	GC-2	0.159	0.160	0.159	0.159	PJC	CE1	DCJ
	GC-3	0.213	0.213	0.214	0.213	PJC	CE1	DCJ
	GC-4	0.269	0.269	0.269	0.269	PJC	CE1	DCJ
	GC-6	0.400	0.398	0.401	0.400	PJC	CE1	DCJ
	GC-7	0.447	0.447	0.447	0.447	PJC	CE1	DCJ
	GC-8	0.529	0.530	0.530	0.530	PJC	CE1	DCJ

QA/QC Checked By: DCJ
Date: 10/30/03

Each diameter measured to 0.001 in.?
High to Low ≤ 0.004 in.?
Data set complete?

Nozzle number shall include material designation:
G=Pyrex glass Q=Quartz SS=Stainless steel T=Teflon
Three diameters must be measured and recorded.

TRC

THERMOCOUPLE CALIBRATION FORM (for TRC SOP AM-103)

ASTM Thermometer Serial No.: 5379
Thermocouple Calibrator
Make: _____ Model: _____ Serial No.: _____
Operator: Paul Clark Date: 1/6/04
Pretest: _____ Posttest: X

Thermocouple ID	Reference Temp 1, °F	Temp. Reading 1, °F	Criteria	Criteria Met	Reference Temp 2, °F	Temp. Reading 2, °F	Criteria	Criteria Met
Meter In	63	63	+/- 2°F	✓				
Meter Out	63	63		✓				
Probe	63	63		✓				
Probe Heat	63	64		✓				
Imp Exit	63	62	↓	✓				

Thermocouple ID	Reference Temp 3, °F	Temp. Reading 3, °F	Criteria	Criteria Met	Reference Temp 4, °F	Temp. Reading 4, °F	Criteria	Criteria Met

Criteria: Percent difference between the Reference Temperature and the Average Temperature can be only ± 1.5%°R.

Equation: $\frac{[(\text{Ref. Temp.} + 460) - (\text{Temp. Reading} + 460)] \times 100}{(\text{Ref. Temp.} + 460)}$

QA/QC Check By: DC Trevino
Date: 01.06.04

Figure 1. Thermocouple Calibration Sheet

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NIST-TRACEABLE CALIBRATION CERTIFICATE

Catalog Number **17006-03**
Certificate Reference Number **4145105-00-1**
Purchase Order Number **JAASLAND72403**

Unit Under Test 1: 08003-53
Description: Ertco ASTM Glass Thermometer; range 18 - 89F; total immersion; 379 mm total length
Serial Number 1: 5379
Equipment Condition: USED

Certificate Completed for:
TRC ENVIRONMENTAL CORP
19501 144TH AVENUE NE
D 700
WOODINVILLE WA 98072

InnoCal certifies that the calibration of the listed units, used procedure number MWI-17006-03 with equipment traceable to the National Institute of Standards and Technology (NIST), and the test was performed in accordance with ANSI/NCSL Z540-1, ISO 17025.

Calibration has shown the equipment to meet with manufacturer tolerances listed on the next page.

Actual uncertainties available upon request

Calibration Standards Used

Manufacturer	Function Performed	Model Number	Serial Number	Due Date
Burns Engineering	Platinum Resistance Probe	3925	403541	10/30/03
Ertco/Hart	Temperature Indicator	850	155	11/11/03

Lab Technician: 321

Date Completed: 07/25/2003 **Issue Date: 07/25/2003** **Received Date: 07/21/2003**

This certificate shall not be reproduced except in full and requires written approval from InnoCal
** Results data shown relates only to above listed item(s)*

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NIST-TRACEABLE CALIBRATION CERTIFICATE

Catalog Number **17006-03** Certificate Reference Number **4145105-00-1**

Instrument Tolerance

Unit 1: ±1 scale division

	Equipment "As Found"				Equipment "As Left"		
Measured In:	Test Points	Reading	Deviation	O.O.T	Test Points	Reading	Deviation
°F	32.155	32.0	-0.155	✓	32.155	32.0	-0.155
°F	54.903	55.0	0.097	✓	54.903	55.0	0.097
°F	83.345	83.4	0.055	✓	83.345	83.4	0.055

**** Note **** Check mark under the O.O.T column indicates the equipment is Out Of Tolerance.

This certificate was performed under the climate controlled lab conditions of: **20** °C **57** %RH **995** mbar

Additional Comments:

This certificate shall not be reproduced except in full and requires written approval from InnoCal.
** Results data shown relates only to above listed item(s)*

ALTERNATIVE METHOD 2
THERMOCOUPLE CALIBRATION PROCEDURE

INTRODUCTION

In EPA Method 2, EPA recommended the use of an extrapolation technique for a simplified, post-test, thermocouple calibration procedure using a two point calibration: (1) ice bath and (2) boiling water. Because of the inherent accuracy and precision of the thermocouple within ±1.3°F in the range of -32°F to 2500°F, the two-point post-test calibration procedure may be replaced with a single-point check.

A single-point calibration procedure that checks the operation of a thermocouple system within ±1.0 percent of the absolute measured temperature is all that is necessary to check the system for the presence of disconnected wire junctions, other loose connections, or a potential miscalibrated emf readout. A system that performs accurately at one temperature is expected to behave similarly at other temperatures.

Therefore, an alternative to the Method 2, two-point, thermocouple calibration can be used and the procedure is as follows:

ALTERNATIVE POST-TEST AND RECOMMENDED PRETEST CALIBRATION PROCEDURE

After each test run series, check the accuracy (and, hence, the calibration) of each thermocouple system at ambient temperature, or any other temperature, within the range specified by the manufacture, using a reference thermometer (either ASTM reference thermometer or a thermometer that has been calibrated against an ASTM reference thermometer). The temperatures of the thermocouple and reference thermometers shall agree to within ±2°F.

A crimp in the connecting wires or crossed lines that change the location of the reference junction will affect readings. Check the continuity of the thermocouple by subjecting it to a change in the temperature (e.g.., removing it from the stack or touching an ice cube). This step will also check for loose connections and reversed connections (noted by a wrong change in the temperature).

To ensure linearity of the measurements, it is recommended that the emf meter be originally calibrated against a NIST traceable or a comparable voltage source at several points covering the range of intended use, e.g., 0, 500, 1000, and 2000°F.

REFERENCE

1. Shigehara, R.T., E.W. Stewart, Kenneth Alexander, "Simplified Thermocouple Calibration Procedure", Entropy, Incorporated, contained in the EMTIC TSAR Library.

PRETEST METER BOX CALIBRATION

Meter No.	28579
Pbar:	30.03

Calibration Test Meter (CTM)		Date:	2/27/2003
SDGM Serial No.:	971654	Operator:	M. Ellis

			Meter Volume	Temperatures, °F Meter In	Temperatures, °F Meter Out	CTM Volume	CTM Temp., °F	CTM Y_d	CTM Flow Rate (SCFM)
Delta H	0.5	Start	192.667	80	70	904.298	66		
				81	71		66		
				81	71		66		
Time (min)	15.00	Stop	198.965	81	71	910.407	66		
		Total	6.298			6.109	66.00		
		Average		75.75				0.998500	0.410
			Meter Volume	Temperatures, °F Meter In	Temperatures, °F Meter Out	CTM Volume	CTM Temp., °F	CTM Y_d	CTM Flow Rate (SCFM)
Delta H	1.0	Start	201.745	86	72	913.097	67		
				88	74		67		
				89	75		68		
Time (min)	15.00	Stop	210.420	89	75	921.506	68		
		Total	8.675			8.409	67.50		
		Average		81.00				0.998500	0.562
			Meter Volume	Temperatures, °F Meter In	Temperatures, °F Meter Out	CTM Volume	CTM Temp., °F	CTM Y_d	CTM Flow Rate (SCFM)
Delta H	1.5	Start	215.287	88	76	926.232	69		
				92	77		69		
				92	77		69		
Time (min)	15.00	Stop	225.978	92	77	936.602	69		
		Total	10.691			10.370	69.00		
		Average		83.88				0.998500	0.692
			Meter Volume	Temperatures, °F Meter In	Temperatures, °F Meter Out	CTM Volume	CTM Temp., °F	CTM Y_d	CTM Flow Rate (SCFM)
Delta H	2.0	Start	229.880	94	78	940.392	69		
				94	78		69		
				95	79		69		
Time (min)	15.00	Stop	242.160	95	79	952.305	69		
		Total	12.280			11.913	69.00		
		Average		86.50				0.998500	0.795
			Meter Volume	Temperatures, °F Meter In	Temperatures, °F Meter Out	CTM Volume	CTM Temp., °F	CTM Y_d	CTM Flow Rate (SCFM)
Delta H	3.0	Start	260.552	89	74	970.362	69		
				89	74		69		
				92	75		69		
Time (min)	15.00	Stop	275.482	92	75	984.982	69		
		Total	14.930			14.620	69.00		
		Average		82.50				0.998500	0.975

Acceptable Tolerances:
Y = +/- 0.02 from the average
dH@ = +/- 0.2 from the average

t	dH	Y	Variation	Delta H@	Variation
1	0.5	0.9853	-0.0065	1.656	-0.0636
2	1.0	0.9902	-0.0015	1.743	0.0235
3	1.5	0.9921	0.0003	1.722	0.0024
4	2.0	0.9958	0.0041	1.733	0.0139
5	3.0	0.9954	0.0036	1.743	0.0238
Average	Average	0.9918		1.719	
			PASSED		PASSED

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POST TEST METER BOX CALIBRATION

Meter No.	28579
Pbar:	30.12

Calibration Test Meter (CTM)		Date:	12/29/2003
SDGM Serial No.:	28610	Operator:	M.Ellis

			Meter Volume	Temperatures, °F Meter In	Temperatures, °F Meter Out	CTM Volume	CTM Temp., °F	CTM Y_d	CTM Flow Rate (SCFM)
Delta H	1.0	Start	240.498	69	64	185.578	63		
				74	65		63		
				77	65		63		
Time (min)	15.00	Stop	249.005	77	66	194.004	63		
		Total Average	8.507	69.63		8.426	63.00	0.999000	0.570
			Meter Volume	Temperatures, °F Meter In	Temperatures, °F Meter Out	CTM Volume	CTM Temp., °F	CTM Y_d	CTM Flow Rate (SCFM)
Delta H	1.0	Start	249.005	77	66	194.004	63		
				78	68		63		
				78	68		63		
Time (min)	15.00	Stop	257.585	78	68	202.468	63		
		Total Average	8.580	72.63		8.464	63.00	0.999000	0.573
			Meter Volume	Temperatures, °F Meter In	Temperatures, °F Meter Out	CTM Volume	CTM Temp., °F	CTM Y_d	CTM Flow Rate (SCFM)
Delta H	1.0	Start	257.585	78	68	202.468	63		
				78	68		63		
				80	69		63		
Time (min)	15.00	Stop	266.227	80	69	210.971	63		
		Total Average	8.642	73.75		8.503	63.00	0.999000	0.576

Acceptable Tolerances:
Y = +/-5% of Pretest Y

Pretest Y- 5%	0.942
Pretest Y	0.992
Pretest Y + 5%	1.041

dH	Y	Variation
1.0	0.9996	-0.0009
1.0	1.0012	0.0007
1.0	1.0007	0.0002
Average	1.0005	
	PASSED	

APPENDIX E

PROJECT PARTICIPANTS

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Spectrum Glass Company

Mr. Larry Witsell, Glass Technologist
Ms. Sherry Van Mondfrans, Environmental & Safety Manager

Puget Sound Clean Air Agency (PSCAA)

Mr. Fred Austin, P.E., Source Test Engineer
Mr. John Schantz, Inspector

TRC Environmental Corporation

Mr. Wesley D. Snowden, Senior Program Manager
Mr. Paul Clark, Field Team Leader / NW Air Measurements Manager
Mr. Doug Towne, Sample Team Member / Project Manager
Mr. Matt Ellis, Sample Team Member
Ms. Judy Aasland, Report Preparation and Senior Project Assistant

YAKIMA REGIONAL CLEAN AIR AUTHORITY
NORTHWEST OPACITY CERTIFICATION
CERTIFICATE OF COMPLETION
PLUME EVALUATION TRAINING

Paul Clark

EPA REFERENCE METHOD 9 YES

CERTIFICATE NO WA-S97-23

EXPIRATION DATE 3/4/2004

BEARER'S SIGNATURE

PROGRAM COORDINATOR
NORTHWEST OPACITY CERTIFICATION

YAKIMA REGIONAL CLEAN AIR AUTHORITY
NORTHWEST OPACITY CERTIFICATION
CERTIFICATE OF COMPLETION
PLUME EVALUATION TRAINING

DOUG TOWNE

EPA REFERENCE METHOD 9 YES

CERTIFICATE NO 1499

EXPIRATION DATE 3/11/2004

BEARER'S SIGNATURE

PROGRAM COORDINATOR
NORTHWEST OPACITY CERTIFICATION