CLOW

CLOW WATER SYSTEMS COMPANY

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52

May 31, 2012

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AIR ENFORCEMENT BRANCH
U.S. EPA REGION 5

James M. Proctor II
McWane, Inc.
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Jeet Radia
McWane, Inc.
jradia@mcwane.com

Re: Consent Decree Civil Action No. [CV] 10-JEO-1902-S
NESHAP 40 CFR Part 63 Subpart ZZZZZ

Dear Sir/Madam:

Clow Water Systems Company (Clow) conducted a stack test on May 3, 2012 of its Cupola Scrubber System (P901) to demonstrate compliance with the Emission Limit of 0.078 pounds of particulate matter per ton of metal melted as required by the Consent Decree (Appendix 3 (III)).

In addition, observations were made for opacity at the Cupola Shroud and Flange Fabrication central roof vent using Method 9 and Method 22 respectfully in accordance with NESHAP 40 CFR Part 63 Subpart ZZZZZ.

A copy of the stack test report is enclosed. The results of the stack test are summarized below. All values are averages of three 60-minute test runs.

Emission Rate (lb PM/ton metal melted):	0.039
Operating Rate (ton metal melted/hr):	74
Scrubber System Total Pressure Drop (in. H_20):	78
Ring Jet Water Flow Rate (gpm):	810
Ring Jet Pump Pressure (psi):	35
Venturi Water Flow Rate (gpm):	450
Venturi Pump Pressure (psi):	17
Method 9 Cupola Shroud (max % VE):	15
Method 22 Flange Fabrication vent:	no VE observed

If you have any questions regarding the enclosed, please contact me at (740) 291-1087.

Sincerely,

Heather Rainwater

Heather Rainwater
Environmental Manager
Clow Water Systems Company

Superior Quality Emission Testing.

Valid Results Guaranteed.

Air Compliance Testing, Inc.

P.O. Box 41156 Cleveland, Ohio 44141
1-800-EPA-AIR1 www.aircomp.com
testing@aircomp.com

May 30, 2012

Heather Rainwater
Environmental Manager
Clow Water Systems Co.
PO Box 6001
Coshocton, Ohio 43812-6001

Dear Heather:

The following report provides the results of the compliance emission testing conducted on May 3, 2012. These results are a product of the application of the U.S. EPA Stationary Source Sampling Methods listed in 40 CFR Part 60 Appendix A that were in effect at the time of this test. To the best of my knowledge, this report has been checked for completeness, and the results presented are accurate, error-free, legible, and representative of the actual emissions measured during testing.

Please mail one copy of this report along with any other supportive process operating data collected during this test to your local EPA representative. You should also attach a cover letter (on company letterhead) stating the purpose and the outcome of this test. Additionally, you may address, preferably in a timetable format, any obligations or implications that might be necessary to achieve environmental compliance because of the result of this test.

Please do not hesitate to call if you have any questions or concerns about these test results. On behalf of Air Compliance Testing, I would also like to personally thank you for the opportunity to work with you on this testing project and would enjoy the opportunity to work with you again on any additional future testing projects.

Sincerely,

Robert J. Lisy, Jr.
Technical Manager

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1.0 INTRODUCTION

1.1 Summary of Test Program

Clow Water Systems Co. (Facility ID: 06-16-01-0006), located in Coshocton, Ohio, contracted Air Compliance Testing, Inc. of Cleveland, Ohio, to conduct compliance stack emission testing for their Cupola Emission System (P901). Testing was performed to satisfy the emission testing requirements pursuant to Appendix 3 Section III of the McWane, Inc. Consent Decree and the testing requirements outlined in the National Emission Standards for Hazardous Air Pollutants (NESHAP) for Iron and Steel Foundries Area Sources (40 CFR Part 63 Subpart ZZZZZ). The testing was performed on May 3, 2012.

Sampling was performed at the P901 Scrubber Exhaust Stack to determine the emissions of filterable particulate matter (PM). In addition, observations were performed at the P901 Scrubber System Shroud Area to determine the percent opacity of visible emissions (VE's). Testing was conducted during maximum achievable operations. During this test, emissions from P901 were controlled by an afterburner, wet cap, venturi scrubber, and Ring Jet scrubber system which includes packed bed, Ring Jets and demister.

The test methods that were conducted during this test were EPA Methods 1, 2, 3, 4, 5, and 9.

1.2 Key Personnel

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

Heather Rainwater, Environmental Manager, Clow Water Systems Company, 740-622-6651
Marco Deshaies, Ohio EPA, SEDO DAPC, 740-380-5255
Tyson Houchin QSTI, Operations Director, Air Compliance Testing, Inc., 800-372-2471
Sin Hoi Chiew QI, Reporting Engineer, Air Compliance Testing, Inc., 800-372-2471

2.0 SUMMARY AND DISCUSSION OF TEST RESULTS

2.1 Objectives and Test Matrix

The purpose of this test was to determine the emissions of filterable PM at the P901 Scrubber System Exhaust Stack and the percent opacity of VE's at the P901 Scrubber System Shroud Area during maximum achievable operations. Testing was performed to satisfy the emission testing requirements pursuant to Appendix 3 Section III of the McWane, Inc. Consent Decree and the testing requirements outlined in 40 CFR Part 63 Subpart ZZZZZ.

The specific test objectives for this test were to:

Measure the concentration of filterable PM at the P901 Scrubber System Exhaust Stack.

Measure the dry standard and actual volumetric flow rate of the stack gas at the P901 Scrubber Exhaust Stack.

Utilize the above variables to determine the emissions of filterable PM at the P901 Scrubber Exhaust Stack during maximum achievable operations.

Determine the VE's (as %-opacity) at the P901 Scrubber System Shroud Area during maximum achievable operations.

Table 2.1 presents the sampling and analytical matrix log for this test.

2.2 Field Test Changes and Problems

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

2.3 Presentation of Results

A single sampling train was utilized during each run at the P901 Scrubber Exhaust Stack to determine the emissions of filterable PM. This sampling train measured the stack gas volumetric flow rate, dry molecular weight, moisture content, and concentration of filterable PM.

Table 2.2 displays the emissions of filterable PM measured at the P901 Scrubber Exhaust Stack and the minimum, maximum, and six-minute average opacity readings at the P901 Scrubber System Shroud Area.

Tables 2.3.1 - 2.3.3 display the measured results for the VE readings at the P901 Scrubber System Shroud Area. The data displays the minimum, maximum, and maximum six-minute average opacity readings.

			EPA TEST METHODS UTILIZED				
			M1/M2 (Flow)	M3 (Dry Mol. Wt.)	M4 (%H_2O)	M5 (Filterable PM)	M9 (VE's)
Date	Run No.	Sampling Location	Sampling Time / Duration (min)	Sampling Time / Duration (min)	Sampling Time / Duration (min)	Sampling Time / Duration (min)	Sampling Time / Duration (min)
5/3/2012	1	P901 Scrubber Exhaust Stack	9:20 - 10:33 60	9:20 - 10:33 60	9:20 - 10:33 60	9:20 - 10:33 60	9:20 - 10:33 60
5/3/2012	2	P901 Scrubber Exhaust Stack	11:15 - 12:24 60	11:15 - 12:24 60	11:15 - 12:24 60	11:15 - 12:24 60	11:15 - 12:24 60
5/3/2012	3	P901 Scrubber Exhaust Stack	13:04 - 14:24 60	13:04 - 14:24 60	13:04 - 14:24 60	13:04 - 14:24 60	13:04 - 14:24 60

All times are Eastern Daylight Time.

Table 2.1 - Sampling and Analytical Matrix

	P901 Scrubber Exhaust Stack			
	Run 1	Run 2	Run 3	Average
Total Metal Charged (ton/hr)*	71.0	74.0	78.0	74.3
Filterable Particulate Matter Mass Emission Rate (lb/ton)	0.031	0.037	0.051	0.039
Filterable Particulate Matter Mass Emission Rate (lb/hr)	2.18	2.72	3.97	2.96
Filterable Particulate Matter Concentration (grains/dscf)	0.0047	0.0059	0.0087	0.0064
Maximum Six-Minute Average of Visible Emissions (% opacity)	10.83	9.79	9.17	9.93
Minimum Reading (% opacity)	0	0	0	-
Maximum Reading (% opacity)	15	15	15	-
Stack Gas Average Flow Rate (acfm)	74,074	73,249	73,029	73,451
Stack Gas Average Flow Rate (scfm)	61,214	60,670	60,435	60,773
Stack Gas Average Flow Rate (dscfm)	54,424	53,830	53,040	53,765
Stack Gas Average Velocity (fpm)	3,411	3,373	3,363	3,382
Stack Gas Average Static Pressure (in-H_2O)	0.45	0.46	0.44	0.45
Stack Gas Average Temperature (°F)	162	162	162	162
Stack Gas Percent by Volume Moisture (%H_2O)	11.09	11.27	12.24	11.53
Measured Stack Inner Diameter (in)†	63 X 63.2	63 X 63.2	63 X 63.2	63 X 63.2
Percent by Volume Carbon Dioxide in Stack Gas (%-dry)	9.67	9.83	9.83	9.78
Percent by Volume Oxygen in Stack Gas (%-dry)	12.50	11.67	10.50	11.56
Percent by Volume Nitrogen in Stack Gas (%-dry)	77.83	78.50	79.67	78.67

* Provided by Clow Water Systems personnel.

† The P901 Scrubber Exhaust Stack was elliptical in shape.

Table 2.2 - Emission Results

Max 6 min average	10.83
Minimum Reading	0
Maximum Reading	15.00

Start Time	9:20
End Time	10:33

Sec.	0	15	30	45	Six minute averages:			
Min.								
0	0	0	0	5	2.50	2.71	2.92	3.13
1	5	0	0	0	2.92	2.71	2.71	2.71
2	5	5	5	5	2.92	3.13	3.54	3.54
3	10	5	0	0	3.54	3.13	3.13	3.33
4	5	5	5	0	3.75	3.54	3.33	3.13
5	0	0	0	0	3.13	3.13	3.13	3.13
6	5	5	5	0	3.13	2.92	2.92	2.92
7	0	0	0	5	3.33	3.75	3.75	3.75
8	10	15	5	5	3.54	3.13	2.50	2.50
9	0	5	5	10	2.50	2.50	2.29	2.29
10	0	0	0	0	2.08	2.08	2.08	2.29
11	0	0	0	0	2.29	2.29	2.29	2.29
12	0	5	5	10	2.29	2.71	2.92	3.33
13	10	0	0	0	3.54	3.75	4.17	4.58
14	0	0	5	5	4.79	5.00	5.21	5.21
15	0	0	5	5	5.21	5.42	5.63	5.42
16	0	0	5	0	5.21	5.21	5.21	5.00
17	0	0	0	0	5.00	5.00	5.00	5.00
18	10	10	15	15	5.00	4.58	4.17	3.54
19	15	10	10	5	2.92	2.50	2.29	2.08
20	5	5	5	5	1.88	1.67	1.46	1.46
21	5	5	0	0	1.25	1.04	0.83	0.83
22	0	0	0	0	1.04	1.25	1.67	2.08
23	0	0	0	0	2.29	2.29	2.29	2.29
24	0	0	0	0	2.50	2.92	3.13	3.13
25	5	5	5	0	3.13	2.92	2.71	2.50
26	0	0	5	0	2.71	2.71	2.92	2.71
27	0	0	0	5	2.92	3.33	3.75	4.17
28	5	10	10	5	4.38	4.38	4.17	3.96
29	0	0	0	5	3.96	4.17	4.58	5.00
30	10	5	0	0	5.21	5.21	5.42	6.04
31	0	0	0	5	6.46	6.67	6.88	7.08
32	0	5	0	5	7.08	7.50	7.71	7.92
33	10	10	10	10	7.92	7.71	7.50	7.29
34	5	5	5	5	7.08	7.08	7.29	7.29
35	5	10	10	10	7.29	7.50	7.50	7.29
36	10	10	15	10	7.08	7.08	7.08	6.67
37	5	5	5	5	6.46	6.88	7.29	7.71
38	10	10	5	5	7.92	7.92	7.92	8.13
39	5	5	5	5	8.33	8.54	8.75	8.96
40	5	10	5	5	9.17	9.38	9.38	9.79
41	10	10	5	5	10.00	10.00	10.00	10.21
42	10	10	5	5	10.42	10.42	10.42	10.63
43	15	15	15	10	10.83	10.63	10.21	9.58
44	10	10	10	10	9.38	9.17	8.96	8.75
45	10	10	10	10	8.54	8.33	8.13	7.92
46	10	10	15	10	7.71	7.50	7.29	6.88
47	10	10	10	10	6.67	6.46	6.25	6.04
48	10	10	10	10	5.83	5.63	5.42	5.21
49	10	5	0	5	5.00	4.79	4.79	4.79
50	5	5	5	5	4.58	4.38	4.38	4.38
51	5	5	5	5	4.38	4.17	3.96	3.75
52	5	5	5	5	3.54	3.54	3.54	3.54
53	5	5	5	5	3.54	3.54	3.54	3.54
54	5	5	5	5	3.54			
55	5	5	0	0				
56	0	5	5	5				
57	0	0	0	0				
58	5	5	5	5				
59	5	5	5	5				

Table 2.3.1 - Visible Emissions - Run 1

Max 6 min average	9.79
Minimum Reading	0
Maximum Reading	15.00

Start Time	11:15
End Time	12:24

Sec.	0	15	30	45	Six minute averages:			
Min.								
0	5	5	5	5	5.00	5.00	5.00	5.21
1	5	5	5	5	5.42	5.42	5.42	5.63
2	5	0	0	0	5.83	5.63	5.83	6.04
3	5	5	5	5	6.25	6.25	6.25	6.25
4	5	10	10	10	6.25	6.25	6.04	6.04
5	5	5	5	5	6.04	6.04	6.04	6.04
6	5	5	10	10	6.25	6.46	6.67	6.67
7	5	5	10	10	6.67	6.88	7.08	7.08
8	0	5	5	5	7.08	7.50	7.71	7.92
9	5	5	5	5	8.13	8.54	8.75	8.75
10	5	5	10	10	8.75	8.75	8.96	8.96
11	5	5	5	10	9.17	9.17	9.17	9.38
12	10	10	10	10	9.38	9.38	9.38	9.58
13	10	10	10	10	9.58	9.79	9.79	9.79
14	10	10	10	10	9.79	9.58	9.38	9.38
15	15	10	5	5	9.38	9.17	8.96	8.96
16	5	10	10	15	8.96	9.17	8.96	8.96
17	5	5	10	10	8.75	8.96	9.17	8.96
18	10	10	15	10	8.96	9.17	8.96	8.75
19	15	10	10	10	8.54	8.13	7.92	7.92
20	5	5	10	10	7.71	7.71	7.71	7.50
21	10	5	5	5	7.50	7.50	7.50	7.50
22	10	5	10	10	7.50	7.29	7.29	7.08
23	10	10	5	10	6.88	6.67	6.67	6.88
24	15	5	10	5	6.88	6.46	6.46	6.25
25	5	5	10	5	6.04	5.83	5.83	5.63
26	5	5	5	10	5.63	5.63	5.83	6.04
27	10	5	5	5	6.04	6.04	6.25	6.46
28	5	5	5	5	6.88	6.88	6.88	6.88
29	5	10	10	10	7.08	7.29	7.08	6.67
30	5	5	5	0	6.67	6.88	6.88	7.08
31	0	5	5	5	7.50	7.92	8.13	8.13
32	5	10	10	10	8.13	8.13	7.92	7.71
33	10	10	10	15	7.50	7.29	7.08	6.88
34	5	5	5	10	6.67	6.88	7.08	7.29
35	10	5	0	10	7.08	6.88	6.88	7.08
36	10	5	10	10	7.08	7.08	7.08	7.08
37	10	10	5	5	6.88	6.67	6.67	6.88
38	5	5	5	5	7.08	7.29	7.29	7.50
39	5	5	5	10	7.71	7.92	8.13	8.33
40	10	10	10	5	8.13	8.13	8.13	7.92
41	5	5	5	10	7.92	8.13	8.13	8.33
42	10	5	10	5	8.33	8.13	8.13	7.92
43	5	10	10	10	8.13	7.92	7.71	7.50
44	10	5	10	10	7.29	6.88	6.67	6.46
45	10	10	10	5	6.25	6.04	5.83	5.63
46	10	10	5	5	5.63	5.63	5.42	5.42
47	10	5	10	10	5.42	5.42	5.63	5.63
48	5	5	5	10	5.42	5.42	5.63	5.83
49	0	5	5	5	5.83	6.04	6.04	6.04
50	0	0	5	5	6.25	6.46	6.67	6.46
51	5	5	5	5	6.25	6.25	6.04	6.04
52	10	5	5	5	6.04	5.83	5.83	5.83
53	10	10	10	5	5.83	5.63	5.42	5.21
54	5	10	10	10	5.21			
55	5	5	5	10				
56	5	5	0	0				
57	5	0	5	5				
58	5	5	5	5				
59	5	5	5	5				

Table 2.3.2 - Visible Emissions - Run 2

Max 6 min average	9.17
Minimum Reading	0
Maximum Reading	15.00

Start Time	13:04
End Time	14:24

Sec.	0	15	30	45	Six minute averages:			
Min.								
0	5	10	5	5	7.71	7.92	7.71	7.92
1	5	5	5	10	8.13	8.13	8.13	8.13
2	10	10	10	10	8.13	7.92	7.92	7.92
3	15	10	10	10	7.71	7.29	7.08	6.88
4	5	5	10	5	6.67	6.88	6.88	6.67
5	10	5	5	5	6.67	6.46	6.67	6.88
6	10	5	10	10	6.88	6.88	7.08	7.08
7	5	5	5	10	7.08	7.29	7.29	7.29
8	5	10	10	5	7.08	7.29	7.29	7.29
9	5	5	5	5	7.50	7.50	7.50	7.71
10	10	5	5	5	7.92	7.92	8.13	8.33
11	5	10	10	5	8.54	8.75	8.75	8.75
12	10	10	10	10	8.96	9.17	8.96	8.75
13	10	5	5	5	8.75	8.54	8.54	8.54
14	10	10	10	10	8.75	8.54	8.33	8.13
15	5	5	10	10	7.92	7.92	7.92	7.71
16	10	10	10	10	7.50	7.50	7.50	7.50
17	10	10	10	10	7.29	7.29	7.08	6.88
18	15	5	5	10	6.67	6.25	6.25	6.25
19	5	5	5	10	6.04	6.04	6.25	6.25
20	5	5	5	5	6.04	6.25	6.46	6.67
21	5	5	5	5	6.88	6.88	7.08	7.29
22	10	10	10	5	7.29	7.08	6.88	6.67
23	10	5	5	5	6.67	6.46	6.25	6.04
24	5	5	5	5	6.04	6.04	6.04	6.25
25	5	10	5	5	6.46	6.46	6.46	6.67
26	10	10	10	10	6.67	6.46	6.25	6.04
27	5	10	10	5	5.83	5.83	5.63	5.63
28	5	5	5	5	5.83	5.83	5.83	6.04
29	5	0	0	5	6.25	6.46	6.88	7.29
30	5	5	10	10	7.29	7.29	7.29	7.08
31	5	10	10	5	6.88	6.88	6.67	6.67
32	5	5	5	5	6.88	7.08	7.08	7.08
33	5	5	10	10	6.88	6.67	6.46	6.04
34	5	5	10	10	5.63	5.42	5.42	5.21
35	10	10	10	5	5.21	5.21	5.21	5.21
36	5	5	5	5	5.42	5.63	5.83	6.04
37	5	5	10	10	6.04	6.04	6.04	5.83
38	10	5	5	0	5.63	5.42	5.42	5.42
39	0	0	0	0	5.63	5.83	6.25	6.46
40	0	5	5	10	6.67	6.88	6.88	6.88
41	10	10	10	10	6.67	6.46	6.25	6.04
42	10	10	10	5	5.83	5.63	5.63	5.42
43	5	5	5	5	5.63	5.83	6.04	6.04
44	5	5	5	5	6.04	5.83	5.83	5.83
45	5	10	5	5	5.83	5.83	5.63	5.83
46	5	5	5	5	6.04	6.46	6.88	7.08
47	5	5	5	5	7.29	7.50	7.71	7.92
48	5	10	5	10	8.13	8.33	8.33	8.54
49	10	10	5	5	8.54	8.33	8.13	8.13
50	0	5	5	5	8.13	8.33	8.54	8.54
51	5	5	10	10	8.54	8.75	8.96	8.96
52	15	15	10	10	8.75	8.54	8.33	8.13
53	10	10	10	10	8.13	8.13	8.13	8.13
54	10	10	10	10	8.13			
55	5	5	5	5				
56	5	10	5	5				
57	10	10	10	5				
58	10	10	5	10				
59	10	10	10	10				

Table 2.3.3 - Visible Emissions - Run 3

3.0 PLANT AND SAMPLING LOCATION DESCRIPTIONS

3.1 Process Description and Operation

Clow Water Systems Company manufactures ductile iron pipe and fittings. As part of the grey and ductile iron casting process, scrap metal is melted in a cupola, poured into specially designed sand molds or centrifugal casting machines, and then, undergoes a controlled solidification and cooling process. The P901 Cupola Melting Furnace was in operation for this test event and has a permitted capacity of 85 tons/hr.

Figure 3.1 depicts the process schematic.

3.2 Control Equipment Description

During this test, emissions from P901 were controlled by an afterburner, wet cap, venturi scrubber, and Ring Jet scrubber system which includes packed bed, Ring Jets and demister.

3.3 Flue Gas Sampling Locations

The P901 Scrubber Exhaust Stack was elliptical in shape with measured inner diameters of 63.0-inches and 63.2-inches. The stack was oriented in the vertical plane and was accessed from a manlift. Two (2) 6.0-inch I.D. sampling ports were located 90° apart from one another at a location that met EPA Method 1, Section 11.1.1 criteria. During emissions sampling, the stack was traversed for stack gas volumetric flow rate, dry molecular weight, moisture content, and filterable PM concentration determination.

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

3.4 Process Sampling Location

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

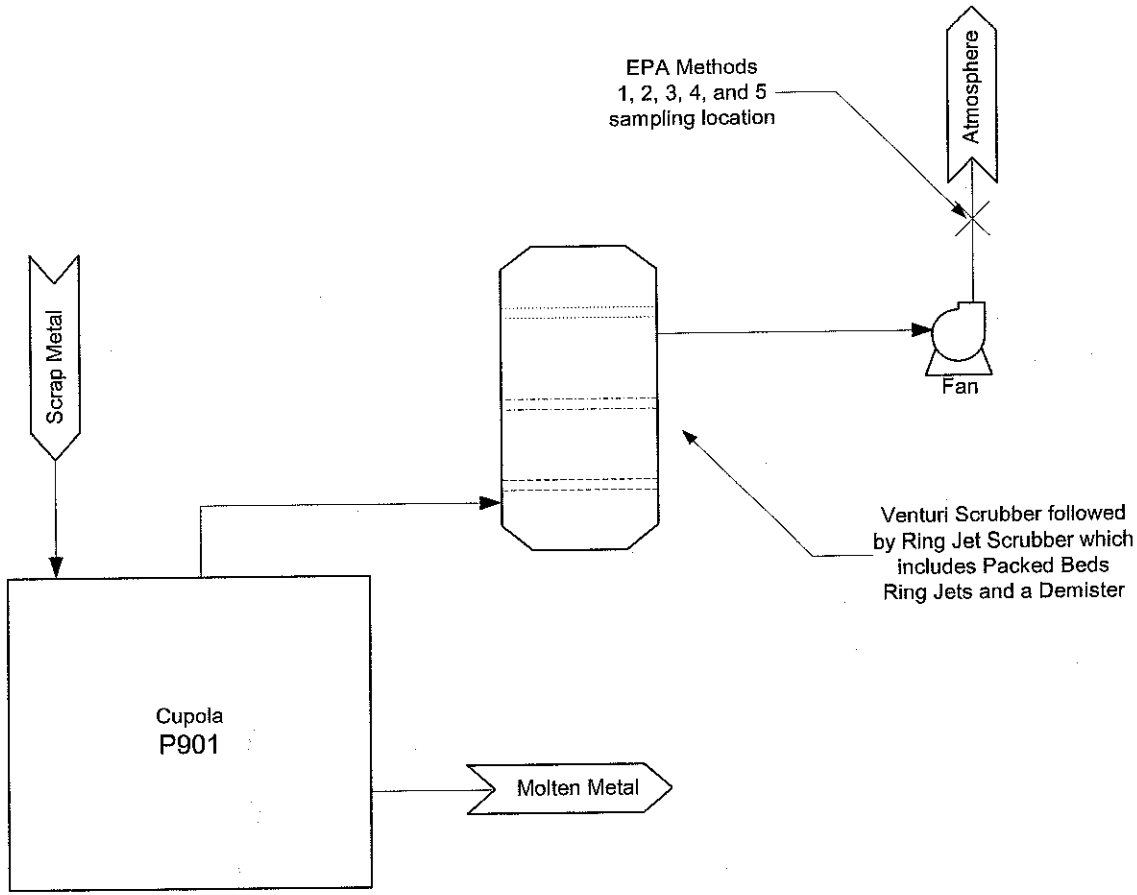
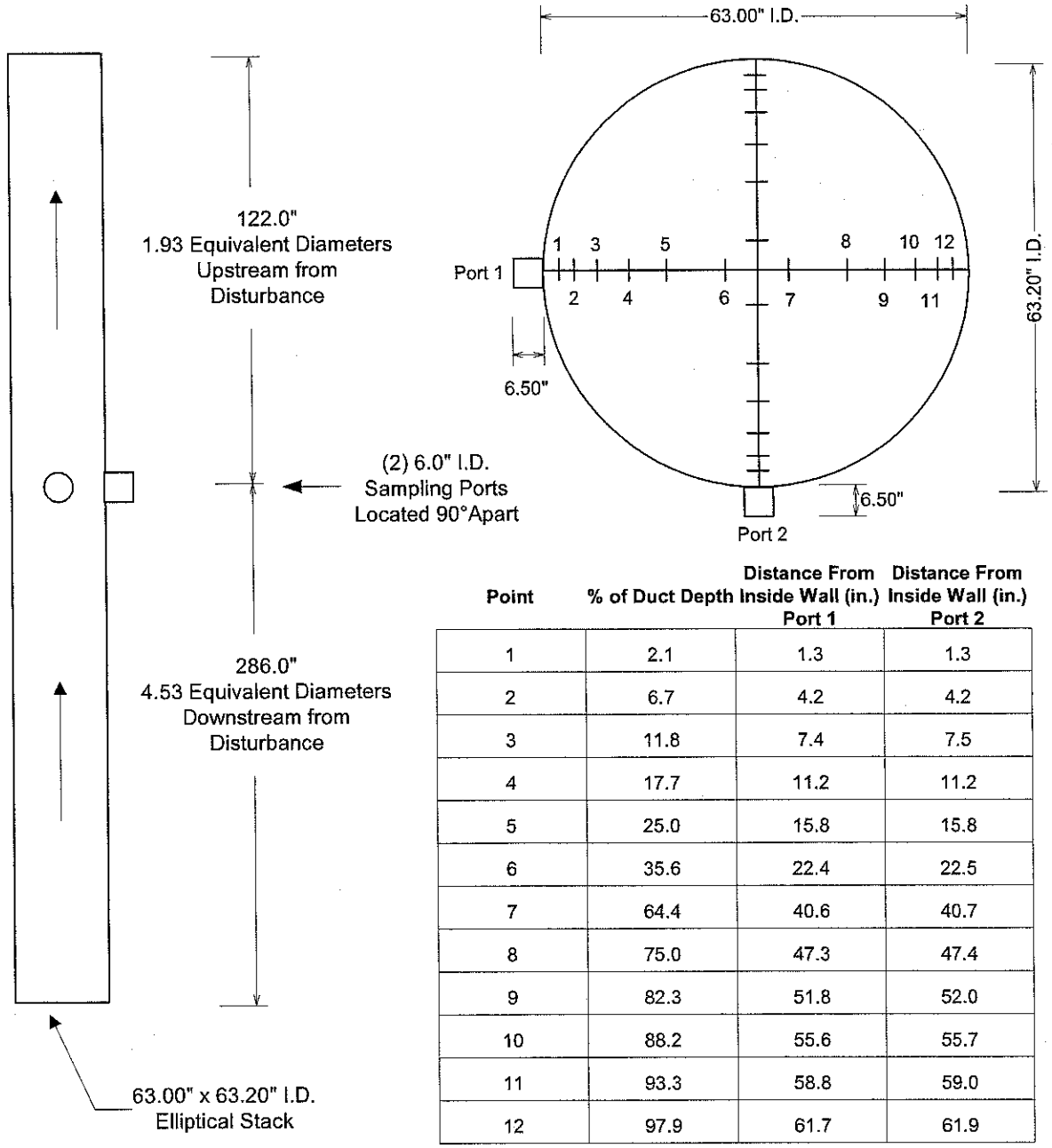


Figure 3.1 - Cupola Emission Control System Schematic



Point	% of Duct Depth	Distance From Inside Wall (in.) Port 1	Distance From Inside Wall (in.) Port 2
1	2.1	1.3	1.3
2	6.7	4.2	4.2
3	11.8	7.4	7.5
4	17.7	11.2	11.2
5	25.0	15.8	15.8
6	35.6	22.4	22.5
7	64.4	40.6	40.7
8	75.0	47.3	47.4
9	82.3	51.8	52.0
10	88.2	55.6	55.7
11	93.3	58.8	59.0
12	97.9	61.7	61.9

Figure 3.2 - P901 Scrubber Exhaust Stack Traverse Point Location Drawing

4.0 SAMPLING AND ANALYTICAL PROCEDURES

4.1 Test Methods

4.1.1 EPA Method 1: Sample and Velocity Traverses for Stationary Sources
Principle: To aid in the representative measurement of pollutant emissions and/or total volumetric flow rate from a stationary source, a measurement site where the effluent stream is flowing in a known direction is selected, and the cross-section of the stack is divided into a number of equal areas. A traverse point is then located within each of these equal areas. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.2 EPA Method 2: Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S)
Principle: The average gas velocity in a stack is determined from the gas density and from measurement of the average velocity head with a Type S (Stausscheibe or reverse type) pitot tube. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

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

4.1.4 EPA Method 4: Determination of Moisture Content in Stack Gases
Principle: A gas sample is extracted at a constant rate from the source; moisture is removed from the sample stream and determined either volumetrically or gravimetrically. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.5 EPA Method 5: Determination of Particulate Emissions from Stationary Sources (Filterable PM only)
Principle: Particulate matter (PM) is withdrawn isokinetically from the source and collected on a glass fiber filter maintained at a temperature in the range of 120 ± 14°C (248 ± 25°F) or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator, U.S. Environmental Protection Agency, for a particular application. The PM mass, which includes any material that condenses at or above the filtration temperature, is determined gravimetrically after removal of uncombined water. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.6 EPA Method 9: Visual Determination of the Opacity of Emissions from Stationary Sources
Principle: The opacity of emissions from stationary sources is determined visually by a qualified observer. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

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

4.2 Procedures for Obtaining Process Data

Process data was recorded by Clow Water Systems Co. personnel utilizing their typical record keeping procedures. Recorded process data was provided to Air Compliance Testing, Inc. personnel at the conclusion of this test event. The process data is located in Table 2.2 and in the Appendix.

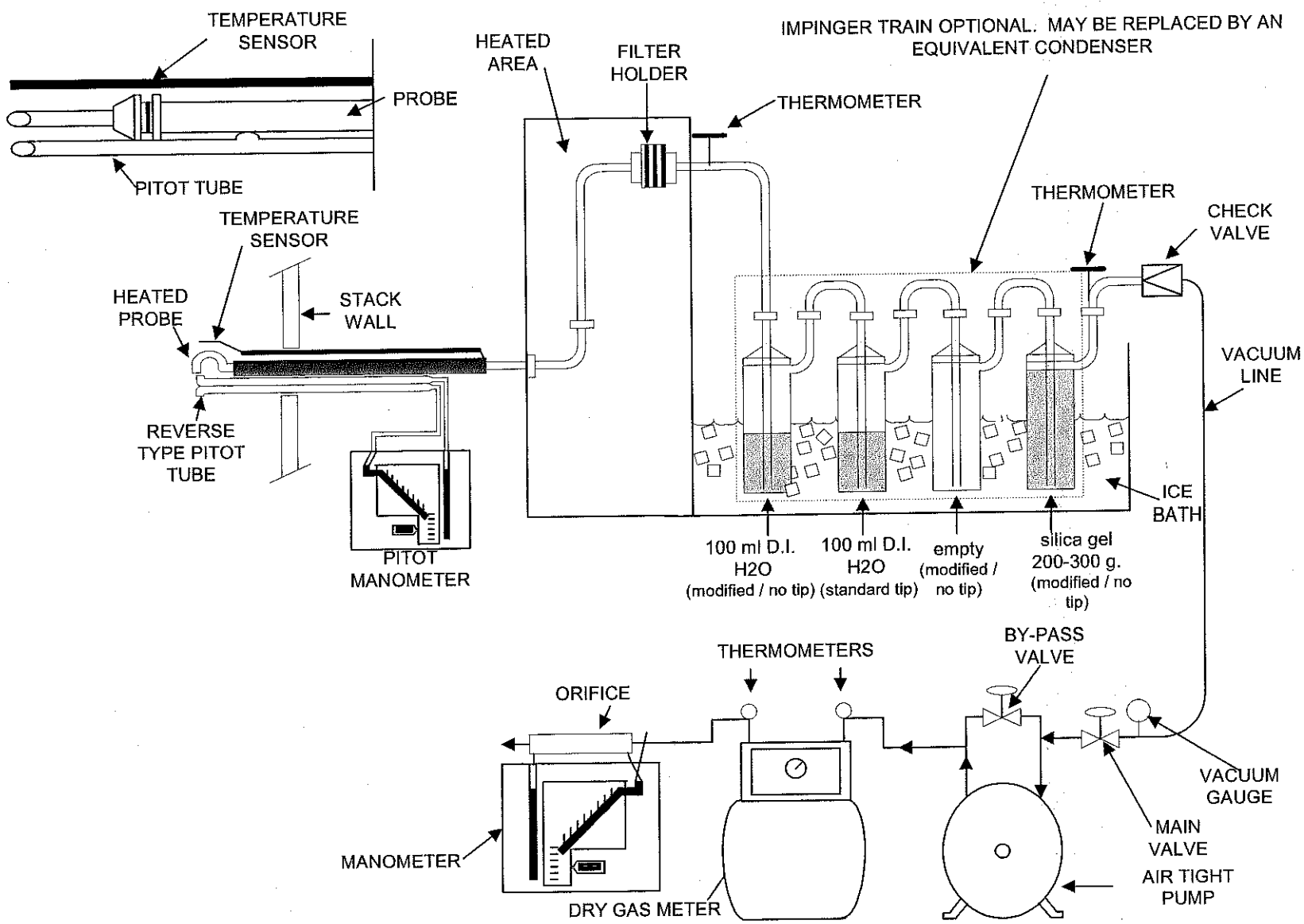


Figure 4.1 - EPA Method 5 Sampling Train Schematic

5.0 INTERNAL QA/QC ACTIVITIES

5.1 QA Audits

Tables 5.1 and 5.2 illustrate the QA audit activities that were performed during this test.

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

Kenneth Lievense was certified on February 7, 2012 as a Visible Emissions Evaluator. The expiration date is six months from the issue date.

For quality assurance, the observers obtained a view of the emissions with the best available contrasting background and with the sun oriented in the 140° sector to their back. Readings were taken every 15 seconds and made to the nearest 5% opacity.

5.2 QA/QC Problems

No QA/QC problems occurred during this test event.

	P901 Scrubber Exhaust Stack		
Method 5 Sampling Train	**Run 1**	**Run 2**	**Run 3**
Leak Rate Observed (Pre/Post) (cfm)	0.001 / 0.000	0.003 / 0.000	0.002 / 0.001
Applicable Method Allowable Leak Rate (cfm)	< 0.020	< 0.020	< 0.020
Acceptable	Yes	Yes	Yes
Volume of Dry Gas Collected (dscf)	36.246	36.180	34.661
Recommended Volume of Dry Gas Collected (dscf)	21.000	21.000	21.000
Acceptable	Yes	Yes	Yes
Percent of Isokinetic Sampling Rate (%)	102.2	103.1	100.2
Applicable Method Allowable Isokinetic Sampling Rate (%)	100 ± 10	100 ± 10	100 ± 10
Acceptable	Yes	Yes	Yes

Table 5.1 - EPA Method 5 Sample Train Audit Results Table

P901 Scrubber Exhaust Stack				
Pre-Test Dry Gas Meter Calibration Factor (Y)	Average Post-Test Dry Gas Meter Calibration Check Value (Yqa)	Post Test Dry Gas Meter Calibration Check Value Difference From Pre-Test Calibration Factor (%)	Applicable Method Allowable Difference (%)	Acceptable
1.0019	1.0184	1.65%	5.00%	Yes

Table 5.2 - EPA Method 5 Dry Gas Meter Audit Results Table

6.0 APPENDIX

Appendix attached.

APPENDIX

to

Compliance Stack Emission Test Report

Determination of Filterable Particulate Matter and Visible Emissions

Cupola Emission System (P901)

EPA Methods 1, 2, 3, 4, 5, and 9

Clow Water Systems Co.
Coshocton, Ohio

Date Conducted: May 3, 2012
Job Number: 120505

Prepared by:
Air Compliance Testing, Inc.
PO Box 41156
Cleveland OH 44141-0156
Phone: (800) EPA-AIR1 (372-2471)

Report Date: May 30, 2012

Appendix Contents

1-PROCESS DATA

- [x] Process Operational Data

2-LABORATORY DATA

- [x] Laboratory Results

3-FIELD DATA

- [x] Excel Test Data
- [x] Excel Method Specific Data
- [x] Excel Run Data
- [x] Example Calculation

- [ ] Test Log (CEMS Methods)
- [ ] Main Method Field Data Sheets
- [x] Isokinetic Field Data Sheets
- [ ] EPA Method 9 Field Data
- [x] EPA Method 4 and ALT-008 Moisture Recovery
- [x] EPA Method 3 Fyrite/Orsat Field Data
- [x] EPA Method 3 Dry Molecular Weight Calculation
- [ ] EPA Method 2 Flow Data Sheets
- [ ] EPA Method 1 Cyclonic Flow
- [x] EPA Method 1 Preliminary Field Data

4-CALIBRATIONS AND CERTIFICATIONS

ANALYZER CALIBRATIONS

- [ ] Analyzer Calibration Error
- [ ] Analyzer System Bias and System Drift

EQUIPMENT INSPECTIONS / CALIBRATIONS

- [x] Probe Nozzle Inspections
- [x] Pre-Test Pitot Tube / Probe Inspections
- [x] Post-Test Pitot Tube / Probe Inspections

- [x] Pre-Test Thermocouple System Audit
- [x] Post-Test Thermocouple Check

- [x] 10-Minute Cals
- [x] Pre-Test Meter Box Leak Check
- [x] Pre-Test Dry Gas Meter / Orifice Calibration
- [x] Pre-Test Meter Console Calibration
- [x] Post-Test dry Gas Meter ALT-009 Leak Check

- [ ] Post-Test Dry Gas Meter / Orifice and Console Calibration

- [ ] Post-Test Mini Meter / Orifice and Console Calibration

EQUIPMENT CERTIFICATIONS / HISTORY

- [x] Dry Gas Meter Calibration History
- [x] Aneroid Barometer/ DPG Calibration History
- [x] Acetone Residuals History

- [ ] Calibration Gas Certifications
- [ ] Calibration Gas Diluter Certifications
- [x] Quartz or Glass Fiber Filter Certification
- [x] True Primary Flow Standard
- [x] Reference Meter Calibration
- [ ] Micromanometer Certificate
- [x] Ω Thermocouple Certificate of Calibration
- [x] Lake Balance (Method 4 and ALT-008)
- [x] Lake Balance Report for H64 (Gravimetrics)
- [x] VE Azimuth Tables
- [x] VE Declination
- [x] VE Certificates
- [x] Intent to Test Notification / Test Protocol

CLOW WATER OPERATIONAL DATA
05/03/12 SUMMARY

					60 minute averages				
Run	Start Time	Pause Time	Stop Time	Total Metal Charged (ton/hr)	Emission System Total DP (in.H2O)	Ring Jet Water Flow Rate (gpm)	Ring Jet Pump Pressure (psi)	Venturi Water Flow Rate (gpm)	Venturi Pump Pressure (psi)
1	9:20am	9:50am-10:03am	10:33am	71	79	811	35	450	17
2	11:15am	11:45am-11:54pm	12:24pm	74	78	811	35	450	17
3	1:04pm	1:34pm-1:38pm; 1:40pm-1:52pm	2:24pm	78	77	810	35	450	17
			AVERAGE	**74**	**78**	**810**	**35**	**450**	**17**

Run 1

(9:20am - 9:50am; 10:03am - 10:33am)

Emission System Monitoring Data

Date	Time	Emission System Total DP (in.H2O)	Ring Jet Water Flow Rate (gpm)	Ring Jet Pump Pressure (psi)	Venturi Water Flow Rate (gpm)	Venturi Pump Pressure (psi)
05/03/12	09:20:05.560	80	811	35	449	17
05/03/12	09:21:05.811	81	811	35	451	17
05/03/12	09:22:05.828	79	811	35	451	17
05/03/12	09:23:05.830	79	814	35	451	17
05/03/12	09:24:05.847	81	811	35	448	17
05/03/12	09:25:05.849	77	811	35	449	17
05/03/12	09:26:05.866	79	810	35	447	17
05/03/12	09:27:05.867	80	811	35	448	17
05/03/12	09:28:05.869	79	811	35	449	17
05/03/12	09:29:05.886	80	811	35	450	17
05/03/12	09:30:05.888	81	811	35	451	17
05/03/12	09:31:05.905	77	813	35	449	17
05/03/12	09:32:05.906	80	810	35	450	17
05/03/12	09:33:05.923	78	813	35	452	17
05/03/12	09:34:05.925	79	813	35	450	17
05/03/12	09:35:05.942	80	813	35	448	17
05/03/12	09:36:06.006	79	811	35	449	17
05/03/12	09:37:06.008	79	812	35	451	17
05/03/12	09:38:06.025	80	812	35	450	17
05/03/12	09:39:06.026	78	809	35	450	17
05/03/12	09:40:06.028	80	811	35	447	17
05/03/12	09:41:06.108	79	810	35	450	17
05/03/12	09:42:06.109	81	812	35	448	17
05/03/12	09:43:06.111	80	812	35	450	17
05/03/12	09:44:06.128	80	813	35	451	17
05/03/12	09:45:06.129	79	810	35	449	17
05/03/12	09:46:06.146	80	810	35	450	17
05/03/12	09:47:06.148	80	811	35	449	17
05/03/12	09:48:06.165	79	811	35	448	17
05/03/12	09:49:06.167	79	811	35	449	17
05/03/12	10:03:06.719	80	811	35	452	17
05/03/12	10:04:06.737	80	811	35	452	17
05/03/12	10:05:06.738	80	811	35	450	17
05/03/12	10:06:06.755	78	812	35	449	17
05/03/12	10:07:06.757	79	810	35	451	17
05/03/12	10:08:06.774	79	812	35	452	17
05/03/12	10:09:06.791	78	812	35	449	17
05/03/12	10:10:06.793	77	812	35	449	17
05/03/12	10:11:06.794	78	810	35	450	17
05/03/12	10:12:06.811	79	811	35	449	17
05/03/12	10:13:06.813	79	814	35	448	17
05/03/12	10:14:06.815	80	811	35	449	17
05/03/12	10:15:06.832	77	811	35	448	17
05/03/12	10:16:06.833	78	810	35	450	17
05/03/12	10:17:06.850	79	811	35	449	17
05/03/12	10:18:06.852	80	812	35	450	17
05/03/12	10:19:06.869	79	811	35	450	17
05/03/12	10:20:06.871	81	810	35	450	17
05/03/12	10:21:06.872	79	810	35	451	17
05/03/12	10:22:06.889	78	809	35	451	17
05/03/12	10:23:06.891	78	810	35	449	17
05/03/12	10:24:06.908	79	810	35	450	17
05/03/12	10:25:06.910	81	811	35	448	17
05/03/12	10:26:06.911	79	811	35	450	17
05/03/12	10:27:06.928	81	810	35	452	17
05/03/12	10:28:06.930	79	811	35	451	16
05/03/12	10:29:06.931	78	810	35	447	17
05/03/12	10:30:06.948	79	811	35	450	17
05/03/12	10:31:06.950	78	811	35	453	17
05/03/12	10:32:06.967	77	810	35	450	18
	AVERAGE	**79**	**811**	**35**	**450**	**17**

Run 1

(9:20am - 9:50am; 10:03am - 10:33am)

Cupola Melt Data

Date	Time	Total Metal Charged (lb)	
05/03/12	09:22:09	7,020	
05/03/12	09:24:47	6,931	
05/03/12	09:27:23	6,999	
05/03/12	09:30:02	7,170	
05/03/12	09:32:39	7,113	
05/03/12	09:35:29	7,321	
05/03/12	09:38:08	6,964	
05/03/12	09:40:44	7,162	
05/03/12	09:43:21	6,980	
05/03/12	09:45:58	6,975	
05/03/12	09:48:36	7,120	
05/03/12	10:04:19	7,045	
05/03/12	10:08:06	7,030	
05/03/12	10:11:48	6,989	
05/03/12	10:15:15	7,015	
05/03/12	10:19:25	7,116	
05/03/12	10:22:47	7,091	
05/03/12	10:25:58	7,040	
05/03/12	10:28:43	6,921	
05/03/12	10:31:34	7,015	
	TOTAL	141,017	
	TOTAL	**71**	**ton/hr**

Run 2

(11:15am - 11:45am; 11:54am - 12:24am)

Emission System Monitoring Data

Date	Time	Emission System Total DP (in.H2O)	Ring Jet Water Flow Rate (gpm)	Ring Jet Pump Pressure (psi)	Venturi Water Flow Rate (gpm)	Venturi Pump Pressure (psi)
05/03/12	11:15:08.627	80	810	35	449	17
05/03/12	11:16:08.629	79	811	35	449	17
05/03/12	11:17:08.646	80	812	35	451	17
05/03/12	11:18:08.647	81	811	35	451	17
05/03/12	11:19:08.649	79	812	35	449	17
05/03/12	11:20:08.666	79	811	35	449	17
05/03/12	11:21:08.667	78	810	35	448	17
05/03/12	11:22:08.685	78	811	35	447	17
05/03/12	11:23:08.686	81	812	35	447	17
05/03/12	11:24:08.688	79	810	35	446	17
05/03/12	11:25:09.049	78	809	35	445	17
05/03/12	11:26:09.066	80	811	35	449	17
05/03/12	11:27:09.067	79	812	35	449	17
05/03/12	11:28:09.084	80	811	35	450	17
05/03/12	11:29:09.086	81	809	35	449	17
05/03/12	11:30:09.103	80	810	35	449	17
05/03/12	11:31:09.105	78	811	35	450	17
05/03/12	11:32:09.122	78	811	35	452	17
05/03/12	11:33:09.123	77	810	35	449	17
05/03/12	11:34:09.141	76	811	35	450	17
05/03/12	11:35:09.158	79	810	35	449	17
05/03/12	11:36:09.159	78	810	35	448	17
05/03/12	11:37:09.161	79	810	35	450	17
05/03/12	11:38:09.178	80	812	35	451	17
05/03/12	11:39:09.242	79	811	35	451	17
05/03/12	11:40:09.244	79	812	35	452	17
05/03/12	11:41:09.261	80	812	35	448	17
05/03/12	11:42:09.684	80	812	35	450	17
05/03/12	11:43:09.686	80	812	35	450	17
05/03/12	11:44:09.687	78	811	35	450	17
05/03/12	11:54:10.203	78	812	35	450	17
05/03/12	11:55:10.220	79	810	35	452	17
05/03/12	11:56:10.221	79	812	35	451	17
05/03/12	11:57:10.238	80	810	35	449	17
05/03/12	11:58:10.240	80	811	35	448	17
05/03/12	11:59:10.273	76	810	35	451	17
05/03/12	12:00:10.274	79	811	35	451	17
05/03/12	12:01:10.276	75	811	35	452	17
05/03/12	12:02:10.293	75	810	35	451	17
05/03/12	12:03:10.295	76	810	35	451	17
05/03/12	12:04:10.312	75	810	35	450	17
05/03/12	12:05:10.313	77	811	35	450	17
05/03/12	12:06:10.315	78	811	35	451	17
05/03/12	12:07:10.332	77	811	35	450	17
05/03/12	12:08:10.333	78	810	35	451	17
05/03/12	12:09:10.351	73	810	35	449	17
05/03/12	12:10:10.352	75	812	35	448	17
05/03/12	12:11:10.354	75	811	35	449	17
05/03/12	12:12:10.605	78	811	35	449	18
05/03/12	12:13:10.622	76	812	35	448	17
05/03/12	12:14:10.598	76	810	35	448	17
05/03/12	12:15:10.586	76	811	35	448	17
05/03/12	12:16:10.558	78	809	35	448	17
05/03/12	12:17:10.546	76	812	35	447	17
05/03/12	12:18:10.519	77	810	35	449	17
05/03/12	12:19:10.522	77	811	35	451	17
05/03/12	12:20:10.762	78	809	35	449	18
05/03/12	12:21:10.751	77	810	35	451	17
05/03/12	12:22:10.756	77	810	35	451	17
05/03/12	12:23:10.762	77	811	35	450	17
	AVERAGE	**78**	**811**	**35**	**450**	**17**

Run 2

(11:15am - 11:45am; 11:54am - 12:24am)

Cupola Melt Data

Date	Time	Total Metal Charged (lb)	
05/03/12	11:16:01	7,010	
05/03/12	11:18:38	7,000	
05/03/12	11:21:51	7,006	
05/03/12	11:24:51	7,029	
05/03/12	11:27:32	7,126	
05/03/12	11:31:12	7,434	
05/03/12	11:33:47	6,961	
05/03/12	11:36:25	6,981	
05/03/12	11:39:31	7,252	
05/03/12	11:42:25	7,066	
05/03/12	11:54:08	7,106	
05/03/12	11:57:36	7,001	
05/03/12	12:01:03	7,192	
05/03/12	12:03:53	7,087	
05/03/12	12:07:03	7,030	
05/03/12	12:10:19	7,051	
05/03/12	12:13:23	7,019	
05/03/12	12:16:00	7,015	
05/03/12	12:18:37	6,985	
05/03/12	12:21:14	6,990	
05/03/12	12:23:53	6,976	
	TOTAL	148,317	
	TOTAL	**74**	**ton/hr**

Run 3

(1:04pm - 1:34pm; 1:38pm - 1:40pm; 1:52pm - 2:24pm)

Emission System Monitoring Data

Date	Time	Emission System Total DP (in.H2O)	Ring Jet Water Flow Rate (gpm)	Ring Jet Pump Pressure (psi)	Venturi Water Flow Rate (gpm)	Venturi Pump Pressure (psi)
05/03/12	13:04:11.452	77	810	35	449	17
05/03/12	13:05:11.467	75	812	35	448	17
05/03/12	13:06:11.466	77	812	35	448	17
05/03/12	13:07:11.466	77	811	35	449	17
05/03/12	13:08:11.543	77	809	35	450	17
05/03/12	13:09:11.542	78	810	35	449	17
05/03/12	13:10:11.541	77	810	35	452	17
05/03/12	13:11:11.556	78	809	35	449	17
05/03/12	13:12:11.556	78	810	35	448	17
05/03/12	13:13:11.759	79	811	35	451	17
05/03/12	13:14:11.766	79	812	35	450	17
05/03/12	13:15:11.789	79	811	35	451	17
05/03/12	13:16:11.796	77	811	34	448	18
05/03/12	13:17:11.803	75	809	35	450	17
05/03/12	13:18:11.824	78	811	35	451	17
05/03/12	13:19:11.826	79	810	35	450	17
05/03/12	13:20:11.844	77	811	35	448	17
05/03/12	13:21:11.861	79	810	35	452	17
05/03/12	13:22:11.863	78	809	35	450	17
05/03/12	13:23:11.880	76	810	35	447	17
05/03/12	13:24:11.880	76	809	35	448	17
05/03/12	13:25:11.896	78	809	35	451	17
05/03/12	13:26:11.896	77	810	35	451	17
05/03/12	13:27:11.912	77	808	35	449	17
05/03/12	13:28:11.911	77	809	35	447	17
05/03/12	13:29:11.911	77	807	35	451	17
05/03/12	13:30:11.926	77	808	35	451	17
05/03/12	13:31:11.926	75	810	35	449	17
05/03/12	13:32:11.941	78	810	35	448	17
05/03/12	13:33:11.941	75	811	35	448	17
05/03/12	13:38:11.984	79	810	35	451	17
05/03/12	13:39:11.983	75	809	35	451	17
05/03/12	13:52:12.911	80	809	35	448	17
05/03/12	13:53:12.910	79	809	35	448	17
05/03/12	13:54:12.925	80	809	35	447	17
05/03/12	13:55:12.924	79	810	35	448	17
05/03/12	13:56:12.923	77	809	35	450	17
05/03/12	13:57:12.938	80	809	35	450	17
05/03/12	13:58:12.937	77	809	35	450	17
05/03/12	13:59:12.952	77	809	35	451	17
05/03/12	14:00:12.951	78	809	35	451	17
05/03/12	14:01:12.966	77	809	35	451	17
05/03/12	14:02:13.434	76	810	35	449	18
05/03/12	14:03:13.433	78	810	35	451	18
05/03/12	14:04:13.448	78	810	35	451	17
05/03/12	14:05:13.463	78	808	35	451	17
05/03/12	14:06:13.462	78	808	35	450	17
05/03/12	14:07:13.462	77	808	35	450	17
05/03/12	14:08:13.476	77	808	35	451	17
05/03/12	14:09:13.476	78	809	35	452	17
05/03/12	14:10:13.490	78	810	35	451	17
05/03/12	14:11:13.490	79	809	35	449	17
05/03/12	14:12:13.739	78	808	35	450	17
05/03/12	14:13:14.160	76	809	35	452	17
05/03/12	14:14:14.175	78	809	35	451	17
05/03/12	14:15:14.174	77	809	35	448	17
05/03/12	14:16:14.173	78	810	35	447	17
05/03/12	14:17:14.188	77	811	35	447	17
05/03/12	14:18:14.187	76	810	35	447	17
05/03/12	14:19:14.187	78	810	35	447	17
05/03/12	14:20:14.202	76	810	35	450	17
05/03/12	14:21:14.201	78	809	35	449	17
05/03/12	14:22:14.216	77	808	35	451	17
05/03/12	14:23:14.215	78	808	35	450	17
	AVERAGE	**77**	**810**	**35**	**450**	**17**

Run 3

(1:04pm - 1:34pm; 1:38pm - 1:40pm; 1:52pm - 2:24pm)

Cupola Melt Data

Date	Time	Total Metal Charged (lb)	
05/03/12	13:04:45	7,053	
05/03/12	13:08:03	7,076	
05/03/12	13:11:15	7,147	
05/03/12	13:14:00	7,217	
05/03/12	13:18:12	6,996	
05/03/12	13:22:26	7,152	
05/03/12	13:25:02	7,107	
05/03/12	13:27:39	7,118	
05/03/12	13:30:41	7,339	
05/03/12	13:33:18	7,107	
05/03/12	13:39:11	7,323	
05/03/12	13:54:53	7,027	
05/03/12	13:57:38	7,002	
05/03/12	14:00:34	7,107	
05/03/12	14:03:46	6,971	
05/03/12	14:06:23	7,016	
05/03/12	14:08:59	6,991	
05/03/12	14:11:37	7,081	
05/03/12	14:14:48	6,996	
05/03/12	14:17:24	7,053	
05/03/12	14:20:28	7,036	
05/03/12	14:23:10	7,047	
	TOTAL	155,962	
	TOTAL	**78**	**ton/hr**

Method 5 Filter Gravimetric

Plant Name: Clow Water Systems Location: Cupola Emission System (P901) Exhaust Stack

Run Number	1
Run Date	5.3.12
Filter Recovered By	JG
Were filters intact upon opening filter assembly?	Yes
Were there any visible filter fragments remaining on the frit after initial filter removal?**	Yes
Were filter fragments rinsed into acetone rinse container?	Yes
Sample Loading - lt / med / heavy	med
Sample Color	brown
Filter Number	5457
Petri Dish Number	191

Weight Number	Total Weight (g) (Includes Dish)*	Done By	Date/Time	Lab Temp/RH (°F)/(%)	PBar ("Hg)
1	3.0259	JG	5.6.12 / 8:04	74, 44	28.60
2	3.0260	JG	5.7.12 / 7:[illegible]	73, 46	28.45
3				/	
4				/	
5				/	
6				/	
7				/	
8				/	
9				/	
10				/	
Avg.	3.0260				

0.3812 Filter Tare Weight (g)

2.6352 Dish Tare Weight (g)

8.55 **Filter Catch Weight (mg)**

Describe Sample:

Run Number	2
Run Date	5.3.12
Filter Recovered By	JG
Were filters intact upon opening filter assembly?	Yes
Were there any visible filter fragments remaining on the frit after initial filter removal?**	Yes
Were filter fragments rinsed into acetone rinse container?	Yes
Sample Loading - lt / med / heavy	med
Sample Color	brown
Filter Number	5459
Petri Dish Number	217

Weight Number	Total Weight (g) (Includes Dish)*	Done By	Date/Time	Lab Temp/RH (°F)/(%)	PBar ("Hg)
1	3.0119	JG	5.6.12 / 8:05	74, 44	28.60
2	3.0121	JG	5.7.12 / 7:09	73, 46	28.45
3				/	
4				/	
5				/	
6				/	
7				/	
8				/	
9				/	
10				/	
Avg.	3.0120				

0.3828 Filter Tare Weight (g)

2.6166 Dish Tare Weight (g)

12.6 **Filter Catch Weight (mg)**

Describe Sample:

Analytical Balance I.D. 3004206

Balance Located in Stable, Draft-Free Area? (Yes) / No

* Consecutive weighings must not differ by more than 0.5mg or 1% of the total catch weight, whichever is greater.

** If visible filter fragments were removed from frit, then negative filter weight values may be possible.

Job Number: 120505A

Done By / Date: JG 5.9.12

Checked By / Date: — / —

Final Check By / Date: SS / 5.17.12

Air Compliance Testing, Inc.

(Method 5-Filter Gravimetric) 5/4/2012

Method 5 Filter Gravimetric

Plant Name Clow Water Systems Location Cupola Emission System (P901) Exhaust Stack

Run Number	3
Run Date	5.3.12
Filter Recovered By	JG
Were filters intact upon opening filter assembly?	Yes
Were there any visible filter fragments remaining on the frit after initial filter removal?**	Yes
Were filter fragments rinsed into acetone rinse container?	Yes
Sample Loading - lt / med / heavy	med
Sample Color	brown
Filter Number	5461
Petri Dish Number	218

Weight Number	Total Weight (g) (Includes Dish)*	Done By	Date/Time	Lab Temp/RH (°F)/(%)	PBar ("Hg)
1	3.0224 3	JG	5.6.12 / 8:06	75 / 44	28.60
2	3.0224	JG	5.7.12 / 7:09	73 / 46	28.45
3				/	
4				/	
5				/	
6				/	
7				/	
8				/	
9				/	
10				/	
Avg.	3.0224				

0.3837	Filter Tare Weight (g)
2.6291	Dish Tare Weight (g)
10.55	**Filter Catch Weight (mg)**

Describe Sample:

Run Number	
Run Date	
Filter Recovered By	
Were filters intact upon opening filter assembly?	
Were there any visible filter fragments remaining on the frit after initial filter removal?**	
Were filter fragments rinsed into acetone rinse container?	
Sample Loading - lt / med / heavy	
Sample Color	
Filter Number	
Petri Dish Number	

Weight Number	Total Weight (g) (Includes Dish)*	Done By	Date/Time	Lab Temp/RH (°F)/(%)	PBar ("Hg)
1				/	
2				/	
3				/	
4				/	
5				/	
6				/	
7				/	
8				/	
9				/	
10				/	
Avg.					

	Filter Tare Weight (g)
	Dish Tare Weight (g)
	Filter Catch Weight (mg)

Describe Sample:

Analytical Balance I.D. 3004206
Balance Located in Stable, Draft-Free Area? (Yes) / No
* Consecutive weighings must not differ by more than 0.5mg or 1% of the total catch weight, whichever is greater.
** If visible filter fragments were removed from frit, then negative filter weight values may be possible.

Job Number: 120505A
Done By / Date: JG / 5.9.12
Checked By / Date: / /
Final Check By / Date: SS / 5-17-12

Air Compliance Testing, Inc.
(Method 5-Filter Gravimetric) 5/4/2012

Method 5 Rinse Gravimetric

Plant Name Clow Water Systems

Location Cupola Emission System (P901) Exhaust Stack

Run Number 1
Run Date 5.7.12
Rinse Recovered By JG
Sample Loading - lt / med / heavy lt
Sample Color gray
Beaker Number 192

Weight Number	Total Weight (g) (Includes Beaker)*	Done By	Date/Time	Temp/RH (°F)/(%)	PBar ("Hg)
1	108.1174	JG	5.6.12 / 8:07	75 / 45	28.60
2	108.1173	JG	5.7.12 / 7:10	73 / 46	28.45
3				/	
4				/	
5				/	
6				/	
7				/	
8				/	
9				/	
10				/	
Avg.	108.1174				

108.1143 Beaker Tare Weight (g)
200 Rinse Volume (ml)
0.0016 Residue Weight (g)
1.45 **Rinse Catch Weight (mg)**

Describe Sample:

Run Number 2
Run Date 5.7.12
Rinse Recovered By JG
Sample Loading - lt / med / heavy lt
Sample Color gray
Beaker Number 440

Weight Number	Total Weight (g) (Includes Beaker)*	Done By	Date/Time	Temp/RH (°F)/(%)	PBar ("Hg)
1	95.5134	JG	5.6.12 / 8:09	75 / 44	28.60
2	95.5132	JG	5.7.12 / 7:17	73 / 46	28.45
3				/	
4				/	
5				/	
6				/	
7				/	
8				/	
9				/	
10				/	
Avg.	95.5133				

95.5105 Beaker Tare Weight (g)
200 Rinse Volume (ml)
0.0016 Residue Weight (g)
1.2 **Rinse Catch Weight (mg)**

Describe Sample:

Analytical Balance I.D. 3004206
Balance Located in Stable, Draft-Free Area? (Yes) / No
* Consecutive weighings must not differ by more than 0.5mg or 1% of the total catch weight, whichever is greater.
** If no visible fragments remain on frit, then negative filter weight values may be deemed a zero value.

Job Number: 120505A
Done By / Date: JG / 5.7.12
Checked By / Date: — / —
Final Check By / Date: SS / 5-12-12

Air Compliance Testing, Inc.
(Method 5-Rinse Gravimetric) 5/4/2012

Method 5 Rinse Gravimetric

Plant Name Clow Water Systems

Location Cupola Emission System (P901) Exhaust Stack

Run Number: 3
Run Date: 5.3.12
Rinse Recovered By: JG
Sample Loading - lt / med / heavy: lt
Sample Color: gray
Beaker Number: 452

Weight Number	Total Weight (g) (Includes Beaker)*	Done By	Date/Time	Temp/RH (°F)/(%)	PBar ("Hg)
1	108.7994	JG	5.6.12 / 8:10	75 / 44	28.60
✓ 2	108.7989	JG	5.7.12 / 7:19	73 / 46	28.45
3				/	
4				/	
5				/	
6				/	
7				/	
8				/	
9				/	
10				/	
Avg.	108.7992				

108.7825 Beaker Tare Weight (g)
200 Rinse Volume (ml)
0.0016 Residue Weight (g)
9.05 Rinse Catch Weight (mg)

Describe Sample:

Run Number: BL
Run Date: 5.3.12
Rinse Recovered By: JG
Sample Loading - lt / med / heavy: –
Sample Color: –
Beaker Number: 460

Weight Number	Total Weight (g) (Includes Beaker)*	Done By	Date/Time	Temp/RH (°F)/(%)	PBar ("Hg)
1	109.5701	JG	5.6.12 / 8:11	75 / 44	28.60
✓ 2	109.5704	JG	5.7.12 / 7:20	73 / 46	28.45
3				/	
4				/	
5				/	
6				/	
7				/	
8				/	
9				/	
10				/	
Avg.	109.5703				

109.5627 Beaker Tare Weight (g)
200 Rinse Volume (ml)
0.00755 Residue Weight (g)
– Rinse Catch Weight (mg)

Describe Sample:

Analytical Balance I.D. 3004206
Balance Located in Stable, Draft-Free Area? Yes / No
* Consecutive weighings must not differ by more than 0.5mg or 1% of the total catch weight, whichever is greater.
** If no visible fragments remain on frit, then negative filter weight values may be deemed a zero value.

Job Number: 120505A
Done By / Date: JG / 5.4.12
Checked By / Date: – / – : – / –
Final Check By / Date: SG / 5-17-12

Air Compliance Testing, Inc.
(Method 5-Rinse Gravimetric) 5/4/2012

Method 5 Acetone Residuals Calculation

Determine weight of acetone residuals (g) 0.00755

Divide by the volume of the acetone blank (ml) 200

Acetone residuals measured (g/ml) 0.00003775 (should be less than 0.0000079g/ml)

Acetone residuals used (g/ml) 0.0000079

	Run 1	Run 2	Run 3	Run 4
Determine volume of front half rinse (ml)	200	200	200	–
Acetone residuals in sample (g)	0.0016	0.0016	0.0016	–

*Subtract sample residuals from sample catch weight (g)

Job Number: 120505A

Done By / Date: JB / 5.4.12

Checked By / Date: – / – : – / –

Final Check By / Date: SS / 5-17-12

Method 5 Record of Custody Filter

ping/Transportation Container Number: 2

Sample ID		Full Signature	Date	Time	Remarks	Filter Number	Dish Number
120505 A - 1 - M5/F	S	[signature]	4.28.12	14:45		5457	191
	B	[signature]	5.4.12	17:37			
	S						
	B						
120505 A - 2 - M5/F	S	[signature]	4.28.12	14:50		5459	217
	B	[signature]	5.4.12	17:47			
	S						
	B						
120505 A - 3 - M5/F	S	[signature]	4.28.12	15:00		5460	~~218~~ 219
	B						
	S						
	B						
120505 A - 4 - M5/F	S	[signature]	4.28.12	15:03		5461	218
	B	[signature]	5.4.12	1539			
	S						
	B						
	S						
	B						
	S						
	B						
	S						
	B						
	S						
	B						
	S						
	B						
	S						
	B						

Were all seals intact? ✓ Yes ____ No (Describe seal and reasoning in the "Remarks")

Received By Sample Custodian [signature] 5/7/12

(Full Signature) (Date)

Remarks:

Job Number: 120505 A

Done By / Date: JG / 5.4.12

Final Check By / Date: SS / 5-17-12

Method 5 Record of Custody Sheet

Shipping/Transportation Container Number: 2

Sample ID		Full Signature	Date	Time	Remarks	Final Vol. ml	Beaker Number
120505 A - 1 - M5/AR	S		5/3/12	1143		200	192
	B		5.4.12	17:30			
	S						
	B						
120505 A - 2 - M5/AR	S		5/3/12	1354		200	440
	B		5.4.12	17:50			
	S						
	B						
120505 A - 3 - M5/AR	S		5.3.12	15:10		200	452
	B		5.4.12	15:57			
	S						
	B						
120505 A - 4 - M5/AR	S						
	B						
	S						
	B						
	S						
	B						
	S						
	B						
	S						
	B						
	S						
	B						
120505 A - BL - M5/AR	S					200	460
	B						

Were all seals intact? ✓ Yes _____ No (Describe seal and reasoning in the "Remarks")

Were all liquid levels at marked levels? ✓ Yes _____ No (Estimate loss in the "Remarks")

Received By Sample Custodian _____ 5/2/12

(Full Signature) (Date)

Remarks: _____

Job Number: 120505 A

Done By / Date: — / —

Final Check By / Date: SS / 5.17.12

TEST DATA

Number of Test Runs	3			
Traverse Points	24			
	Run 1	Run 2	Run 3	Average
Stack Cross-Sectional Diameter 1 (**circular**) (in)	63.0	63.0	63.0	63.0
Stack Cross-Sectional Diameter 2 (**circular**) (in)	63.2	63.2	63.2	63.2
Pitot Tube Coefficient (Cp)	0.84	0.84	0.84	0.84
Barometric Pressure at Ground Level (Pbar) (in Hg)	29.13	29.17	29.17	29.16
Elevation Difference Between Ground Level and Meter Box Locations (ft)	5.00	5.00	5.00	5.00
Elevation Difference Between Ground Level and Sampling Locations (ft)	30.00	30.00	30.00	30.00
Initial Dry Gas Meter Reading (ft3)	922.278	960.528	999.879	
Final Dry Gas Meter Reading (ft3)	960.435	999.464	1037.362	
Dry Gas Meter Calibration Factor (Gamma)	1.0019	1.0019	1.0019	1.0019
Dry Gas Meter Calibration Coefficient (Delta H@)	1.836	1.836	1.836	1.836
Total Sampling Run Time (Theta) (min)	60	60	60	60
Volume of Water Vapor Condensed in the Impingers (g)	83.8	86.3	81.6	83.9
Weight of Water Vapor Collected in Silica Gel (g)	12.1	11.2	20.9	14.7
Air Percent by Volume Carbon Dioxide in Stack Gas (%-dry)	9.67	9.83	9.83	9.78
Air Percent by Volume Oxygen in Stack Gas (%-dry)	12.50	11.67	10.50	11.56
Air Percent by Volume Nitrogen in Stack Gas (%-dry)	77.83	78.50	79.67	78.67
Test Run Start Time (hrmin)	5/3/2012 9:20	5/3/2012 11:15	5/3/2012 13:04	
Test Run Stop Time (hrmin)	5/3/2012 10:33	5/3/2012 12:24	5/3/2012 14:24	

DETAILED RESULTS

Stack Gas Conditions	Run 1	Run 2	Run 3	Average
Stack Cross-Sectional Area (A) (ft2)	21.716	21.716	21.716	21.716
Barometric Pressure at Sampling Location (in Hg)	29.10	29.14	29.14	29.13
Dry Molecular Weight of Stack Gas (Md) (lb/lb-mole)	30.05	30.04	29.99	30.03
Wet Molecular Weight of Stack Gas (Ms) (lb/lb-mole)	28.71	28.68	28.53	28.64
Average Absolute Stack Gas Pressure (Ps) (in Hg)	29.13	29.17	29.17	29.16
Average Stack Gas Static Pressure (ps) (in H2O)	0.45	0.46	0.44	0.45
Average Stack Gas Temperature (ts) (°F)	162.1	161.6	162.1	161.9
Average Stack Gas Temperature (Ts) (°R)	622.1	621.6	622.1	621.9
Average Stack Gas Velocity (Vs) (ft/sec)	56.85	56.22	56.05	56.37
Average Stack Gas Velocity (Vs) (ft/min)	3,411	3,373	3,363	3,382
Wet Volumetric Stack Gas Flow at Actual Conditions (Qaw) (acfm)	74,074	73,249	73,029	73,451
Wet Volumetric Stack Gas Flow at Standard Conditions (scfm)	61,214	60,670	60,435	60,773
Dry Volumetric Stack Gas Flow at Standard Conditions (Qstd) (dscfm)	54,424	53,830	53,040	53,765
Percent by Volume Moisture as measured in Stack Gas (%H2O)	11.09	11.27	12.24	11.53
Test Results				
Volume of Dry Gas Sampled at Standard Conditions (Vmstd) (dscf)	36.246	36.180	34.661	35.696
Rate of Dry Gas Sampled at Standard Conditions (dscfm)	0.604	0.603	0.578	0.595
Predicted 1-Hour Sample Volume Based on Current Sampling Rate (dscf)	36.246	36.180	34.661	35.696
Dry Mole Fraction of Flue Gas (Mfd) (1-bw/100)	0.889	0.887	0.878	0.885
Average Velocity Pressure (Delta P) (in H2O)	0.8546	0.8333	0.8229	0.8369
Average Square Root of Delta P	0.9179	0.9083	0.9027	0.9096
Average Pressure Differential of Orifice Meter (Delta H) (in H2O)	1.3500	1.3250	1.2958	1.3236
Average DGM Temperature (tm) (°F)	83.938	96.792	99.458	93.396
Average Dry Gas Meter Temperature (Tm) (°R)	543.938	556.792	559.458	553.396
Volume of Metered Gas Sample (Vm) (dry) (acf)	38.157	38.936	37.483	38.192
Post-Test Calibration (Yqa)	1.0206	1.0020	1.0326	1.0184
Post-Test/Pre-Test Calibration Factor Difference (%)	-1.87	-0.01	-3.07	-1.65
SAMPLING QA				
Current Predicted Allowable Post-Test Leak Rate (dscfm)	0.020	0.020	0.020	
Current Sampling Rate Status	**OK**	**OK**	**OK**	
Probe Nozzle Diameter (in)	0.208	0.208	0.208	
Percent Isokinetic of Sampling Rate (% I)	102.2	103.1	100.2	
In Field Isokinetic QA	**GOOD**	**GOOD**	**GOOD**	
Count of Velocity Pressure Readings Below 0.05 in H2O	0	0	0	
Sensitivity Factor for Differential Pressure Gauge (T)	1.003	1.003	1.003	
Is Meter Box Manometer Adequate (Yes / No) ?	YES	YES	YES	

MEASURED DATA FROM TEST RUNS

Point Count	Run #	Run Time (min)	Pitot Delta P (in H2O)	Square Root of Delta P	Orifice Delta H (in H2O)	DGM Temp IN (°F)	DGM Temp OUT (°F)	Average DGM Temp (°F)	Stack Pressure (in H2O)	Stack Temp (°F)
1	1	0	0.80	0.894	1.30	76	73	74.50	0.45	162
2	1	2.5	1.10	1.049	1.70	77	73	75.00		163
3	1	5	1.10	1.049	1.70	78	74	76.00		164
4	1	7.5	1.10	1.049	1.70	79	74	76.50		163
5	1	10	1.10	1.049	1.70	81	75	78.00		162
6	1	12.5	1.10	1.049	1.70	81	75	78.00		162
7	1	15	0.81	0.900	1.30	83	75	79.00		163
8	1	17.5	0.60	0.775	0.95	84	75	79.50		164
9	1	20	0.60	0.775	0.95	86	76	81.00		163
10	1	22.5	0.50	0.707	0.80	88	77	82.50		162
11	1	25	0.50	0.707	0.80	89	77	83.00		163
12	1	27.5	0.51	0.714	0.80	90	77	83.50		162
13	1	30	0.99	0.995	1.60	91	78	84.50		160
14	1	32.5	0.80	0.894	1.30	92	78	85.00		161
15	1	35	0.80	0.894	1.30	92	78	85.00		161
16	1	37.5	0.90	0.949	1.40	94	80	87.00		162
17	1	40	0.95	0.975	1.50	95	81	88.00		163
18	1	42.5	0.95	0.975	1.50	96	83	89.50		162
19	1	45	1.00	1.000	1.60	97	84	90.50		161
20	1	47.5	1.00	1.000	1.60	98	84	91.00		162
21	1	50	0.85	0.922	1.30	98	84	91.00		161
22	1	52.5	0.85	0.922	1.30	99	85	92.00		162
23	1	55	0.80	0.894	1.30	99	85	92.00		161
24	1	57.5	0.80	0.894	1.30	99	86	92.50		162
25	2	0	0.75	0.866	1.20	97	88	92.50	0.46	160
26	2	2.5	0.76	0.872	1.20	97	88	92.50		161
27	2	5	0.81	0.900	1.30	99	88	93.50		161
28	2	7.5	0.95	0.975	1.50	100	89	94.50		162
29	2	10	1.00	1.000	1.60	100	89	94.50		161
30	2	12.5	1.00	1.000	1.60	100	90	95.00		163
31	2	15	0.90	0.949	1.40	101	91	96.00		164
32	2	17.5	0.90	0.949	1.40	102	92	97.00		162
33	2	20	0.91	0.954	1.40	102	93	97.50		162
34	2	22.5	0.86	0.927	1.40	103	93	98.00		163
35	2	25	0.86	0.927	1.40	103	93	98.00		162
36	2	27.5	0.84	0.917	1.30	103	93	98.00		161
37	2	30	0.81	0.900	1.30	100	92	96.00		160
38	2	32.5	1.00	1.000	1.60	101	92	96.50		162
39	2	35	1.00	1.000	1.60	102	93	97.50		161
40	2	37.5	1.00	1.000	1.60	102	93	97.50		161
41	2	40	1.00	1.000	1.60	102	93	97.50		161
42	2	42.5	1.00	1.000	1.60	103	94	98.50		162
43	2	45	0.80	0.894	1.30	103	94	98.50		162
44	2	47.5	0.65	0.806	1.00	103	94	98.50		161
45	2	50	0.60	0.775	0.95	103	95	99.00		160
46	2	52.5	0.60	0.775	0.95	103	94	98.50		161
47	2	55	0.50	0.707	0.80	104	94	99.00		162
48	2	57.5	0.50	0.707	0.80	104	94	99.00		163

MEASURED DATA FROM TEST RUNS

Point Count	Run #	Run Time (min)	Pitot Delta P (in H2O)	Square Root of Delta P	Orifice Delta H (in H2O)	DGM Temp IN (°F)	DGM Temp OUT (°F)	Average DGM Temp (°F)	Stack Pressure (in H2O)	Stack Temp (°F)
49	3	0	0.50	0.707	0.80	100	95	97.50	0.44	162
50	3	2.5	0.60	0.775	0.95	100	95	97.50		161
51	3	5	0.60	0.775	0.95	100	96	98.00		161
52	3	7.5	0.60	0.775	0.95	101	96	98.50		163
53	3	10	0.81	0.900	1.30	101	96	98.50		161
54	3	12.5	0.82	0.906	1.30	102	96	99.00		162
55	3	15	1.10	1.049	1.70	102	96	99.00		163
56	3	17.5	1.10	1.049	1.70	103	97	100.00		164
57	3	20	1.10	1.049	1.70	103	97	100.00		163
58	3	22.5	1.00	1.000	1.60	103	97	100.00		162
59	3	25	0.92	0.959	1.40	103	98	100.50		162
60	3	27.5	0.92	0.959	1.40	103	98	100.50		161
61	3	30	0.80	0.894	1.30	103	98	100.50		162
62	3	32.5	0.80	0.894	1.30	100	95	97.50		160
63	3	35	0.80	0.894	1.30	101	95	98.00		160
64	3	37.5	0.82	0.906	1.30	102	96	99.00		161
65	3	40	0.82	0.906	1.30	102	97	99.50		162
66	3	42.5	0.82	0.906	1.30	102	97	99.50		162
67	3	45	0.91	0.954	1.40	102	97	99.50		163
68	3	47.5	0.89	0.943	1.40	103	98	100.50		163
69	3	50	0.89	0.943	1.40	103	98	100.50		164
70	3	52.5	0.82	0.906	1.30	103	98	100.50		164
71	3	55	0.71	0.843	1.10	104	99	101.50		162
72	3	57.5	0.60	0.775	0.95	104	99	101.50		162

TEST DATA

	Run 1	Run 2	Run 3	Average
Particulate Weight in Probe Rinse (mg)	1.45	1.20	9.05	3.90
Particulate Weight in Filter Catch (mg)	9.55	12.60	10.55	10.90

DETAILED RESULTS

	Run 1	Run 2	Run 3	Average
Emission Results				
Filterable Particulate Matter Emission Rate (lb/hr)	2.185	2.716	3.967	2.956
Filterable Particulate Matter Concentration (grains/dscf)	0.0047	0.0059	0.0087	0.0064

EPA Methods 1, 2, 3, 4, and 5 Nomenclature and Sample Calculations
Run No. - 1

Constants

CO_2F_{wt}= 44.0	in wg= 0.073529	NO_2F_{wt}= 46.01	$HClF_{wt}$= 36.46
O_2F_{wt}= 32.0	gr= 0.000142857	COF_{wt}= 28.01	SO_2F_{wt}= 64.06
CON_2F_{wt}= 28.0	mmBtu= 1000000 Btu	$H_2SO_4F_{wt}$= 98.08	Cl_2F_{wt}= 70.91
H_2OF_{wt}= 18.0	CF_{wt}= 12.011	T_{std}= 528	P_{std}= 29.92
	PF_{wt}= 44.0962		

Stack Variables

Cp =	0.84	pitot tube coefficient (dimensionless)
P_{bar} =	29.13 in. Hg	barometric pressure
E_{box} =	5 ft	elevation difference between ground level and meter box
E_{sam} =	30 ft	elevation difference between ground level and sampling ports
γ =	1.0019	gamma, dry gas meter calibration factor (dimensionless)
θ =	60.0 min	net run time (minutes)
V_{lc} =	95.9 g	total mass of liquid collected in impingers (g)
$\%CO_2$ =	9.67 %	percent CO_2 by volume (dry basis) (dimensionless)
$\%O_2$ =	12.50 %	percent O_2 by volume (dry basis) (dimensionless)
$\%N_2$ =	77.83 %	percent N_2 by volume (dry basis) (dimensionless)
A =	21.7163 ft^2	stack cross-sectional area
P_g =	0.45 in. H_2O	flue gas static pressure
T_{savg} =	622.13 R	average absolute flue gas temperature (460R+tsavg °F)
$SQ\Delta P_{avg}$ =	0.92 in. wg	average square root ΔP
ΔH =	1.35 in. wg	average pressure differential of orifice meter
T_m =	543.94 R	dry gas meter temperature (460R+tsavg °F)
V_m =	38.16 ft^3	volume of metered gas sample (dry actual cubic feet)
D_n =	0.208 in.	sampling nozzle diameter

Calculated Stack Variables

Barometric pressure at sampling location

NOTE: Barometric pressure recorded at ground level

$$P_{sam} = P_{bar} - [(E_{sam} / 100 \text{ ft}) * 0.1 \text{ in. Hg}]$$

$$P_{sam} = 29.13 - ((30.0 / 100) * 0.1)$$

$$P_{sam} = 29.10 \text{ in. Hg}$$

Volume of dry gas sampled at standard conditions (dscf)

$$V_{mstd} = \gamma * Vm * [P_{bar} - ([(E_{box} / 100 \text{ ft}) * 0.1 \text{ in. Hg}] + (\Delta H / 13.6)) / P_{std}] * (T_{std} / T_m)$$

$$V_{mstd} = 1.0019 * 38.157 * ((29.13 - ((5.0 / 100) * 0.1) + (1.3500 / 13.6)) / 29.92) * (528.0 / 543.938)$$

$$V_{mstd} = 36.246 \text{ ft}^3$$

Volume of water vapor at standard conditions (68 °F, scf)

$$V_{wstd} = (0.04715 \text{ ft}^3/\text{g}) * Vlc$$

$$V_{wstd} = (0.04715 * 95.9)$$

$$V_{wstd} = 4.5 \text{ ft}^3$$

Percent moisture by volume as measured in flue gas

$\%H_2O$ (Measured) = 100 * [V_{wstd} / (V_{wstd} + V_{mstd})]

$\%H_2O$ (Measured) = 100 * (4.522 / (4.522 + 36.246))

$\%H_2O$ (Measured) = 11.09

$\%H_2O$ (Saturated) = (100 / P_{sam}) * 10 ^ (6.6911 - (3144 / (T_{savg} + 390.86 - 460)))

$\%H_2O$ (Saturated) = (100 / 29.133088) * 10 ^ (6.6911 - (3144 / (622.125000 + 390.86 - 460)))

$\%H_2O$ (Saturated) = 34.78

$\%H_2O$ = 11.09

Absolute flue gas pressure

P_s = P_{sam} + (Pg / 13.6)

P_s = 29.10 + (0.45 / 13.6)

P_s = 29.13 in. Hg

Dry mole fraction of flue gas (dimensionless)

M_{fd} = 1 - ($\%H_2O$ / 100)

M_{fd} = 1 - (11.09 / 100)

M_{fd} = 0.889

Dry molecular weight of flue gas (lb/lb-mole)

M_d = [($\%CO_2$ / 100) * 44.0] + [($\%O_2$ / 100) * 32.0] + [((100 - $\%CO_2$ - $\%O_2$) / 100) * 28.0]

M_d = ((9.67 / 100) * 44.0) + ((12.50 / 100) * 32.0) + (((100 - 9.67 - 12.50) / 100) * 28.0)

M_d = 30.05 lb/lb-mole

M_d = 30.05

Wet molecular weight of flue gas (lb/lb-mole)

M_s = M_d * M_{fd} + (H_2OF_{wt} * ($\%H_2O$ / 100))

M_s = 30.047 * 0.889 + 18.00 * (11.09 / 100)

M_s = 28.71 lb/lb-mole

Average flue gas velocity (ft/sec)

v_s = 85.49 * Cp * ($SQ\Delta P_{avg}$) * (T_{avg} / (P_s * M_s))$^{0.5}$

v_s = 85.49 * 0.84 * (0.9179) * (622.13 / (29.133 * 28.711)) ^ 0.5

v_s = 56.85 ft/sec

Wet volumetric flue gas flow rate at actual conditions (acfm)

Q_{aw} = v_s * A * 60 sec/min

Q_{aw} = 56.850 * 21.716 * 60

Q_{aw} = 74,074 ft^3/min

Wet volumetric flue gas flow rate at standard conditions (scfm)

$Q_{sdw} = v_s * A * (T_{std} / T_{savg}) * (P_s / P_{std}) * 60$ sec/min

$Q_{sdw} = 56.850 * 21.716 * (528.0 / 622.125) * (29.133 / 29.92) * 60$

$Q_{sdw} =$ 61,214 ft^3/min

Dry volumetric flue gas flow rate at standard conditions (dscfm)

$Q_{sd} = M_{fd} * v_s * A * (T_{std} / T_{savg}) * (P_s / P_{std}) * 60$ sec/min

$Q_{sd} = 0.889 * 56.8502 * 21.7163 * (528.0 / 622.125) * (29.133 / 29.92) * 60$

$Q_{sd} =$ 54,424 ft^3/min

Isokinetic Calculations

Percent isokinetic of sampling rate (%)

$\%I = (P_{std} / T_{std}) * (T_{savg} / P_s) * [V_{mstd} / (v_s * M_{fd} * \theta * \pi * (D_n / 2)^2)]$

%I = ((((29.92 / 528.0) * (622.125 / 29.133)) * (36.246 / (56.8502 * 0.889 * 60.0 * (()3.141593 * (0.208 / 2) ^ 2) / 144))) / 60) * 100

%I = 102.2 %

Method 5 Calculations

Filterable PM total catch weight (mg)

$mg_{quan} =$ 11.00 mg

Filterable PM concentration (grains/dscf)

$C_{grcm} = 0.154322 * mg_{quan} / V_{mstd}$

$C_{grcm} = 0.0154322 * 11.00 / 36.246$

$C_{grcm} =$ 0.0047 gr/ft^3

Filterable PM mass emission rate (lb/hr)

$EMRlbhr = (mg_{quan} / V_{mstd}) * Q_{sd} * (60 / 453592)$

EMRlbhr = 11.00 / 36.246 * 54,424.496 * (60 / 453592)

EMRlbhr = 2.18 lb/hr

Method 5 Isokinetic Field Data

Plant	Clow Water Systems Co.	Meter box no.	T-MTB- 009	Gamma 1.0019	ΔH@ 1.836
Location	P901 Exhaust Stack (A)	Pump no.	T-PMP- 009	K Factor 1.57 / 1	
Run no.	1	Nomograph no.	T-NOM- /	Nozzle Size, in. .208	
Test start time	0920	Probe no.	T-PRB- 810	Barometric pressure, in.Hg 29.13	Barometer no. T-DPG-006
Test stop time	1033	Filter box no.	T-FLB- 006	Ambient temperature, °F 70	
Pre-test leak rate @ 15in.Hg	.001	Impinger box no.	T-IMB- 009	Filter box temperature setting, °F 248 ± 25	
Post-test leak rate @3.5 in.Hg	.000	Umbilical cord no.	T-UMC- 104	Probe temperature setting, °F 248 ± 25	
Pre-test pitot leak check - total ✓	static ✓	Umbilical adapter no.	T-UMA- 010	Orsat flow rate setting, SCFH 0.5	Orsat bag no. 120505-A-1-M3/TB
Post-test pitot leak check - total ✓	static ✓	Filter Exit Therm. no.	T-FXT- 002	Meter box operator BT	Date 5.3.12

POINT	CLOCK TIME min	DRY GAS METER CF	PITOT In. H_2O ΔP	ORIFICE ΔH In. H_2O DESIRED	ORIFICE ΔH In. H_2O ACTUAL	PROBE TEMP °F	STACK TEMP °F	DRY GAS TEMP °F INLET	DRY GAS TEMP °F OUTLET	FILTER BOX TEMP °F	IMPINGER EXIT TEMP °F	FILTER EXIT TEMP °F	PUMP VACUUM in.Hg	ORSAT FLOW SCFH	STATIC PRESSURE ± In.H_2O
1	0	922.278	.80	1.26	1.3	250	162	76	73	256	64	237	1.0	0.3	.45
2	2.5	923.85	1.1	1.72	1.7	250	163	77	73	253	60	240	1.0	0.3	/
3	5	925.65	1.0	1.72	1.7	247	164	78	74	252	60	242	1.0	0.3	/
4	7.5	927.31	1.1	1.72	1.7	248	163	79	74	252	58	245	1.0	0.3	/
5	10	929.42	1.1	1.72	1.7	250	162	81	75	253	55	246	1.0	0.3	/
6	12.5	931.03	1.1	1.72	1.7	250	162	81	75	252	54	247	1.0	0.3	/
7	15	933.04	.81	1.27	1.3	252	163	83	75	252	55	248	1.0	0.3	/
8	17.5	934.43	.60	.95	.95	253	164	84	75	254	55	249	1.0	0.3	/
9	20	935.91	.60	.95	.95	254	163	86	76	253	56	252	1.0	0.3	/
10	22.5	937.07	.50	.78	.80	253	162	88	77	254	56	253	1.0	0.3	/
11	25	938.22	.50	.78	.80	254	163	89	77	252	54	252	1.0	0.3	/
12	27.5	939.41	.51	.80	.80	253	162	90	77	251	55	253	1.0	0.3	/
1	30	940.641	.99	1.55	1.6	252	160	91	78	252	56	254	1.0	0.3	/
2	32.5	942.33	.80	1.26	1.3	250	161	92	78	250	56	250	1.0	0.3	/
3	35	944.11	.80	1.26	1.3	249	161	92	78	249	56	251	1.0	0.3	/
4	37.5	945.45	.90	1.4	1.4	250	162	94	80	250	57	252	1.0	0.3	/
5	40	947.23	.95	1.49	1.5	252	163	95	81	252	57	253	1.0	0.3	/
6	42.5	949.01	.95	1.49	1.5	250	162	96	83	254	58	253	1.0	0.3	/
7	45	950.65	1.0	1.57	1.6	253	161	97	84	254	58	254	1.5	0.3	/
8	47.5	952.32	1.0	1.57	1.6	252	162	98	84	253	58	253	2.0	0.3	/
9	50	953.97	.85	1.33	1.3	253	161	98	84	254	58	252	2.0	0.3	/
10	52.5	955.71	.85	1.33	1.3	252	162	99	85	253	59	253	2.0	0.3	/
11	55	957.27	.80	1.26	1.3	251	161	99	85	254	59	254	2.0	0.3	/
12	57.5	958.92	.80	1.26	1.3	252	162	99	86	253	60	252	2.0	0.3	/
Final	60	960.435													

Nomograph Calibration Variables: Cp ____ Ts ____ Tm ____ Ps ____ Pm ____ Bws ____

Comments: Pause 09:50 Resume 1003

Leak Checks

Int. DGM Reading ____

Final DGM Reading ____

Pause Times

Pause: ____

Resume: ____

Air Compliance Testing, Inc.

(Method 5.xls - Isokinetic Field Data) 04/27/12

lisa Ohio EPA

Done By / Date : Checked By / Date BT 15-7-12 SS 15-15-12

Job Number: 120505 A

Method 5 Isokinetic Field Data

Plant	Clow Water Systems Co.
Location	P901 Exhaust Stack (A)
Run no.	2
Test start time	11:15
Test stop time	12:24
Pre-test leak rate @ 15in.Hg	.003
Post-test leak rate @ 4.0 in.Hg	.000
Pre-test pitot leak check - total	✓ static ✓
Post-test pitot leak check - total	✓ static ✓

Meter box no.	T-MTB- 009
Pump no.	T-PMP- 009
Nomograph no.	T-NOM- /
Probe no.	T-PRB- 808
Filter box no.	T-FLB- 002
Impinger box no.	T-IMB- 005
Umbilical cord no.	T-UMC- 104
Umbilical adapter no.	T-UMA- 018
Filter Exit Therm. no.	T-FXT- 002

Gamma 1.0019	ΔH@ 1.836
K Factor 1.57 /	/
Nozzle Size, in. .208	
Barometric pressure, in.Hg 29.17	Barometer no. T-B86-006
Ambient temperature, °F 75	
Filter box temperature setting, °F 248 ± 25	
Probe temperature setting, °F 248 ± 25	
Orsat flow rate setting, SCFH 0.3	Orsat bag no. 120505-A-2
Meter box operator BI	Date 5.3.12

POINT	CLOCK TIME min	DRY GAS METER CF	PITOT in. H_2O ΔP	ORIFICE ΔH in. H_2O DESIRED	ORIFICE ΔH in. H_2O ACTUAL	PROBE TEMP °F	STACK TEMP °F	DRY GAS TEMP °F INLET	DRY GAS TEMP °F OUTLET	FILTER BOX TEMP °F	IMPINGER EXIT TEMP °F	FILTER EXIT TEMP °F	PUMP VACUUM in.Hg	ORSAT FLOW SCFH	STATIC PRESSURE ± in.H_2O
1	0	960.528	.75	1.17	1.2	251	160	97	88	255	63	236	1.0	0.3	.46
2	2.5	962.11	.76	1.19	1.2	252	161	97	88	253	65	240	1.0	0.3	/
3	5	963.75	.81	1.27	1.3	253	161	99	88	254	60	246	1.0	0.3	/
4	7.5	965.34	.95	1.49	1.5	252	162	100	89	253	60	248	1.5	0.3	/
5	10	967.48	1.0	1.57	1.6	254	161	100	89	254	59	249	1.5	0.3	/
6	12.5	968.71	1.0	1.57	1.6	252	163	100	90	253	58	250	2.0	0.3	/
7	15	970.42	.90	1.41	1.4	250	164	101	91	254	57	249	2.0	0.3	/
8	17.5	972.31	.90	1.41	1.4	251	162	102	92	256	56	248	2.0	0.3	/
9	20	973.75	.91	1.43	1.4	253	162	102	93	255	56	250	2.0	0.3	/
10	22.5	975.73	.86	1.35	1.4	252	163	103	93	255	56	249	2.0	0.3	/
11	25	977.21	.86	1.35	1.4	251	162	103	93	254	55	251	2.0	0.3	/
12	27.5	978.82	.84	1.31	1.3	252	161	103	93	253	55	252	2.0	0.3	/
1	30	980.368	.81	1.27	1.3	253	160	100	92	250	60	250	1.5	0.3	/
2	32.5	981.93	1.0	1.57	1.6	251	162	101	92	250	59	251	1.5	0.3	/
3	35	983.56	1.0	1.57	1.6	250	161	102	93	248	58	252	1.5	0.3	/
4	37.5	985.52	1.0	1.57	1.6	251	161	102	93	249	57	253	2.0	0.3	/
5	40	987.16	1.0	1.57	1.6	252	161	102	93	251	57	253	2.0	0.3	/
6	42.5	989.15	1.0	1.57	1.6	254	162	103	94	253	57	253	2.0	0.3	/
7	45	990.83	.80	1.26	1.3	253	162	103	94	252	56	252	2.0	0.3	/
8	47.5	992.02	.65	1.02	1.0	254	161	103	94	252	56	253	2.0	0.3	/
9	50	993.95	.60	0.94	.95	253	160	103	95	251	56	253	2.0	0.3	/
10	52.5	995.54	.60	0.94	.95	251	161	103	94	250	56	254	2.0	0.3	/
11	55	996.65	.50	0.79	.80	251	162	104	94	252	57	252	2.0	0.3	/
12	57.5	997.37	.50	0.79	.80	253	163	104	94	251	58	252	2.0	0.3	/
Final	60	999.464													

Nomograph Calibration Variables: Cp Ts Tm Ps Pm Bws

Comments: Pause: 11:45 Resume: 11:54

Leak Checks

Int. DGM Reading

Final DGM Reading

Pause Times

Pause:

Resume:

Done By / Date : Checked By / Date BI 5.3.12 SS 5-15-12

Air Compliance Testing, Inc.

(Method 5.xls - Isokinetic Field Data) 04/27/12

Job Number: 120505 A

See Sum EPA

Method 5 Isokinetic Field Data

Plant	Clow Water Systems Co.	Meter box no.	T-MTB- 009	Gamma	1.0019 ΔH@ 1.836
Location	P901 Exhaust Stack (A)	Pump no.	T-PMP- 009	K Factor	1.57 1 1
Run no.	3	Nomograph no.	T-NOM- —	Nozzle Size, in.	.208
Test start time	13:04	Probe no.	T-PRB- 811	Barometric pressure, in.Hg	29.17 Barometer no. T-DRG-006
Test stop time	14:21	Filter box no.	T-FLB- 009	Ambient temperature, °F	80
Pre-test leak rate @ 15in.Hg	.003	Impinger box no.	T-IMB- 009	Filter box temperature setting, °F	248 ± 25
Post-test leak rate @4.0 in.Hg	.001	Umbilical cord no.	T-UMC- 104	Probe temperature setting, °F	248 ± 25
Pre-test pitot leak check - total ✓	static ✓	Umbilical adapter no.	T-UMA- 001	Orsat flow rate setting, SCFH	0.3 Orsat bag no. 120505-A-3-M3/TB
Post-test pitot leak check - total ✓	static ✓	Filter Exit Therm. no.	T-FXT- 015	Meter box operator	BI Date 5-3-12

POINT	CLOCK TIME min	DRY GAS METER CF	PITOT In. H_2O ΔP	ORIFICE ΔH In. H_2O DESIRED	ORIFICE ΔH In. H_2O ACTUAL	PROBE TEMP °F	STACK TEMP °F	DRY GAS TEMP °F INLET	DRY GAS TEMP °F OUTLET	FILTER BOX TEMP °F	IMPINGER EXIT TEMP °F	FILTER EXIT TEMP °F	PUMP VACUUM in.Hg	ORSAT FLOW SCFH	STATIC PRESSURE ± In.H_2O
1	0	999.879	.50	.785	.80	242	162	100	95	243	62	237	1.0	0.3	.94
2	2.5	1000.835	.60	.94	.95	250	161	100	95	245	61	240	1.0	0.3	—
3	5	1001.34	.60	.94	.95	251	161	100	96	248	60	242	1.0	0.3	—
4	7.5	1003.43	.60	.94	.95	252	163	101	96	246	60	245	1.0	0.3	—
5	10	1004.89	.81	1.27	1.3	253	161	101	96	249	59	249	1.0	0.3	—
6	12.5	1006.42	.82	1.29	1.3	252	162	102	96	249	58	250	1.0	0.3	—
7	15	1008.03	1.1	1.73	1.7	252	163	102	96	249	57	250	1.0	0.3	—
8	17.5	1009.95	1.1	1.73	1.7	254	164	103	97	250	56	250	1.0	0.3	—
9	20	1011.74	1.1	1.73	1.7	252	163	103	97	251	56	250	1.0	0.3	—
10	22.5	1013.37	1.0	1.57	1.6	253	162	103	97	252	57	249	1.0	0.3	—
11	25	1015.15	.92	1.4	1.4	251	162	103	98	251	57	250	1.0	0.3	—
12	27.5	1017.01	.92	1.4	1.4	250	161	103	98	253	57	251	1.0	0.3	—
1	30	1018.560	.80	1.26	1.3	250	162	103	98	251	60	252	1.0	0.3	—
2	32.5	1020.02	.80	1.26	1.3	247	160	100	95	250	59	238	1.0	0.3	—
3	35	1021.57	.80	1.26	1.3	250	160	101	95	253	58	243	1.0	0.3	—
4	37.5	1023.06	.82	1.29	1.3	252	161	102	96	252	57	246	1.0	0.3	—
5	40	1024.71	.82	1.29	1.3	251	162	102	97	250	56	247	1.5	0.3	—
6	42.5	1026.45	.82	1.29	1.3	250	162	102	97	251	56	248	1.5	0.3	—
7	45	1027.97	.91	1.43	1.4	252	163	102	97	250	57	250	2.0	0.3	—
8	47.5	1029.64	.89	1.39	1.4	253	163	103	98	252	57	252	2.5	0.3	—
9	50	1031.31	.89	1.39	1.4	252	164	103	98	253	58	252	3.0	0.3	—
10	52.5	1032.92	.82	1.28	1.3	252	164	103	98	253	58	250	3.0	0.3	—
11	55	1034.56	.71	1.11	1.1	250	162	104	99	251	58	251	3.0	0.3	—
12	57.5	1036.15	.60	.94	.95	251	162	104	99	250	59	252	3.0	0.3	—
Final	60	1037.362													

Nomograph Calibration Variables Cp Ts Tm Ps Pm Bws

Comments: Pause: 13:34 Resume: 13:38 Pause: 13:40 (Process) Resume: 13:52

Leak Checks

Int. DGM Reading

Final DGM Reading

Pause Times

Pause:

Resume:

Air Compliance Testing, Inc.

(Method 5.xls - Isokinetic Field Data) 04/27/12

Done By / Date : Checked By / Date BI 15-3-12 SS 15-15-12

Job Number: 120505 A

Method 9 Visible Emissions Observation Form-1

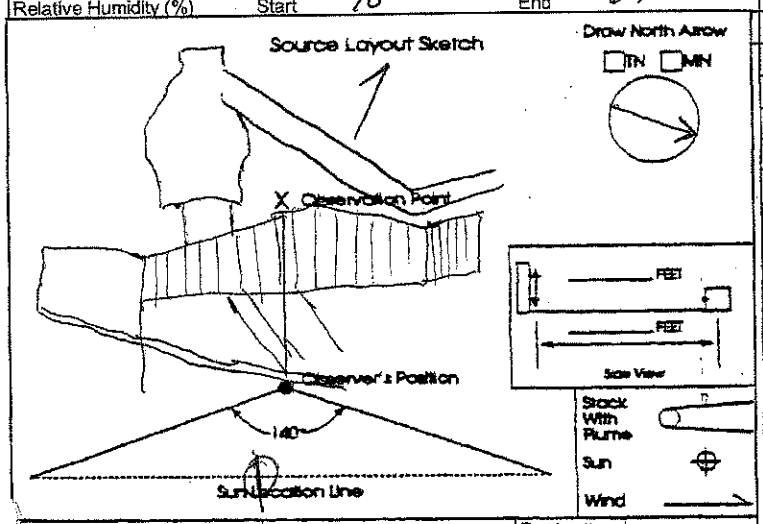
Company Name	Clow Water Systems Co.	Observation Date	5-3-12 Run No. 1
Facility Name	Clow Water Systems Co.	Start Time	920 Planned 950
Street Address	S Sixth St	End Time	1033 Planned 1003
City Coshocton	State OH Zip 43812		

Process & Unit #	Cupola	Operating Mode	max. achievable
Control Equipment		Operating Mode	

Describe Emission Point	Shroud		
Height of Emission Point	Start 70'	End 70'	
Height Relative to Observer	Start 30'	End 30'	
Distance from Observer	Start 250'	End 250	
Direction from Observer (°)	Start 280°	End 280	
Vertical Angle to Observation Point (°)	Start 9	End 9	
Distance and Direction to Observation Point from Emission Point			
Start			
End			

Describe Emissions	Start Light Dust	End Same	
Emission Color	Start Grey	End ↓	
If Water Droplet Plume	Attached —	Detached —	
Point in the Plume at which Opacity was Determined			
Start	6' above roof line		
End			

Describe Plume Background	Start Sky + Cupola	End Same	
Background Color	Start Blue + Brown	End ↓	
Sky Conditions	Start 5-10% Cloudy	End	
Wind Speed (mph)	Start ~~SSW~~ 5	End 5	
Wind Direction (From)	Start SSW	End SSW	
Ambient Temperature (°F)	Start 79	End 84	
Relative Humidity (%)	Start 70	End 65	



Longitude	Latitude	Declination
W 81° 50'	N 40° 16'	5° 49' W

Sec.	0	15	30	45	Sec.	0	15	30	45
Min.									
0	0	0	0	5	30	10	5	0	0
1	5	0	0	0	31	0	0	0	5
2	5	5	5	5	32	0	5	0	5
3	10	5	0	0	33	10	10	10	10
4	5	5	5	0	34	5	5	5	5
5	0	0	0	0	35	5	10	10	10
6	5	5	5	0	36	10	10	15	10
7	0	0	0	5	37	5	5	5	5
8	10	15	5	5	38	10	10	5	5
9	0	5	5	10	39	5	5	5	5
10	0	0	0	0	40	5	10	5	5
11	0	0	0	0	41	10	10	5	5
12	0	5	5	10	42	10	10	5	5
13	10	0	0	0	43	15	15	15	10
14	0	0	5	5	44	10	10	10	10
15	0	0	5	5	45	10	10	10	10
16	0	0	5	0	46	10	10	15	10
17	0	0	0	0	47	10	10	10	10
18	10	10	15	15	48	10	10	10	10
19	15	10	10	5	49	10	5	0	5
20	5	5	5	5	50	5	5	5	5
21	5	5	0	0	51	5	5	5	5
22	0	0	0	0	52	5	5	5	5
23	0	0	0	0	53	5	5	5	5
24	0	0	0	0	54	5	5	5	5
25	5	5	5	0	55	5	5	0	0
26	0	0	5	0	56	0	5	5	5
27	0	0	0	5	57	0	0	0	0
28	5	10	10	5	58	5	5	5	5
29	0	0	0	5	59	5	5	5	5

Range of Opacity Readings	
Minimum 0	Maximum 15
Average Opacity for Highest Period	10.83
Observer's Name (Print)	Ken Lieuma
Observer's Signature	
Date	5-3-12
Organization	*Air Compliance Testing, Inc.*
Certified By (Check below where applicable):	
[ ] Eastern Technical Associates Date:	
[✓] Compliance Assurance Associates Date:	2-7-12

Job Number: 120505 B
Done By / Date: KC / 5-3-12
Checked By / Date: — / — : — / —
Final Check By / Date: SC / 5-15-12

Air Compliance Testing, Inc.
(Method 9-Observation Form-1) 4/27/2012

Method 9 Visible Emissions Observation Form-1

Company Name	Clow Water Systems Co.	Observation Date 5-3-12	Run No. 2
Facility Name	Clow Water Systems Co.	Start Time 1145	Paused 1145
Street Address	S Sixth St	End Time 1224	Resumed 1154
City Coshocton	State OH Zip 43812		

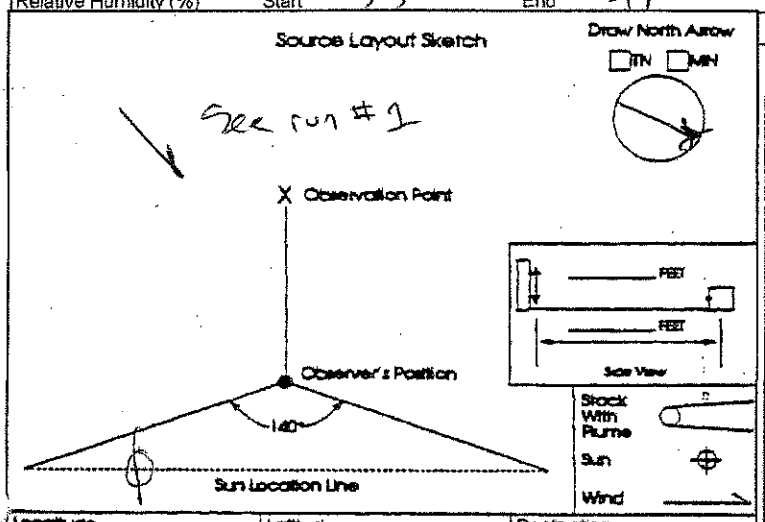
Process & Unit # Cupola	Operating Mode max. achievable
Control Equipment	Operating Mode

Describe Emission Point Shroud			
Height of Emission Point	Start 70'	End Same	
Height Relative to Observer	Start 70'	End	
Distance from Observer	Start 250'	End	
Direction from Observer (°)	Start 250°	End	
Vertical Angle to Observation Point (°)	Start 9°	End	
Distance and Direction to Observation Point from Emission Point			
Start			
End			
Describe Emissions	Start Lofty Dust	End Same	
Emission Color	Start Grey	End	
If Water Droplet Plume	Attached —	Detached —	
Point in the Plume at which Opacity was Determined			
Start			
End			
Describe Plume Background	Start Sky + Cupola	End Same	
Background Color	Start Blue + Brown	End	
Sky Conditions	Start 10-20% Cloudy	End	
Wind Speed (mph)	Start 2	End 2	
Wind Direction (From)	Start S	End S	
Ambient Temperature (°F)	Start 86	End 88	
Relative Humidity (%)	Start 55	End 49	

Sec.	0	15	30	45	Sec.	0	15	30	45
Min.									
0	5	5	5	5	30	5	5	5	0
1	5	5	5	5	31	0	5	5	5
2	5	0	0	0	32	5	10	10	10
3	5	5	5	5	33	10	10	10	15
4	5	10	10	10	34	5	5	5	10
5	5	5	5	5	35	10	5	0	10
6	5	5	10	10	36	10	5	10	10
7	5	5	10	10	37	10	10	5	5
8	0	5	5	5	38	5	5	5	5
9	5	5	5	5	39	5	5	5	10
10	5	5	10	10	40	10	10	10	5
11	5	5	5	10	41	5	5	5	10
12	10	10	10	10	42	10	5	10	5
13	10	10	10	10	43	5	10	10	10
14	10	10	10	10	44	10	5	10	10
15	15	10	5	5	45	10	10	10	5
16	5	10	10	15	46	10	10	5	5
17	5	5	10	10	47	10	5	10	10
18	10	10	15	10	48	5	5	5	10
19	15	10	10	10	49	0	5	5	5
20	5	5	10	10	50	0	0	5	5
21	10	5	5	5	51	5	5	5	5
22	10	5	10	10	52	10	5	5	5
23	10	10	5	10	53	10	10	10	5
24	15	5	10	5	54	5	10	10	10
25	5	5	10	5	55	5	5	5	10
26	5	5	5	10	56	5	5	0	0
27	10	5	5	5	57	5	0	5	5
28	5	5	5	5	58	5	5	5	5
29	5	10	10	10	59	5	5	5	5

Source Layout Sketch

Draw North Arrow ☐TN ☐MN



Longitude	Latitude	Declination
W 81° 50'	N 40° 16'	9° 49' W

Range of Opacity Readings

Minimum 0 Maximum 15

Average Opacity for Highest Period 9.79

Observer's Name (Print) Ken Lieurance

Observer's Signature

Date 5-3-12

Organization *Air Compliance Testing, Inc.*

Certified By (Check below where applicable):

[ ] **Eastern Technical Associates** Date:

[X] **Compliance Assurance Associates** Date: 2-7-12

Job Number: 120505 B

Done By / Date: KL / 5-3-12

Checked By / Date: — / — : — / —

Final Check By / Date: SS / 5-15-12

Air Compliance Testing, Inc.
(Method 9-Observation Form-1) 4/27/2012

Method 9 Visible Emissions Observation Form-1

Company Name	Clow Water Systems Co.	Observation Date	Run No. 3
Facility Name	Clow Water Systems Co.	Start Time 1304	Paused 1334 1346
Street Address	S Sixth St	End Time ~~1400~~ 1424	Resumed 1339 1352
City Coshocton	State OH Zip 43812		

Process & Unit #	Cupola	Operating Mode	max. achievable
Control Equipment		Operating Mode	

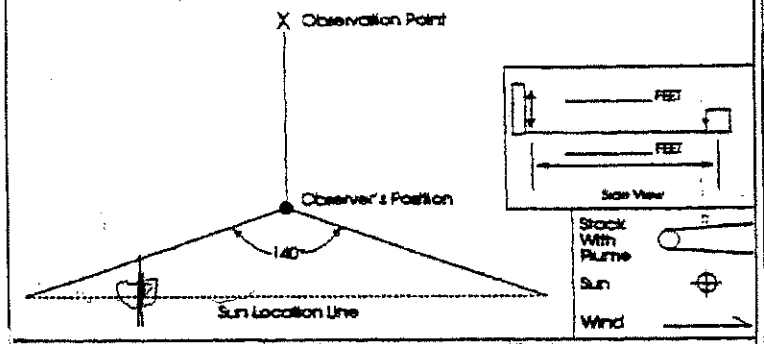
Describe Emission Point	Shroud		
Height of Emission Point	Start 70'	End 70	
Height Relative to Observer	Start 30'	End 30	
Distance from Observer	Start ~~250~~ 300'	End 300'	
Direction from Observer (°)	Start 300°	End 300°	
Vertical Angle to Observation Point (°)	Start 90°	End 90°	
Distance and Direction to Observation Point from Emission Point			
Start			
End			
Describe Emissions	Start Light Dust	End Same	
Emission Color	Start Grey	End ↓	
If Water Droplet Plume	Attached	Detached	
Point in the Plume at which Opacity was Determined			
Start	0 above Cont Lane		
End			
Describe Plume Background	Start Sky + Cupola	End Same	
Background Color	Start Blue + Brown	End ↓	
Sky Conditions	Start 20-30% cloudy	End ↓	
Wind Speed (mph)	Start SSW	End NW	
Wind Direction (From)	Start 2	End 1	
Ambient Temperature (°F)	Start 91	End 89	
Relative Humidity (%)	Start 45	End 47	

Sec.	0	15	30	45	Sec.	0	15	30	45
Min.									
0	5	10	5	5	30	5	5	10	10
1	5	5	5	10	31	5	10	10	5
2	10	10	10	10	32	5	5	5	5
3	15	10	10	10	33	5	5	10	10
4	5	5	10	5	34	5	5	10	10
5	10	5	5	5	35	10	10	10	5
6	10	5	10	10	36	5	5	5	5
7	5	5	5	10	37	5	5	10	10
8	5	10	10	5	38	10	5	5	0
9	5	5	5	5	39	0	0	0	0
10	10	5	5	5	40	0	5	5	10
11	5	10	10	5	41	10	10	10	10
12	10	10	10	10	42	10	10	10	5
13	10	5	5	5	43	5	5	5	5
14	10	10	10	10	44	5	5	5	5
15	5	5	10	10	45	5	10	5	5
16	10	10	10	10	46	5	5	5	5
17	10	10	10	10	47	5	5	5	5
18	15	5	5	10	48	5	10	5	10
19	5	5	5	10	49	10	10	5	5
20	5	5	5	5	50	0	5	5	5
21	5	5	5	5	51	5	5	10	10
22	10	10	10	5	52	15	15	10	10
23	10	5	5	5	53	10	10	10	10
24	5	5	5	5	54	10	10	10	10
25	5	10	5	5	55	5	5	5	5
26	10	10	10	10	56	5	10	5	5
27	5	10	10	5	57	10	10	10	5
28	5	5	5	5	58	10	10	5	10
29	5	0	0	5	59	10	10	10	10

Source Layout Sketch

Draw North Arrow ☐TN ☐MN

See run #2



Longitude	Latitude	Declination
W 81° 50'	N 40° 16'	7° 49' W

Range of Opacity Readings

Minimum 0 Maximum 15

Average Opacity for Highest Period 9.17

Observer's Name (Print) Ken Cicerone

Observer's Signature [signature]

Date 5-3-12

Organization *Air Compliance Testing, Inc.*

Certified By (Check below where applicable):

[ ] **Eastern Technical Associates** Date:

[X] **Compliance Assurance Associates** Date: 2-7-12

Job Number: 120505 B

Done By / Date: KL 5-3-12

Checked By / Date: — / — : — / —

Final Check By / Date: SS 5-15-12

Air Compliance Testing, Inc.
(Method 9-Observation Form-1) 4/27/2012

Method 4 Moisture Recovery

Company Name Kirkwood Industries Location P901 Exhaust Stack (A)

Prepared By KL Date 5-2-12 Shop Balance ID 607 Field Balance ID 067

Run Number	1	2	3	4
Run Date	5-3-12	5-3-12	5.3.12	
Recovery Date	5-3-12	5-3-12	5.3.12	
Recovery Time	1050	1235	14:45	
Recovered By	KL	KL	TST	
Impinger Box No.	009	005	009	
Turbidity / Color (Clear, Cloudy, Suspended Particulates, etc.)	clear	clear	clear	
Knockout Impinger (optional)				
Final Weight (g)				
Tared Weight (g)				
Condensed H_2O (g)				
Impinger #1				
Final Weight (g)	759.9	802.4	717.2	
Tared Weight (g)	705.7	739.9	649.5	
Condensed H_2O (g)	54.2	62.5	67.7	
Impinger #2				
Final Weight (g)	703.1	708.4	694.3	
Tared Weight (g)	678.3	687.9	683.5	
Condensed H_2O (g)	24.8	20.5	10.8	
Impinger #3				
Final Weight (g)	602.7	601.8	591.4	
Tared Weight (g)	597.9	598.5	588.3	
Condensed H_2O (g)	4.8	3.3	3.1	
Total Condensed (g)	83.8	86.3	81.6	
SILICA GEL				
Final Weight (g)	832.2	927.4	899.6	
Tared Weight (g)	820.1	916.2	878.7	
Adsorbed H_2O (g)	12.1	11.2	20.9	
Total H_2O Collected (g)	95.9	97.5	102.5	

Job Number: 120505 A

Done By / Date: KL / 5-3-12

Final Check By / Date: SS / 5-15-12

Air Compliance Testing, Inc.
(Method 4-Moisture Recovery) 4/27/2012

Plant Name Clow Water Systems Location P901 Exhaust Stack (A)

Reagents Prepared By KL / Date 5/2/12

	Run 1	Run 2	Run 3
Run Date	5/3/12	5/3/12	5/3/12
Analysis Date	5/3/12	5/3/12	5/3/12
Time of Analysis	10:50	12:35	14:45
IMPINGER #1			
Final Weight (g)	759.9	802.4	717.2
Tared Weight (g)	705.7	739.9	649.5
Condensed H_2O (ml,g)	54.2	62.5	67.7
IMPINGER #2			
Final Weight (g)	703.1	708.4	694.3
Tared Weight (g)	678.3	687.9	683.5
Condensed H_2O (ml,g)	24.8	20.5	10.8
IMPINGER #3			
Final Weight (g)	602.7	601.8	591.4
Tared Weight (g)	597.9	598.5	588.3
Condensed H_2O (ml,g)	4.8	3.3	3.1
Total Condensed (ml,g)	83.8	86.3	81.6
SILICA GEL			
Final Weight (g)	832.2	927.4	899.6
Tared Weight (g)	820.1	916.2	878.7
Adsorbed H_2O (ml,g)	12.1	11.2	20.9
Total H_2O Collected (ml,g)	95.9	97.5	102.5

Shop Balance	A - BAL -	007
Field Balance	A - BAL -	007

Method 3 Fyrite Field Data

Plant Name: Clow Water Systems Co.

Test Location: P901 Exhaust Stack (A)

CO_2 Zero (Y) N O_2 Zero (Y) N

Run Number: 1			Operator: BSI	
Time of Sample Collection	Time of Analysis	%CO_2 (A)	%O_2 (B)	%N_2 (100 - (A + B))
09:20 - 10:33	1400	9.5	12.5	78.0
	1402	10.0	12.5	77.5
	1404	9.5	12.5	78.0
	Average	9.67	12.50	77.85

Analyzer I.D. - A - FYR - 001 Tedlar Bag I.D. - 120505-A-1-M3/TB

Run Number: 2			Operator: BSI	
Time of Sample Collection	Time of Analysis	%CO_2 (A)	%O_2 (B)	%N_2 (100 - (A + B))
11:15 - 12:24	1407	9.5	12.0	78.5
	1409	10.0	11.5	78.5
	1412	10.0	11.5	78.5
	Average	9.83	11.67	78.50

Analyzer I.D. - A - FYR - 001 Tedlar Bag I.D. - 120505-A-2-M3/TB

Run Number: 3			Operator: DI	
Time of Sample Collection	Time of Analysis	%CO_2 (A)	%O_2 (B)	%N_2 (100 - (A + B))
13:04 - 14:21	1501	9.5	10.5	80.0
	1504	10.0	10.5	79.5
	1507	10.0	10.5	79.5
	Average	9.83	10.5	79.67

Analyzer I.D. - A - FYR - 001 Tedlar Bag I.D. - 120505-A-3-M3/TB

Job Number: 120505 A

Done By / Date: BSI / 5-3-12

Checked By / Date: — / — : — / —

Final Check By / Date: SS / 6-15-12

Method 3 Dry Molecular Weight Calculation

Run 1

	%CO2	%O2	%N2	Molecular Weight	Mean Difference
	9.5	12.5	78.0	30.02	-0.027
	10.0	12.5	77.5	30.10	0.053
	9.5	12.5	78.0	30.02	-0.027
Average	9.67	12.50	77.83	30.05	

Run 2

	%CO2	%O2	%N2	Molecular Weight	Mean Difference
	9.5	12.0	78.5	30.00	-0.040
	10.0	11.5	78.5	30.06	0.020
	10.0	11.5	78.5	30.06	0.020
Average	9.83	11.67	78.50	30.04	

Run 3

	%CO2	%O2	%N2	Molecular Weight	Mean Difference
	9.5	10.5	80.0	29.94	-0.053
	10.0	10.5	79.5	30.02	0.027
	10.0	10.5	79.5	30.02	0.027
Average	9.83	10.50	79.67	29.99	

Port Number	1	2
Relative Location	NW	SW
From Far Wall to Outside of Port (in.)	69.25	69.50
Nipple Length or Wall Thickness (in.)	6.50	6.50
Port Protrusion Length (opt) (in.)	0.25	0.20
Depth of Stack or Duct (in.)	63.00	63.20
Stack or Duct Type	Elliptical	
Port Hole Inner Diameter (in.)	6.0	
Stack or Duct Width (If Rectangular) (in.)		#N/A
Stack Outer Circumference (in.)		
Number of Ports	2.0	
Elevation of Ports from Ground Level (ft)	30.0	

Equivalent Diameter = D_e (in.)

$$De = \frac{2 \times (\text{Depth} \times \text{Width})}{(\text{Depth} + \text{Width})} = \text{---}$$

"Velocity" or "Particulate" Traverse	Particulate
Distance Upstream from Flow Disturbance (in.)	122.0
Diameters Upstream from Flow Disturbance (* 0.5 De)	1.93
Minimum Traverse Points Needed for a Velocity Traverse *	12
Minimum Traverse Points Needed for a Particulate Traverse *	12

Distance Downstream from Flow Disturbance (in.)	286.0
Diameters Downstream from Flow Disturbance (* 2 De)	4.53
Minimum Traverse Points Needed for a Velocity Traverse *	16
Minimum Traverse Points Needed for a Particulate Traverse *	24

Minimum Traverse Points	24
Traverse Point Overide	
Duct Area - in^2	3127.15
Duct Area - ft^2	21.7163
Diameter Check via Circumference (in.)	0.0000

Location of Points in Circular Stacks or Ducts

	4	6	8	10	12	14	16	18	20	22	24
1	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.6	3.2
3	76.0	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	14.5	12.9	11.6	10.5
6		95.6	80.6	65.8	35.6	29.0	22.0	18.6	16.5	14.6	13.2
7			89.5	77.4	64.4	39.0	29.3	23.8	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	36.2	30.5	26.2	23.0
10				97.4	88.2	79.9	71.7	61.8	38.5	31.6	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	73.6	67.7
15							95.1	89.1	83.5	78.2	72.5
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	94.0	89.5
21										96.6	92.1
22										98.9	94.5
23											96.8
24											98.9

Location of Points in Rectangular Stacks or Ducts

Note:

1) Stacks having a diameter greater than 24in, shall have no traverse points located within 1.0in of the Stack walls.

2) Stacks having a diameter less than or equal to 24in, shall have no traverse points located within .50in of the Stack walls.

3) Add nipple protrusion length to Point 1 only. Actual nipple length = (length - protrusion)

Relocate to a distance equal to the inside diameter of the nozzle being used or to the above minimum distances, whichever is larger.

Number of Ports: 2
Direction of Flow: Up
Isokinetic Sample: Yes Yes
Stack Build-up: Yes / N No

Port	Point	% of Duct Depth	Dist. From Inside Wall (Decimal)	Dist. From Outside Wall (Decimal)
1	1	2.1	1.3	7.8
1	2	6.7	4.2	10.5
1	3	11.8	7.4	13.7
1	4	17.7	11.2	17.4
1	5	25	15.8	22.0
1	6	35.6	22.4	26.7
1	7	64.4	40.6	46.8
1	8	75	47.3	53.5
1	9	82.3	51.8	58.1
1	10	88.2	55.6	61.8
1	11	93.3	58.8	65.0
1	12	97.9	61.7	67.9
2	1	2.1	1.3	7.8
2	2	6.7	4.2	10.5
2	3	11.8	7.5	13.8
2	4	17.7	11.2	17.5
2	5	25	15.8	22.1
2	6	35.6	22.5	28.8
2	7	64.4	40.7	47.0
2	8	75	47.4	53.7
2	9	82.3	52.0	58.3
2	10	88.2	55.7	62.0
2	11	93.3	59.0	65.3
2	12	97.9	61.9	68.2

Method 5 Probe Nozzle Inspection

The sampling nozzle must be calibrated before use in a source experiment. Calibration should be done in the laboratory and checked just before use in the field. Inside / outside calipers are used to measure the interior nozzle diameter to the nearest 0.025mm (0.001 inch).

The calipers are inserted as close to the edge of the nozzle opening as possible; readings are taken on three separate diameters and recorded. The average of the three readings will be the Assignied Nozzle Size. Each reading must agree within 0.1 mm (0.004 inch), or the nozzle must be reshaped. Any nozzle that has been nicked, dented, or corroded must be reshaped and recalibrated. All calibrated nozzles should be permanently identified.

Run # 1-3
Nozzle ID # ~~5-8-12~~ 5-7-3

Measured Nozzle Size (inches)	Assigned Nozzle Size (inches)	Difference Between High and Low Measurements	
~~0.241~~ .208	~~0.240~~ .208	0.001 ~~0.003~~	<= 0.004in
~~0.238~~ .208			
~~0.241~~ .209			

Run # 2
Nozzle ID # 5-8-12

Measured Nozzle Size (inches)	Assigned Nozzle Size (inches)	Difference Between High and Low Measurements	
0.247	0.247	0.001	<= 0.004in
0.247			
~~0.246~~			

Run # _____
Nozzle ID # _____

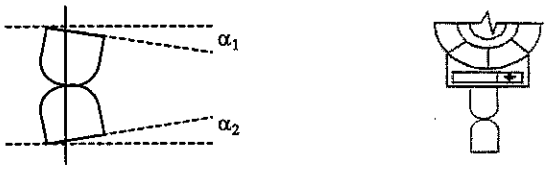
Measured Nozzle Size (inches)	Assigned Nozzle Size (inches)	Difference Between High and Low Measurements	
0.250	~~0.250~~	0	<= 0.004in
0.250			
0.250			

Job Number: 120505 A
Done By / Date: Ve / 5-2-12
Final Check By / Date: SS / 5-15-12

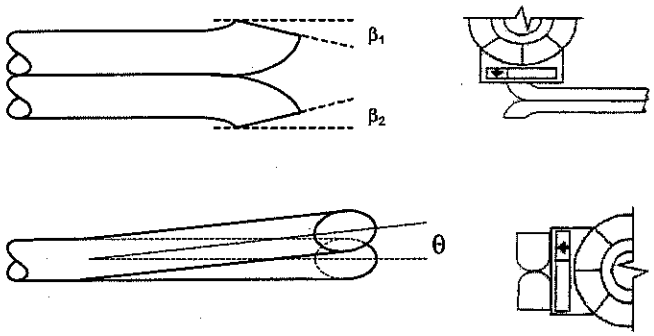
Air Compliance Testing, Inc.
(Method 5-Probe Nozzle Inspection) 4/27/2012

Type S Pitot Tube Inspection

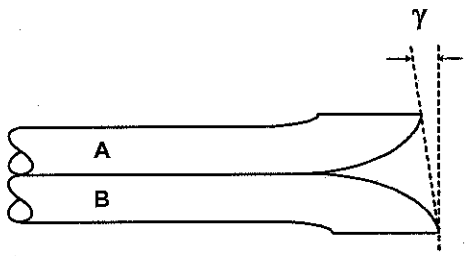
Alignment and Tubing Dimensions



Degree indicating level position for determining α_1 and α_2.

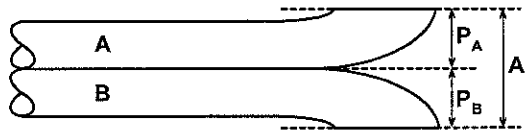


Degree indicating level position for determining θ.

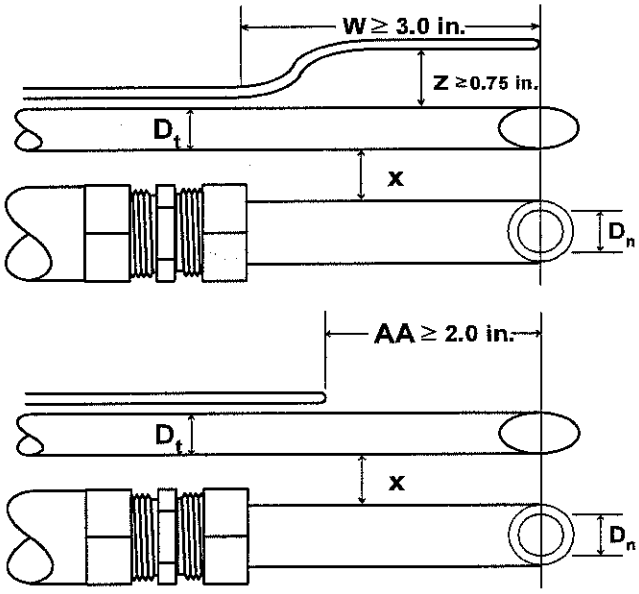


Degree indicating level position for determining γ then calculating Z.

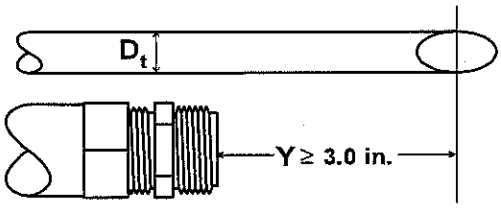
Probe / Pitot Number	PRB-808
Level and Perpendicular	☑
No Obstructions	☑
No Damage	☑
α_1 $(-10° < \alpha_1 < +10°)$	-1.0
α_2 $(-10° < \alpha_2 < +10°)$	1.0
β_1 $(-5° < \beta_1 < +5°)$	0.0
β_2 $(-5° < \beta_2 < +5°)$	0.0
γ	1.00
θ	0.00
A	0.920
z= A tan γ (< 0.125")	0.016
w= A tan θ (< 0.03125")	0.000
D_t (0.1875" < D_t < 0.375")	0.375
P_A $(1.05D_t < P_A < 1.5D_t)$	0.460
P_B $(1.05D_t < P_B < 1.5D_t)$	0.460
$P_A = P_B \pm 0.0625$	0.000



Assembly Inter-Component Spacing Requirements

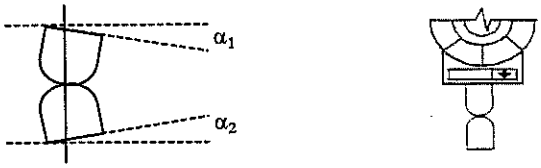


Effective Length (in.)	6.90
W (≥ 3.0")	6.900
-or- AA (≥ 2.0")	
X	1.100
D_n	0.460
X / D_n (≥ 1.5)	2.391
Y (≥ 3.0")	3.600
Z ≥ 0.75"	1.300

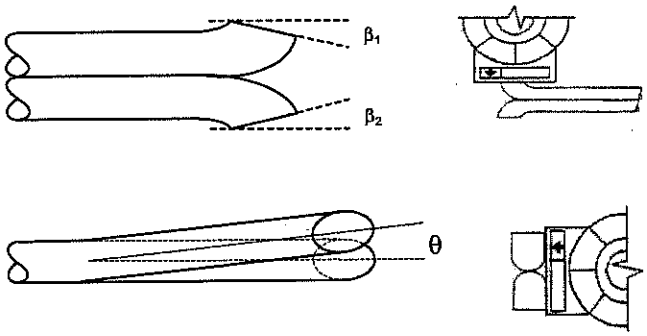


Type S Pitot Tube Inspection

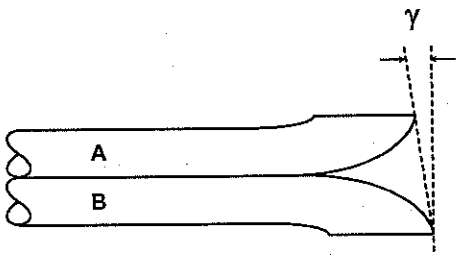
Alignment and Tubing Dimensions



Degree indicating level position for determining α_1 and α_2.

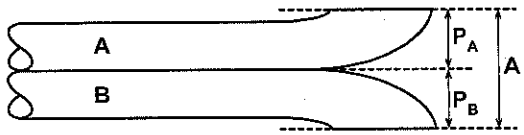


Degree indicating level position for determining θ.

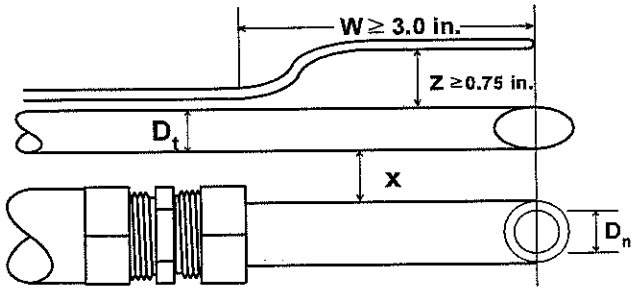


Degree indicating level position for determining γ then calculating Z.

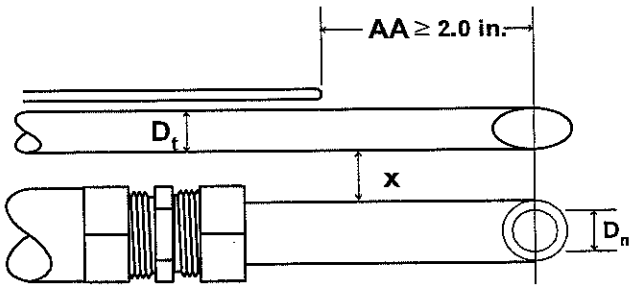
Probe / Pitot Number	PRB-810
Level and Perpendicular	☑
No Obstructions	☑
No Damage	☑
α_1 $(-10° < \alpha_1 < +10°)$	0.0
α_2 $(-10° < \alpha_2 < +10°)$	0.0
β_1 $(-5° < \beta_1 < +5°)$	0.0
β_2 $(-5° < \beta_2 < +5°)$	-1.0
γ	0.00
θ	1.00
A	0.896
z= A tan γ (< 0.125")	0.000
w= A tan θ (< 0.03125")	0.016
D_t (0.1875" < D_t < 0.375")	0.375
P_A $(1.05D_t < P_A < 1.5D_t)$	0.448
P_B $(1.05D_t < P_B < 1.5D_t)$	0.448
$P_A = P_B \pm 0.0625$	0.000

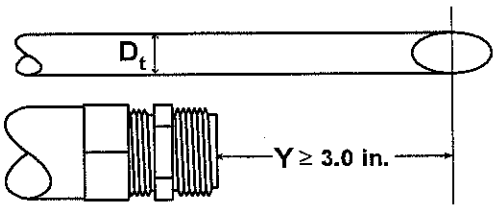


Assembly Inter-Component Spacing Requirements



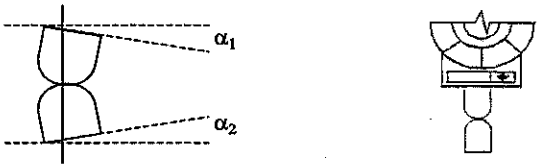
Effective Length (in.)	86.90
W (≥ 3.0")	6.900
-or- AA (≥ 2.0")	
X	1.000
D_n	0.460
X / D_n (≥ 1.5)	2.174
Y (≥ 3.0")	3.300
Z ≥ 0.75"	1.800



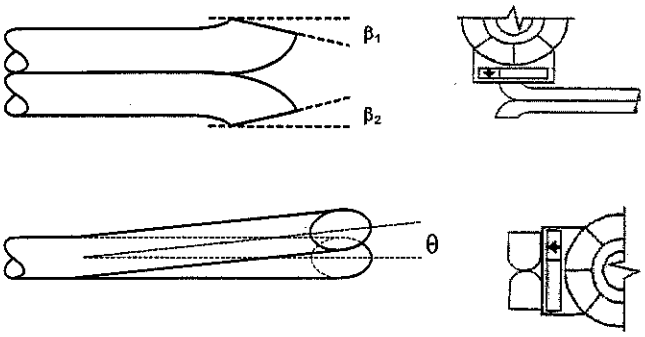


Type S Pitot Tube Inspection

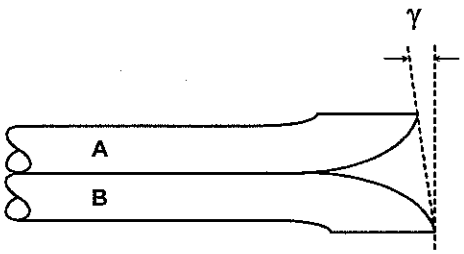
Alignment and Tubing Dimensions



Degree indicating level position for determining α_1 and α_2.

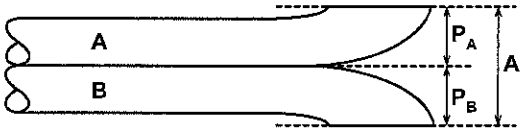


Degree indicating level position for determining θ.

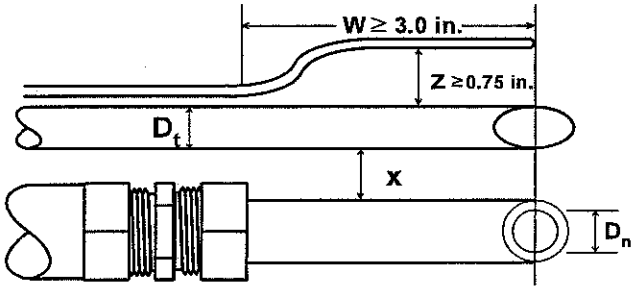


Degree indicating level position for determining γ then calculating Z.

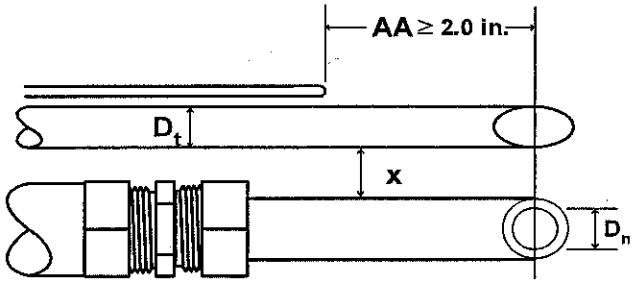
Probe / Pitot Number	PRB-811
Level and Perpendicular	☑
No Obstructions	☑
No Damage	☑
α_1 $(-10° < \alpha_1 < +10°)$	-1.0
α_2 $(-10° < \alpha_2 < +10°)$	4.0
β_1 $(-5° < \beta_1 < +5°)$	2.0
β_2 $(-5° < \beta_2 < +5°)$	2.0
γ	1.00
θ	0.00
A	0.922
z= A tan γ (< 0.125")	0.016
w= A tan θ (< 0.03125")	0.000
D_t (0.1875" < D_t < 0.375")	0.375
P_A $(1.05D_t < P_A < 1.5D_t)$	0.462
P_B $(1.05D_t < P_B < 1.5D_t)$	0.460
$P_A = P_B \pm 0.0625$	0.002

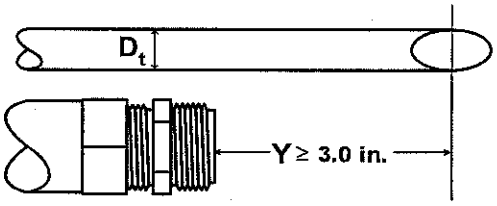


Assembly Inter-Component Spacing Requirements



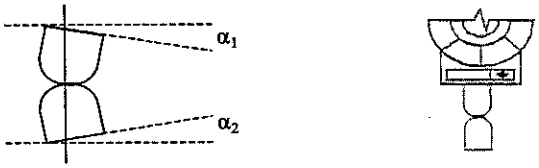
Effective Length (in.)	86.80
W (≥ 3.0")	7.000
-or- AA (≥ 2.0")	
X	0.900
D_n	0.460
X / D_n (≥ 1.5)	1.957
Y (≥ 3.0")	3.600
Z ≥ 0.75"	1.900



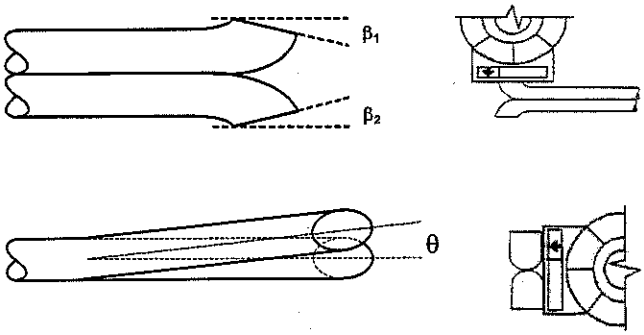


Type S Pitot Tube Inspection

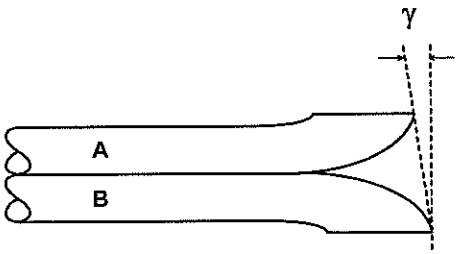
Alignment and Tubing Dimensions



Degree indicating level position for determining α_1 and α_2.

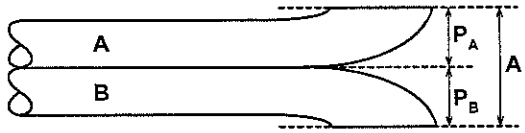


Degree indicating level position for determining θ.

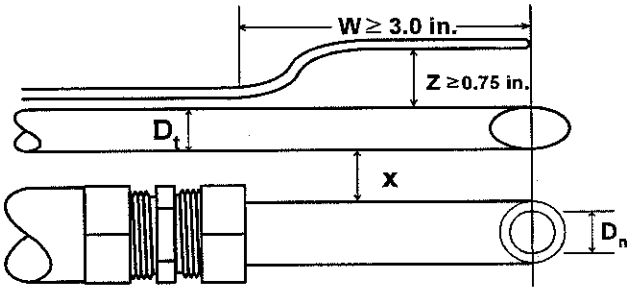


Degree indicating level position for determining γ then calculating Z.

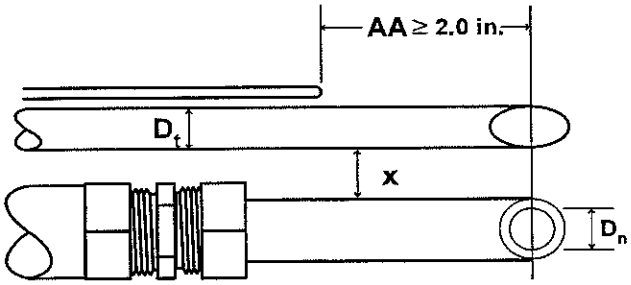
Probe / Pitot Number	PRB-808
Level and Perpendicular	☑
No Obstructions	☑
No Damage	☑
α_1 $(-10° < \alpha_1 < +10°)$	0.0
α_2 $(-10° < \alpha_2 < +10°)$	1.0
β_1 $(-5° < \beta_1 < +5°)$	0.0
β_2 $(-5° < \beta_2 < +5°)$	0.0
γ	1.00
θ	0.00
A	0.920
z= A tan γ (< 0.125")	0.016
w= A tan θ (< 0.03125")	0.000
D_t (0.1875" < D_t < 0.375")	0.375
P_A $(1.05D_t < P_A < 1.5D_t)$	0.460
P_B $(1.05D_t < P_B < 1.5D_t)$	0.460
$P_A = P_B \pm 0.0625$	0.000

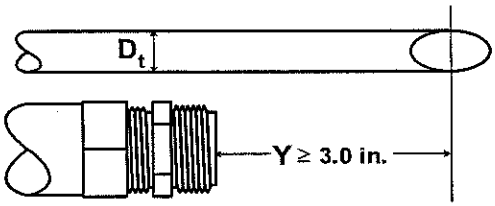


Assembly Inter-Component Spacing Requirements



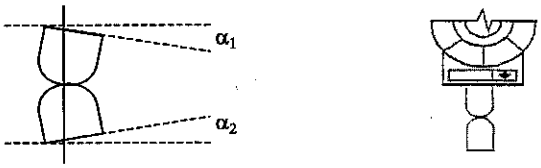
Effective Length (in.)	6.90
W (≥ 3.0")	6.900
-or- AA (≥ 2.0")	
X	1.100
D_n	0.460
X / D_n (≥ 1.5)	2.391
Y (≥ 3.0")	3.600
Z ≥ 0.75"	1.300



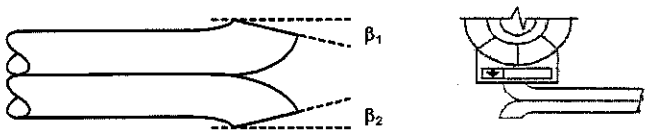


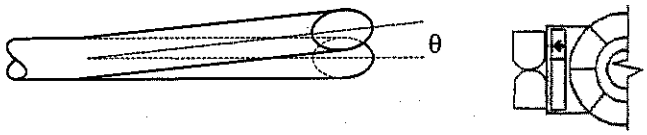
Type S Pitot Tube Inspection

Alignment and Tubing Dimensions

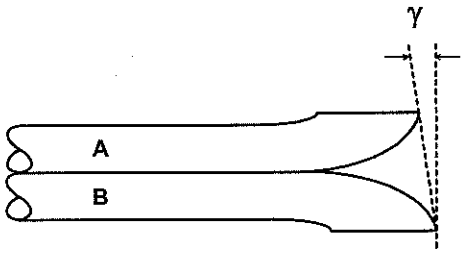


Degree indicating level position for determining α_1 and α_2.



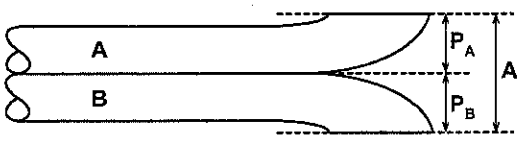


Degree indicating level position for determining θ.

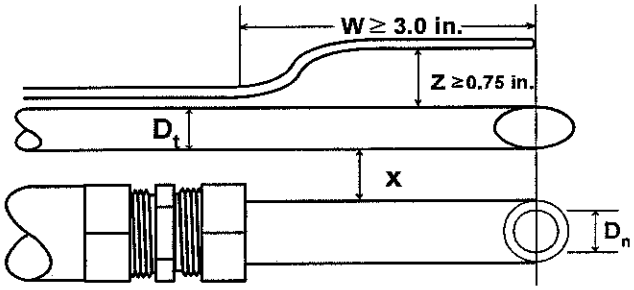


Degree indicating level position for determining γ then calculating Z.

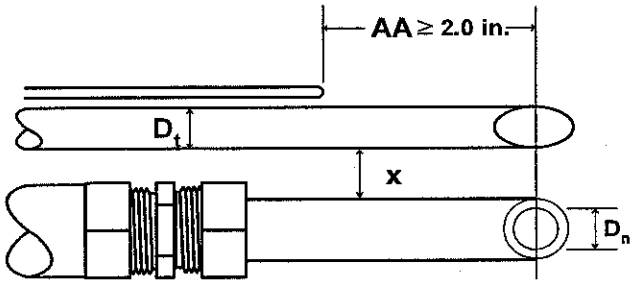
Probe / Pitot Number	PRB-810
Level and Perpendicular	☑
No Obstructions	☑
No Damage	☑
α_1 $(-10° < \alpha_1 < +10°)$	0.0
α_2 $(-10° < \alpha_2 < +10°)$	1.0
β_1 $(-5° < \beta_1 < +5°)$	1.0
β_2 $(-5° < \beta_2 < +5°)$	1.0
γ	0.00
θ	0.00
A	0.896
z= A tan γ (< 0.125")	0.000
w= A tan θ (< 0.03125")	0.000
D_t (0.1875" < D_t < 0.375")	0.375
P_A $(1.05D_t < P_A < 1.5D_t)$	0.448
P_B $(1.05D_t < P_B < 1.5D_t)$	0.448
$P_A = P_B \pm 0.0625$	0.000

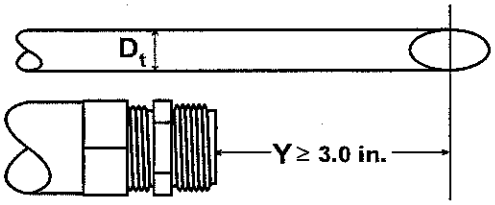


Assembly Inter-Component Spacing Requirements



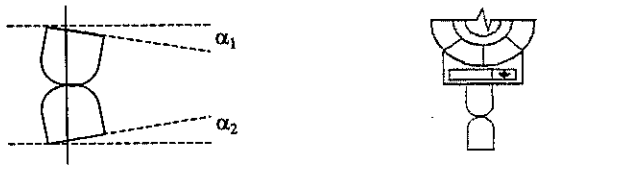
Effective Length (in.)	87.60
W (≥ 3.0")	7.000
-or- AA (≥ 2.0")	
X	0.800
D_n	0.493
X / D_n (≥ 1.5)	1.623
Y (≥ 3.0")	3.700
Z ≥ 0.75"	1.700



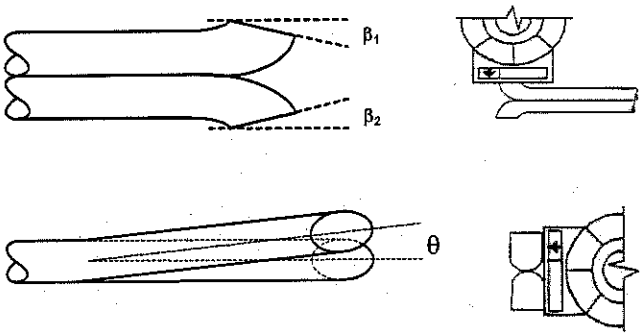


Type S Pitot Tube Inspection

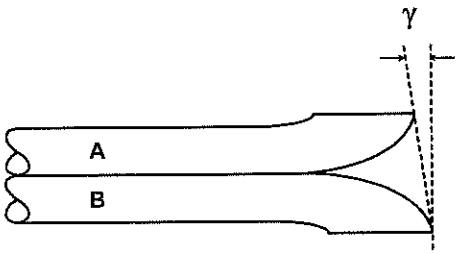
Alignment and Tubing Dimensions



Degree indicating level position for determining α_1 and α_2.

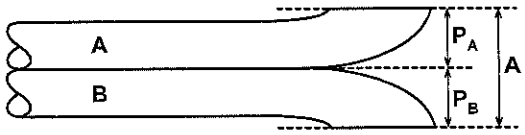


Degree indicating level position for determining θ.

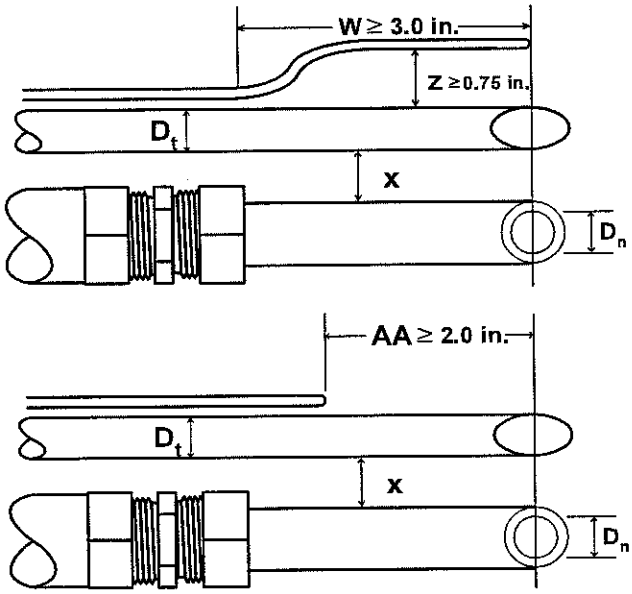


Degree indicating level position for determining γ then calculating Z.

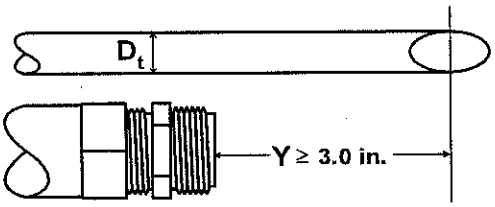
Probe / Pitot Number	PRB-811
Level and Perpendicular	☑
No Obstructions	☑
No Damage	☑
α_1 $(-10° < \alpha_1 < +10°)$	-1.0
α_2 $(-10° < \alpha_2 < +10°)$	3.0
β_1 $(-5° < \beta_1 < +5°)$	2.0
β_2 $(-5° < \beta_2 < +5°)$	1.0
γ	1.00
θ	0.00
A	0.922
z= A tan γ (< 0.125")	0.016
w= A tan θ (< 0.03125")	0.000
D_t (0.1875" < D_t < 0.375")	0.375
P_A $(1.05D_t < P_A < 1.5D_t)$	0.461
P_B $(1.05D_t < P_B < 1.5D_t)$	0.461
$P_A = P_B \pm 0.0625$	0.000



Assembly Inter-Component Spacing Requirements



Effective Length (in.)	86.90
W (≥ 3.0")	7.000
-or- AA (≥ 2.0")	
X	0.900
D_n	0.460
X / D_n (≥ 1.5)	1.957
Y (≥ 3.0")	3.500
Z ≥ 0.75"	1.800



Method 4 Thermocouple System Audit (2)

Run 1	Probe No. - T-PIT-606			Umbilical Adapter No. - NA	
	Meter Box No. - T-MTB-009			Filter Exit No. - NA	
	Umbilical No. - MC-104 M2U-401			Filter Box No. - 21	
Reference Thermometer °F	Stack °F	Meter In °F	Meter Out °F	Filter Exit °F	Impinger Exit °F
50.0	50.0	50.0	51.0	NA	50.0

Run 2	Probe No. -			Umbilical Adapter No. -	
	Meter Box No. -			Filter Exit No. -	
	Umbilical No. -			Filter Box No. -	
Reference Thermometer °F	Stack °F	Meter In °F	Meter Out °F	Filter Exit °F	Impinger Exit °F

Run 3	Probe No. -			Umbilical Adapter No. -	
	Meter Box No. -			Filter Exit No. -	
	Umbilical No. -			Filter Box No. -	
Reference Thermometer °F	Stack °F	Meter In °F	Meter Out °F	Filter Exit °F	Impinger Exit °F

Thermocouple	Primary Meter Box No. - T-MTB-009		
Simulator Setting °F	Stack °F	Filter Exit °F	Impinger Exit °F
50	50.0	NA	50.0
100	101.0	NA	100.0
200	202.0	NA	
300	300.0	NA	
400	400.0		
600	601.0		
800	800.0		
1000	1001.0		
1500	1500.0		

Tolerance Ranges

Stack ± 8.0°F or ± 1.5% absolute

Filter Exit ± 5.4°F

Meter Box ± 5.4°F

Impinger Exit ± 2.0°F

Thermocouple Simulator Used: T-THR-

Completed By: MC

Method 2 Post-Test Thermocouple Check

ALT-011 Post-Test Stack Thermocouple System Check Procedure

Reference Thermometer Serial #	11000622
Reference Thermometer ID	THR-013
In-Field Temperature Display / Meter Box I.D.	MTB-009
Umbilical Cord I.D.	UMC-104
Umbilical Cord I.D.	
Umbilical Cord I.D.	
Continuity Check Performed	☑

	Run 1	Run 2	Run 3	Run 4
Probe I.D.	PRB-810	PRB-811		
Reference Thermometer Ambient Readout (°F)	78.3	78.3		
Stack Temperature Thermocouple Ambient Readout (°F)	79.0	78.0		
Temperature Difference (must be ±2°F)	-0.7	0.3		

Method 4 Pre-Test Orifice Meter Check

M5

_____ Assemble meter box - level / zero the manometer

_____ Operate the meter box at the ΔH@ pressure differential for at least **10 minutes.**

The ΔH@ number is taken from the meter console calibration sheet or the tag.

_____ *During the warm-up period, verify flow through the Method 3 flowmeter.*

_____ Record the dry gas meter volume, meter temperatures and barometric pressure (in.Hg).

Meter Box No. **T-MTB-** 009 Calibration Date 3.28.12

Pump No. **T-PMP-** 009 Barometric Pressure (in.Hg) 29.01

Gamma (γ) 1.0019 Initial Dry Gas Meter Volume (cf) 914.3

ΔH@ 1.836 Final Dry Gas Meter Volume (cf) 921.842

Time (min)	Meter In (°F)	Meter Out (°F)
2	90	79
4	91	80
6	92	81
8	93	81
10	94	82
Avg.	86.3	

_____ Calculate the Dry Gas Meter Calibration Value (γ_c) and compare γ_c against the Dry Gas Meter Calibration Factor (γ) to determine if $\gamma_c = \gamma \pm 3\%$

_____ If the γ_c is not within this range, the Meter Box should be investigated before beginning the test.

PASS

Job Number: 120505 A

Done By / Date: PD / 5.2.2012

Checked By / Date: — / — : — / —

Final Check By / Date: SR / 5-15-12

_____ Operate the Dry Gas Meter at the ΔH@ pressure differential for 10 minutes.
The ΔH@ number is taken from the Meter Console Calibration Sheet or the tag.
_____ Record the Dry Gas Meter Volume (CF), Meter Temperatures (°R = 460 + °F) and Barometric Pressure (in.Hg).

Meter Box: T-MTB-	009	Initial Dry Gas Meter Volume	914.300
Calibration Date	3/28/12	Final Dry Gas Meter Volume	921.842
		Net Dry Gas Meter Volume	7.542
γ =	1.0019		
ΔH@ =	1.836	Barometric Pressure (inHg)	29.01

Time (min)	Meter In (°F)	Meter Out (°F)
2	90	79
4	91	80
6	92	81
8	93	81
10	94	82
Avg.	92	80.6
Avg. of Avgs.	86.3	

_____ Calculate the Dry Gas Meter Calibration Value (γ_c)

$$\gamma_c = (10 / Vm) * [0.0319 (Tm/Pbar]^{1/2}$$

_____ Compare the γ_c value with the Dry Gas Meter Calibration Factor γ to determine if:

$$0.97(\gamma) < \gamma_c < 1.03(\gamma)$$

Calculate

0.9718	<	1.0277	<	1.0320	PASS

_____ If the γ_c is not within this range, the Dry Gas Meter should be investigated before beginning the test.

Meter Box Pre-Test Leak Check

- [x] Remove the front panel from the meter box
- [ ] Disconnect the fan
- [x] Hook up the proper pump to the meter box
- [x] Close both the fine and coarse adjustment valves
- [x] Connect the DH hoses on the front of the meter box
- [x] Remove the copper elbow from stainless tube at the exit side of gas meter
- [x] Stopper the stainless tube with a rubber stopper
- [x] Disconnect the DH static line from the orifice (bottom)
- [x] Plug in leak check tube into the static side of the orifice
- [x] Blowing into the leak check tube, pressurize the system to 5-7 inches and clamp off
- [x] Hold for one minute
- [x] No leakage should occur. If leak is present, it must be corrected
- [x] Affix (w/ electrical tape) the copper elbow onto the stainless tube at the exit side of gas meter
- [x] Reassemble meter box
- [x] Plug in capped swagelok stem at sample inlet
- [x] Start pump, bringing system vacuum to at least 15 in. Hg
- [x] Note DGM reading, start timer
- [x] Observe DGM for one minute
- [x] No leakage should occur. If leak is present, it must be corrected
- [x] Check oil wick position (should be 1/4" above the black O-ring)
- [x] Check pump oil level (should be at fill line)

Meter Box Number MTB- 009

Pump Number PMP- 009

Method 4 Pre-Test Meter Calculation Orifice Calibration Data

Meter Box I.D:	T - MTB - 009
Meter Box Serial Number:	412690
Standard Meter I.D:	T - DGM - 006
Temp Sensor I.D:	T - DGM
Barometer I.D:	T BAR 001
Meter Box Level?	☑

Standard Meter

Calibrated By:	Apex Instruments Inc.
Calibration Date:	February 16, 2012
Gamma:	0.9977
Serial Number:	1512377

REMOVE CAPS FROM STANDARD METER

Run 1

Pressures

ΔH:	1.00	in.H_2O
Meter Box Vac:	5.0	in.Hg
P Bar:	28.40	in.Hg

Meter Readings

	Time	Std Meter	Meter Box
Begin	0.0	185.998	394.554
End	12.0	192.697	401.255
Net	12.0	6.699	6.701

(>5.0 dcf)

Temperatures

Time (min)	Std Meter In	Std Meter Out	Meter Box In	Meter Box Out
4	67.0	67.0	80.0	70.0
8	67.0	67.0	82.0	70.0
12	67.0	67.0	82.0	71.0
Avg.	67.00		75.83	

Run 2

Pressures

ΔH:	2.00	in.H_2O
Meter Box Vac:	5.0	in.Hg
P Bar:	28.40	in.Hg

Meter Readings

	Time	Std Meter	Meter Box
Begin	0.0	193.419	401.985
End	12.0	202.952	411.670
Net	12.0	9.533	9.685

(>5.0 dcf)

Temperatures

Time (min)	Std Meter In	Std Meter Out	Meter Box In	Meter Box Out
4	67.0	67.0	84.0	71.0
8	67.0	67.0	85.0	71.0
12	67.0	67.0	86.0	71.0
Avg.	67.00		78.00	

Run 3

Pressures

ΔH:	3.00	in.H_2O
Meter Box Vac:	5.0	in.Hg
P Bar:	28.40	in.Hg

Meter Readings

	Time	Std Meter	Meter Box
Begin	0.0	204.262	413.001
End	12.0	216.002	424.950
Net	12.0	11.740	11.949

(>5.0 dcf)

Temperatures

Time (min)	Std Meter In	Std Meter Out	Meter Box In	Meter Box Out
4	67.0	67.0	87.0	72.0
8	67.0	67.0	88.0	73.0
12	67.0	67.0	88.0	73.0
Avg.	67.00		80.17	

ΔH:	$\Delta H_@$	γ
1	1.865	1.0115
2	1.834	0.9974
3	1.807	0.9970
AVG.	1.836	1.0020

* Adjust and recalculate if γ does not equal 1.00 ± 0.02

Method 4 Pre-Test Meter Console Calibration

Run No.	Calibration Meter Correction Factor (Yc)	Barometric Press. (Pb) (in.Hg)	Delta H (in w.g.)	Meter Box Volume (Vd) (cu.ft.)	Average Meter Box Temperature (Tm) (F)	Standard Meter Volume (Vc) (cu.ft.)	Standard Meter Temperature (Tc) (F)	Time (min.)	Gamma (Y)	Tolerance (plus or minus 0.02)	Delta H@	Tolerance (plus or minus 0.2)
1	0.9977	28.40	1.000	6.701	75.83	6.699	67.00	12	1.0115	0.009544	1.865	0.029
2	0.9977	28.40	2.000	9.685	78.00	9.533	67.00	12	0.9974	-0.004582	1.834	-0.001
3	0.9977	28.40	3.000	11.949	80.17	11.740	67.00	12	0.9970	-0.004961	1.807	-0.028
										PASS		PASS
							Average		1.0020	PASS	1.836	

Pump Number T-PMP- 009

Meter Box Number T-MTB- 009

Reference Meter Number T-DGM- 001

Add Values to 30 Day Calibration History
Add Values to Dry Gas Meter Calibration History
Tag Meter Box

ALT-009 Post-Test Leak Check

NOTE: Do not perform leak check if meter failed ALT-009 requirements.

- ☑ Remove the front panel from the meter box
- ☑ Disconnect the fan
- ☑ Hook up the proper pump to the meter box
- ☑ Close both the fine and coarse adjustment valves
- ☑ Connect the DH hoses on the front of the meter box
- ☑ Remove the copper elbow from stainless tube at the exit side of gas meter
- ☑ Stopper the stainless tube with a rubber stopper
- ☑ Disconnect the DH static line from the orifice (bottom)
- ☑ Plug in leak check tube into the static side of the orifice
- ☑ Blowing into the leak check tube, pressurize the system to 5-7 inches and clamp off
- ☑ Hold for one minute
- ☑ No leakage should occur.
- ☑ Affix (w/ electrical tape) the copper elbow onto the stainless tube at the exit side of gas meter
- ☑ Reassemble meter box

Meter Box Number MTB- 009

Pump Number PMP- 009

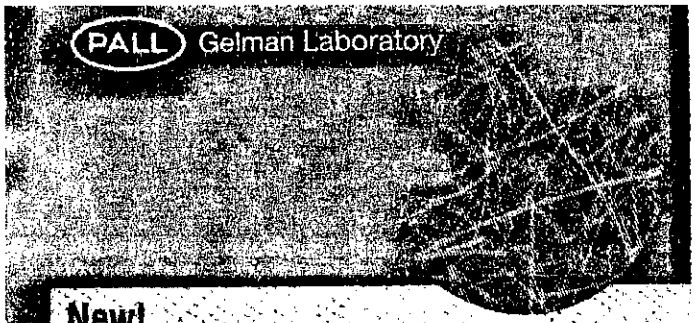
Digital Pressure Gauge Calibration History

Digital Pressure Gauge ID#	(mm Hg) Mercury Barometer	(mm Hg) DPG	(mm Hg) Difference	(<2mm Hg) Pass/Fail	By whom	Date	Adjusted?	(°F) Temp.
T-DPG-002	748	750	-2	Fail	JG	1/3/11	Yes	62
T-DPG-006	744	745	-1	Pass	KL	8/5/11	no	78
T-DPG-005	744	745	-1	Pass	KL	8/5/11	no	78
T-DPG-010	744	744	0	Pass	KL	8/22/11	no	76
T-DPG-009	745	744	1	Pass	MC	8/25/11	no	82
T-DPG-006	747	746	1	Pass	MC	8/26/11	no	76
T-DPG-006	745	743	2	Fail	MC	9/2/11	YES	86
T-DPG-010	745	742	3	Fail	MC	9/2/11	Yes	86
T-DPG-009	752	753	-1	Pass	MC	9/15/11	no	64
T-DPG-005	752	751	1	Pass	MC	9/15/11	no	64
T-DPG-005	745	744	1	Pass	MC	9/19/11	no	68
T-DPG-006	744	744	0	Pass	MC	9/23/11	NO	70
T-DPG-006	728	727	1	Pass	MC	10/17/11	no	62
T-DPG-009	726	727	-1	Pass	KL	10/27/11	yes	68
T-DPG-005	736	736	0	Pass	KL	10/28/11	no	66
T-DPG-006	736	735	1	Pass	MC	11/4/11	no	67
T-DPG-007	736	737	-1	Pass	MC	11/4/11	no	67
T-DPG-008	736	735	1	Pass	MC	11/4/11	no	67
T-DPG-010	736	736	0	Pass	MC	11/4/11	no	67
T-DPG-010	736	736	0	Pass	kl	11/21/11	no	64
T-DPG-005	744	744	0	Pass	BI	11/21/11	No	65
T-DPG-006	743	743	0	Pass	MC	12/23/11	NO	60
T-DPG-006	726	726	0	pass	KL	12/29/11	no	64
T-DPG-005	726	726	0	Pass	KL	12/29/11	no	64
T-DPG-010	731	731	0	Pass	PB	1/5/12	no	66
T-DPG-009	731	732	1	Pass	PB	1/5/12	no	66
T-DPG-005	736	737	1	Pass	PB	1/9/12	no	68
T-DPG-005	740	740	0	Pass	KL	2/20/12	no	66
T-DPG-005	728	729	1	pass	mc	3/1/12	no	66
T-DPG-006	728	727	-1	pass	mc	3/1/12	no	66
T-DPG-010	728	727	-1	PASS	MC	3/21/12	NO	70
T-DPG-010	731	732		PASS	PB	4/3/12	NO	64.2
T-DPG-009	731	731		PASS	PB	4/3/12	NO	64.2
T-DPG-005	731	732		PASS	PB	4/3/12	N0	64.2
T-DPG-006	740	742	2	PASS	KL	4/6/12	yes	68
T-DPG-010	725	726	-1	Pass	BI	4/25/12	no	60
T-DPG-005	731	730	-1	Pass	KL	5/4/12	no	68
T-DPG-010	731	730	-1	Pass	KL	5/4/12	no	68
T-DPG-006	728	728	0	Pass	KL	5/7/12	no	68

Method 5 Acetone Residuals History

DATE	VOL (ml)	RESIDUAL (g/ml)	DATE	VOL (ml)	RESIDUAL (g/ml)	DATE	VOL (ml)	RESIDUAL (g/ml)
10/09/09	200	0.0000008	11/05/10	200	0.0000000	12/19/11	200	0.0000000
10/12/09	200	0.0000015	11/13/10	200	0.0000000	12/23/11	200	0.0000000
10/14/09	200	0.0000000	11/15/10	200	0.0000000	12/29/11	200	0.0000030
10/14/09	200	0.0000005	11/23/10	200	0.0000000	12/29/11	200	0.0000050
10/20/09	200	0.0000005	11/26/10	200	0.0000005	12/29/11	200	0.0000000
10/20/09	200	0.0000008	12/10/10	200	0.0000000	01/18/12	200	0.0000000
10/26/09	200	0.0000079	12/13/10	200	0.0000000	01/19/12	200	0.0000025
11/04/09	200	0.0000010	12/17/10	200	0.0000018	01/31/12	200	0.0000005
11/30/09	200	0.0000000	01/06/11	200	0.0000003	02/03/12	200	0.0000000
11/30/09	200	0.0000000	01/07/11	200	0.0000075	02/29/12	200	0.0000079
12/02/09	200	0.0000000	01/27/11	200	0.0000018	03/08/12	200	0.0000035
01/04/10	200	0.0000010	01/28/11	200	0.0000000	03/16/12	200	0.0000100
01/05/10	200	0.0000000	01/28/11	200	0.0000010	03/26/12	200	0.0000060
01/11/10	200	0.0000000	01/28/11	200	0.0000020	03/26/12	200	0.0000065
01/15/10	250	0.0000002	02/18/11	200	0.0000000	03/30/12	200	0.0000079
01/20/10	200	0.0000030	02/28/11	200	0.0000000	04/03/12	200	0.0000079
02/02/10	200	0.0000010	03/06/11	200	0.0000013	04/05/12	200	0.0000079
02/11/10	200	0.0000060	03/06/11	200	0.0000008	04/11/12	150	0.0000079
02/11/10	200	0.0000050	03/16/11	200	0.0000008	04/17/12	200	0.0000079
02/12/10	200	0.0000000	03/23/11	200	0.0000000	04/27/12	100	0.0000079
02/17/10	220	0.0000016	04/01/11	200	0.0000079	04/28/12	100	0.0000000
03/02/10	200	0.0000027	04/01/11	200	0.0000048	05/01/12	200	0.0000079
03/02/10	200	0.0000000	04/08/11	200	0.0000000	05/02/12	200	0.0000079
03/29/10	300	0.0000012	04/22/11	200	0.0000015	05/04/12	200	0.0000079
04/16/10	200	0.0000070	04/23/11	200	0.0000058			
04/16/10	200	0.0000005	04/24/11	200	0.0000000			
04/16/10	200	0.0000000	04/29/11	200	0.0000010			
04/20/10	200	0.0000013	05/08/11	200	0.0000005			
04/22/10	200	0.0000018	05/15/11	200	0.0000068			
05/12/10	200	0.0000018	05/20/11	200	0.0000005			
05/24/10	200	0.0000070	05/21/11	200	0.0000010			
05/24/10	200	0.0000079	06/04/11	200	0.0000079			
05/25/10	100	0.0000079	06/06/11	200	0.0000043			
06/04/10	100	0.0000050	06/10/11	200	0.0000005			
06/16/10	200	0.0000025	06/24/11	200	0.0000079			
06/29/10	200	0.0000033	07/07/11	200	0.0000079			
07/29/10	200	0.0000018	07/16/11	200	0.0000079			
07/29/10	200	0.0000033	08/08/11	200	0.0000045			
08/11/10	200	0.0000010	08/09/11	200	0.0000020			
08/12/10	200	0.0000079	08/24/11	200	0.0000079			
08/20/10	200	0.0000043	09/12/11	200	0.0000005			
08/21/10	200	0.0000079	09/26/11	200	0.0000018			
08/31/10	200	0.0000079	09/28/11	200	0.0000020			
08/31/10	200	0.0000010	09/29/11	200	0.0000005			
09/01/10	200	0.0000079	09/29/11	200	0.0000015			
09/01/10	200	0.0000063	09/26/11	200	0.0000000			
09/12/10	200	0.0000065	10/05/11	200	0.0000030			
09/21/10	200	0.0000079	10/05/11	200	0.0000028			
09/22/10	200	0.0000079	10/05/11	200	0.0000025			
10/01/10	200	0.0000079	10/22/11	200	0.0000015			
10/06/10	200	0.0000000	10/26/11	200	0.0000038			
10/14/10	200	0.0000015	10/26/11	200	0.0000013			
10/14/10	200	0.0000015	11/07/11	100	0.0000000			
10/15/10	200	0.0000053	11/21/11	200	0.0000005			
10/22/10	200	0.0000000	11/21/11	200	0.0000000			
10/24/10	200	0.0000025	11/23/11	200	0.0000015			
10/29/10	200	0.0000000	12/14/11	200	0.0000000			
11/02/10	200	0.0000000	12/18/11	200	0.0000000			

PALL Gelman Laboratory



New!

Pallflex® Filters

Wide range of filters uniquely suited for a broad range of air monitoring applications.

- Can be used for high temperature and hot gas air monitoring applications.

Applications

Tissuquartz™ Filters

- Heat treated for reduction of trace organics and superior chemical purity.
- High temperature use for analysis of acidic gases and stack sampling aerosols.
- High flow rate and filtration efficiency.
- Ultra-pure soft water processing to reduce residual ion content. Contact us for typical values.

Fiberfilm™ Filters

- Fiberfilm is well suited for a broad range of air sampling applications
- Moisture variations in air or gases during air sampling will not cause chemical reactions on the filter
- Heat-treated (HT) version available for reduction of trace organics.

Emfab™ Filters

- Withstands folding for weighing and transport
- Every filter flushed with DI water to remove any water-soluble residue
- Low air resistance for use in critical aerosol sampling tests such as diesel exhaust.

Complementary Products

For other products related to these applications see:

In-line Holders.....172-174
Open-face Holders.....175

Specifications

Description	Tissuquartz	Emfab	Fiberfilm
Filter Media	Pure quartz, no binder	Borosilicate microfibers reinforced with woven glass cloth and bonded with PTFE	Heat resistant borosilicate glass fiber coated with fluorocarbon (TFE)
Diameter	25 - 90 mm (and 8 x 10 in.)	12 - 142 mm (and 8 x 10 in.)	25 - 100 mm (and 8 x 10 in.)
Typical Thickness	432 µm (17 mils)	178 µm (7 mils)	203 µm (8 mils)
Typical Filter Weight	5.8 mg/cm^2	5.0 mg/cm^2	3.4 mg/cm^2
Typical Water Flow Rate at 0.35 bar (5 psi)	220 mL/min/cm^2	32 mL/min/cm^2	220 mL/min/cm^2
Typical Air Flow Rate at 0.7 bar (10 psi)	73 L/min/cm^2	68 L/min/cm^2	180 L/min/cm^2
Maximum Operating Temperature – Air	1093 °C (2000 °F)	260 °C (500 °F)	315.5 °C (600 °F)
Typical Aerosol Retention*	99.9%	99.9%	96.4%
pH in Boiled Water Extract	6.5 - 7.5	Not available	Not available

**Following ASTM D 2986-71 0.3 µm (DOP) at 32 L/min/100 cm^2 filter media*

Filter Specifications

Bios

Driving a Higher Standard in Flow Measurement™

Met Lab Base Test Certificate

NVLAP®
NVLAP Lab Code 200661

Model ML-500-B
Serial No. 122543
Calibration Date February 23, 2012
Report No. 11695
Sold to:
V-F Controls
8619 Tyler Blvd.
Mentor, OH 44060

PO No. 11884

All calibrations are performed in accordance with ISO 17025 at Bios International Corporation, 10 Park Place, Butler, NJ, 07405, 800-663-4977, an ISO 17025:2005 accredited laboratory through NVLAP. This report shall not be reproduced except in full without the written approval of the laboratory. Results only relate to the items calibrated. This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

The Met Lab ML-500 is a true primary flow standard. A separate calibration certificate is supplied with the flow measuring cell(s). The Clock Period of the timing crystal contained in the ML-500 base unit described above has been tested against NIST-traceable standards to verify its accuracy. Calibration certificates for the standard(s) used in this calibration are available upon request.

As Shipped Clock Period Data. Clock Period tested in accordance with procedure number PR12-03.

DUT Clock Period: 100.494 ms	Target Clock Period: 100.500 ms	Allowable Deviation: ± 0.05 ms	In Tolerance

Expanded uncertainty: Clock Period - ±29 ppm. Two times coverage.

Laboratory Environment:

Temperature Ambient: 22.9 °C Pressure Ambient: 755.60 mmHg

By: Harvey F. Padden

Harvey Padden, President / Chief Metrologist
Bios International Corporation

Bios International • 10 Park Place, Butler, NJ 07405 • 800.663.4977 • www.biosint.com

Bios

Driving a Higher Standard in Flow Measurement℠

Met Lab Calibration Certificate

NVLAP®
NVLAP Lab Code 200661

Model ML-500-44
Serial No. 123449
Calibration Date February 23, 2012
Report No. 11696
Sold To:
V-F Controls
8619 Tyler Blvd.
Mentor, OH 44060

PO No. 11884

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The Met Lab ML-500 is a true primary volumetric flow standard rated with an expanded uncertainty of ±0.40% with a coverage factor of k=2. The flow cell described above is dimensionally calibrated against NIST-traceable standards. The temperature and pressure sensors are also calibrated against NIST-traceable standards. Calibration certificates for the standards used in this calibration are available upon request. The diameter, length, temperature, and pressure are tested in accordance with procedure numbers PR12-01, PR12-02, PR12-04 and PR12-05. Temperature and pressure corrections are then applied to the volumetric flow readings to obtain standardized flow readings.

A flow verification test is performed on all ML-500 flow cells per procedure number PR12-17 using nitrogen or filtered laboratory air to ensure proper operation in typical laboratory conditions.

Expanded uncertainty:	Temperature	±0.03%
	Absolute Pressure	±0.013%
	Length (note 1)	±0.014%
	Diameter (note 1)	±0.007%

All at two times coverage factor of k=2.
Note 1 – Length and Diameter uncertainty are accredited measurements only as part of Bios's flow measurement accreditation.

Laboratory Environment:

Temperature Ambient: 22.4 °C Pressure Ambient: 755.60 mmHg

By:_____
Harvey Padden, President / Chief Metrologist
Bios International Corporation

Page 1 of 2 CAL02-11 Rev G04

Calibration Certificate

Report Number 11696

Measurements for: ML-500-44	SERIAL #: 123449

Date	February 23, 2012

Calibrated Volume (cc) :	59.0461

As Shipped Flow Verification (Functionality Test)

Nominal Flow sccm [1]	Ref. Std. SN 103521	Instrument Under Test	Deviation %	Allowable Deviation [2]	E_N [3]	Tolerance
50000	50222.00	50177.00	-0.09%	0.44%	0.20	In Tolerance
5000	5007.61	5005.00	-0.05%	0.44%	0.12	In Tolerance
500	503.69	504.04	0.07%	0.44%	0.16	In Tolerance

As Shipped Temperature and Pressure Calibration

	Reference Standard	Instrument Under Test	Deviation	Allowable Deviation	E_N [3]	Tolerance
Bath Set Temp. 16.5 (^{0}C)	16.60	16.60	0.00	0.30	0.00	In Tolerance
Bath Set Temp. 22.5 (^{0}C)	22.57	22.60	-0.03	0.30	0.10	In Tolerance
Bath Set Temp. 28.5 (^{0}C)	28.51	28.50	0.01	0.30	0.03	In Tolerance
Pres Zero (mm Hg)	0.36	0.40	-0.04	1.00	0.04	In Tolerance
Pres Amb (mm Hg)	755.63	755.60	0.03	1.00	0.03	In Tolerance

Flow/ Temp/ Pressure Calibration Technician	Jacquella Shives
Dimensional Calibration Technician	Alfred Habazej

1. The flow rate at a standard temperature of 0^{0}C and pressure of 760 mmHg

2. Allowable Deviation for the Flow Verification refers to the RSS of total estimated uncertainty for the Instrument Under Test, the Reference Standard and the test uncertainty.

3. En values ≤ 1 indicate that the two flow measurements agree with each other within uncertainty expectations

Bios

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Met Lab Calibration Certificate

NVLAP®
NVLAP Lab Code 200661

Model ML-500-10
Serial No. 123433
Calibration Date February 23, 2012
Report No. 11697
Sold To:
V-F Controls
8619 Tyler Blvd.
Mentor, OH 44060

PO No. 11884

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The Met Lab ML-500 is a true primary volumetric flow standard rated with an expanded uncertainty of ±0.40% with a coverage factor of k=2. The flow cell described above is dimensionally calibrated against NIST-traceable standards. The temperature and pressure sensors are also calibrated against NIST-traceable standards. Calibration certificates for the standards used in this calibration are available upon request. The diameter, length, temperature, and pressure are tested in accordance with procedure numbers PR12-01, PR12-02, PR12-04 and PR12-05. Temperature and pressure corrections are then applied to the volumetric flow readings to obtain standardized flow readings.

A flow verification test is performed on all ML-500 flow cells per procedure number PR12-17 using nitrogen or filtered laboratory air to ensure proper operation in typical laboratory conditions.

Expanded uncertainty:	Temperature	±0.03%
	Absolute Pressure	±0.013%
	Length (note 1)	±0.014%
	Diameter (note 1)	±0.007%

All at two times coverage factor of k=2.
Note 1 – Length and Diameter uncertainty are accredited measurements only as part of Bios's flow measurement accreditation.

Laboratory Environment:

Temperature Ambient: 22.4 °C Pressure Ambient: 755.60 mmHg

By: Harvey F. Padden
Harvey Padden, President / Chief Metrologist
Bios International Corporation

Page 1 of 2 CAL02-11 Rev G04

Calibration Certificate

Report Number 11697

Measurements for: ML-500-10	SERIAL #: 123433

Date	February 23, 2012

Calibrated Volume (cc) :	4.1272

As Shipped Flow Verification (Functionality Test)

Nominal Flow sccm [1]	Ref. Std. SN 103743	Instrument Under Test	Deviation %	Allowable Deviation [2]	E_N [3]	Tolerance
500	500.94	501.87	0.19%	0.44%	0.42	In Tolerance
90	90.25	90.41	0.18%	0.44%	0.40	In Tolerance
15	15.07	15.10	0.21%	0.44%	0.48	In Tolerance

1. The flow rate at a standard temperature of 0°C and pressure of 760 mmHg

2. Allowable Deviation for the Flow Verification refers to the RSS of total estimated uncertainty for the Instrument Under Test, the Reference Standard and the test uncertainty.

3. En values ≤ 1 indicate that the two flow measurements agree with each other within uncertainty expectations

As Shipped Temperature and Pressure Calibration

	Reference Standard	Instrument Under Test	Deviation	Allowable Deviation	E_N [3]	Tolerance
Bath Set Temp. 16.5 (°C)	16.61	16.60	0.01	0.30	0.03	In Tolerance
Bath Set Temp. 22.5 (°C)	22.57	22.60	-0.03	0.30	0.10	In Tolerance
Bath Set Temp. 28.5 (°C)	28.52	28.60	-0.08	0.30	0.27	In Tolerance
Pres Zero (mm Hg)	0.37	0.40	-0.03	1.00	0.03	In Tolerance
Pres Amb (mm Hg)	755.66	755.70	-0.04	1.00	0.04	In Tolerance

Flow/ Temp/ Pressure Calibration Technician	Jacquella Shives
Dimensional Calibration Technician	Alfred Habazaj

PR12-18 Rev J01

APEX INSTRUMENTS REFERENCE METER CALIBRATION
USING WET-TEST METER #11AE6
15-POINT ENGLISH UNITS

Calibration Meter Information	
Wet Test Meter Model #	AL-20
Wet Test Meter Serial #	11AE6
Wet Test Meter Gamma	0.9990

Calibration Conditions			
Date	Time	16-Apr-09	2:15
Barometric Pressure		29.9	in Hg
Calibration Technician		EW	
DGM Serial Number		S-120-1512377	

Factors/Conversions		
Std Temp	528	°R
Std Press	29.92	in Hg
K_1	17.647	°R/in Hg

Calibration Data												Results		
Run Time	Dry Gas Meter						Calibration Meter					Dry Gas Meter		
												Calibration Factor		Flowrate
Elapsed	Meter Pressure	Volume Initial	Volume Final	Sample Volume	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final	Sample Volume	Outlet Temp Initial	Outlet Temp Final	Value	Variation	Std & Corr
(θ)	(P_m)	(V_{mi})	(V_{mf})	(V_m)	(t_{mi})	(t_{mf})	(V_{wi})	(V_{wf})	(V_w)	(t_{wi})	(t_{wf})	(Y)	(ΔY)	($Q_{std,corr}$)
min	in H_2O	cubic feet	cubic feet	cubic feet	°F	°F	cubic feet	cubic feet	cubic feet	°F	°F			cfm
5.00	-5.5	474.747	480.983	6.236	84.2	84.2	868.400	874.380	5.980	73	73	0.9925	-0.00137	1.182
5.00	-5.5	480.983	487.223	6.240	84.2	86.0	874.380	880.360	5.980	73	73	0.9935	-0.00036	1.182
5.00	-5.5	487.223	493.460	6.237	86.0	87.8	880.360	886.330	5.970	73	73	0.9956	0.00173	1.180
										Passed Calibration Factor Var		0.9939	Averages	1.181
6.00	-4.2	511.684	517.728	6.044	86.0	86.0	904.035	909.850	5.815	73	73	0.9958	-0.00081	0.958
6.00	-4.2	517.728	523.804	6.076	86.0	87.8	909.850	915.695	5.845	73	73	0.9969	0.00023	0.962
6.00	-4.2	523.804	529.885	6.081	87.8	87.8	915.695	921.540	5.845	73	73	0.9972	0.00058	0.962
										Passed Calibration Factor Var		0.9966	Averages	0.961
7.00	-3.3	529.885	535.485	5.600	87.8	89.6	921.540	926.930	5.390	73	73	0.9980	-0.00016	0.760
7.00	-3.3	535.485	541.071	5.586	89.6	89.6	926.930	932.300	5.370	73	73	0.9984	0.00026	0.757
7.00	-3.3	541.071	546.659	5.588	89.6	89.6	932.300	937.670	5.370	73	73	0.9980	-0.00010	0.757
										Passed Calibration Factor Var		0.9981	Averages	0.758
10.00	-2.5	546.659	552.300	5.641	89.6	89.6	937.670	943.120	5.450	73	74	1.0009	0.00176	0.538
10.00	-2.5	552.300	557.928	5.628	89.6	89.6	943.120	948.545	5.425	74	74	0.9982	-0.00100	0.535
10.00	-2.5	557.928	563.565	5.637	89.6	89.6	948.545	953.980	5.435	74	74	0.9984	-0.00076	0.536
										Passed Calibration Factor Var		0.9992	Averages	0.536
15.00	-2.3	493.460	499.555	6.095	86.0	86.0	886.330	892.255	5.925	73	73	1.0014	0.00061	0.390
15.00	-2.3	499.555	505.615	6.060	86.0	86.0	892.255	898.140	5.885	73	73	1.0004	-0.00041	0.388
15.00	-2.3	505.615	511.684	6.069	86.0	86.0	898.140	904.035	5.895	73	73	1.0006	-0.00020	0.388
										Passed Calibration Factor Var		1.0008	Averages	0.389
											Overall Average Y	0.9977		

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is +-0.02.

I certify that the above Dry Gas Meter was calibrated in accordance with USEPA Methods, CFR 40 Part 60, using the Precision Wet Test Meter # 11AE6, which in turn was calibrated using the American Bell Prover # 3785, certificate # F107, which is traceable to the National Bureau of Standards (N.I.S.T.).

Signature Eric Wate Date 4/16/09

APEX INSTRUMENTS REFERENCE METER VERIFICATION
USING WET-TEST METER #11AE6
2-POINT ENGLISH UNITS

Calibration Meter Information	
WTM Model #	AL20
WTM Serial #	11AE6
WTM Gamma	0.9999
Original 15Pt Gamma	0.9977

Calibration Conditions		
Date / Time	16-Feb-12	2:15
Barometric Pressure	29.70	in Hg
Calibration Tech	EW	
DGM Serial Number	S-120-1512377	

Factors/Conversions		
Std Temp	528	°R
Std Press	29.92	in Hg
K_1	17.647	°R/in Hg

Calibration Data												Results		
Run Time	Metering Console						Calibration Meter					Dry Gas Meter		
												Calibration Factor		Flowrate
Elapsed	DGM Input Pressure	Volume Initial	Volume Final	Volume Sample	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final	Volume Sample	Outlet Temp Initial	Outlet Temp Final	Previous	Current	Std & Corr
(θ)	(P_m)	(V_{mi})	(V_{mf})	(V_m)	(t_{mi})	(t_{mf})	(Vw_i)	(Vw_f)	(V_m)	(t_{wi})	(t_{wf})	(Y)	(Y)	($Q_{m(std/corr)}$)
min	in H_2O	cubic feet	cubic feet	cubic feet	°F	°F	cubic feet	cubic feet	cubic feet	°F	°F			cfm
6.00	-3.7	718.798	724.736	5.938	77.0	77.0	119.315	125.215	5.900	73	73	0.9966	1.0103	0.967
											Variation	1.38%	must be less than 1.5%	
10.00	-2.2	713.185	718.798	5.613	77.0	77.0	113.720	119.315	5.595	73	73	0.9992	1.0098	0.550
											Variation	1.06%	must be less than 1.5%	

I certify that the above Dry Gas Meter was calibrated in accordance with USEPA Methods, CFR 40 Part 60, App A, Method 5, Paragraph 7.1.2.2, using the Precision Wet Test Meter # 11AE6, which in turn was calibrated using the American Bell Prover # 3785, certificate # F107, which is traceable to the National Bureau of Standards (N.I.S.T.).

Signature Eric Weh Date 2/16/12

omega.com

T-TAR-010

CERTIFICATE OF CALIBRATION

Model number : CL3512A
Serial number : 11000062
Temperature : 75.2°F - 78.8°F
Relative Humidity : 50±10%

Calibration result of calibrator thermometer

Type	Target	Reading	Deviation
K	32.0 °F	31.8	-0.2
	212 °F	212	0
J	32.0 °F	31.6	-0.4
	212 °F	212	0
T	32.0 °F	32.2	0.2
	212 °F	212	0
E	32.0 °F	32.3	0.3
	212 °F	212	0

According to temperature standard ITS-90
Calibrated standard : FLUKE 5520A calibrator(S/N:7465202)
The listed calibrator has been calibrated using standard whose accuracy is traceable to the U.S. National Institute of Standards and Technology, and meets or exceeds its published specifications. Calibration trace ability of the above listed instrument is in full compliance with ANSI/Z540-1-1994 standards and requirements.

Authorized signature: *Y.I.Tsung* Tested: *L.M.Pereng* Date: March 29, 2011

omega.com®
OMEGA

T- THR-011

CERTIFICATE OF CALIBRATION

Model number : CL3512A
Serial number : 11000091
Temperature : 75.2°F - 78.8°F
Relative Humidity : 50±10%
Calibration result of calibrator thermometer

Type	Target	Reading	Deviation
K	32.0 °F	31.8	-0.2
	212 °F	212	0
J	32.0 °F	32.3	0.3
	212 °F	212	0
T	32.0 °F	32.2	0.2
	212 °F	212	0
E	32.0 °F	32.3	0.3
	212 °F	212	0

According to temperature standard ITS-90
Calibrated standard : FLUKE 5520A calibrator(S/N:7465202)
The listed calibrator has been calibrated using standard whose accuracy is traceable to the U.S. National Institute of Standards and Technology, and meets or exceeds its published specifications. Calibration trace ability of the above listed instrument is in full compliance with ANSI/Z540-1-1994 standards and requirements.

Authorized signature: *Y.I.Tsung* Tested: *L.M.Pereng* Date: March 29, 2011

omega.com®
OMEGA

THR-013

CERTIFICATE OF CALIBRATION

Model number : CL3512A
Serial number : 11000622
Temperature : 75.2°F - 78.8°F
Relative Humidity : 50±10%
Calibration result of calibrator thermometer

Type	Target	Reading	Deviation
K	32.0 °F	31.9	-0.1
	212 °F	212	0
J	32.0 °F	32.0	0.0
	212 °F	212	0
T	32.0 °F	31.8	-0.2
	212 °F	212	0
E	32.0 °F	31.8	-0.2
	212 °F	212	0

According to temperature standard ITS-90
Calibrated standard : FLUKE 5520A calibrator(S/N:7465202)
The listed calibrator has been calibrated using standard whose accuracy is traceable to the U.S. National Institute of Standards and Technology, and meets or exceeds its published specifications. Calibration trace ability of the above listed instrument is in full compliance with ANSI/Z540-1-1994 standards and requirements.

Authorized signature: *Y.I.Tsung* Tested: *L.M.Pereng* Date: August 5, 2011

Certificate of Calibration

OCS technologies, inc.
1300 East Granger Road; Brooklyn Hts. OH 44131
(800) 362-0364 www.ocscal.com

LABORATORY ACCREDITATION BUREAU ACCREDITED
CERT# L1152-1 Calibration

CUSTOMER:
AIR COMPLIANCE TESTING, INC.
10060 BRECKSVILLE ROAD
BRECKSVILLE, OH 44141

ASSET NUMBER:	B26979	PERFORMED ON:	10 Feb 2012
OWNER ASSET #:	BAL-007	DATE DUE:	10 Feb 2013
UNIT UNDER TEST:	A&D EK-1200I BALANCE, 1200G X 0.1G	TEST RESULT:	PASS
		DATA TYPE:	FOUND-LEFT
		TEMP / HUMIDITY:	65.0 °F/ 25 %RH
SERIAL NUMBER:	EP1861726	SERVICE SITE:	ON-SITE
LOCATION:		CALIBRATED BY:	ANGELO COLOMBO
PROCEDURE NAME:	NIST HANDBOOK 44,g,2 STDS	APPROVED BY:	

Unless Otherwise Noted: OCS Technologies, Inc. certifies that the above listed instrument has been tested with a 2:1 Test Uncertainty Ratio (TUR) using standards that are traceable to the International System of Units (SI) through the National Institute of Standards & Technology (NIST), or through NIST accepted intrinsic standards of measurement, or through another National Metrology Institute (NMI). The item tested meets or exceeds all specifications as stated in the referenced procedure solely at the time of calibration. Measurement uncertainty if reported has been calculated at k=2 providing a 95% confidence interval and has been excluded from the Pass/Fail Result above. OCS is ISO/IEC 17025 accredited by the Laboratory Accreditation Bureau. Calibration performed in accordance with ISO 17025:2005 and ISO 10012:2003. This report may only be reproduced in full. Temperature and Humidity for on-site work may be reported above as the mean of high and low values recorded for all items on the day of service. If the data type is FOUND-LEFT then the As Found and As Left data are the same.

Remarks: .

Standards Used

Asset	Traceable Through	Description	Cal Date	Cal Due Date
B947	CERT#:186416	RICE LAKE 1MG - 100G CLASS 1 WEIGHT KIT (210.886G TOTAL)	06 May 2011	06 May 2012
B947A	CERT#186411,1740387A,1740387B	RICE LAKE 50G - 5KG CLASS 1 WEIGHT KIT (10950G TOTAL)	06 May 2011	06 May 2012

Test Results

Test Description	Range	True Value	Test Result	Lower Limit	Upper Limit		%TOL	Status
TESTED IN ACCORDANCE WITH NIST Handbook 44-2011 Section 2.20 Paragraphs N1.1, N1.3, N1.11, N.2,N.3.2 T.N.5 & Tables 4, T.11, 7A as Applicable.								
REPEATABILITY VERIFICATION: Result of Operator Evaluation								Pass
SHIFT TEST VERIFICATION: Result of Operator Evaluation								Pass
LINEARITY:								
1.00 g		1.00	1.0	0.9	1.1	g	0	Pass
10.00 g		10.00	10.0	9.9	10.1	g	0	Pass
100.00 g		100.00	100.0	99.8	100.2	g	0	Pass
500.00 g		500.00	499.9	499.5	500.5	g	20	Pass
1000.00 g		1000.00	999.8	999.5	1000.5	g	40	Pass

Uncertainty of Measurement is 0.13 G

Certificate # 73C84434DAD181478B741481253A333A
Date Printed: 10 Feb 2012 Form No.: 133 Rev 09/2011 Page 1 of 1

Certificate of Calibration

OCS technologies, inc.
1300 East Granger Road: Brooklyn Hts. OH 44131
(800) 362-0364 www.ocscal.com

LABORATORY ACCREDITATION BUREAU ACCREDITED
CERT# L1152-1 Calibration

CUSTOMER:
AIR COMPLIANCE TESTING, INC.
10060 BRECKSVILLE ROAD
BRECKSVILLE, OH 44141

ASSET NUMBER:	B26977	**PERFORMED ON:**	17 Feb 2012
OWNER ASSET #:		**DATE DUE:**	10 Feb 2013
UNIT UNDER TEST:	SARTORIUS 1602MP BALANCE, 160G X 0.0001G	TEST RESULT:	PASS
		DATA TYPE:	AS-LEFT
		TEMP / HUMIDITY:	70.0 °F/ 30 %RH
SERIAL NUMBER:	3004026	SERVICE SITE:	OCS
LOCATION:		CALIBRATED BY:	JH
PROCEDURE NAME:	NIST HANDBOOK 44,g,1 STD	APPROVED BY:	

Unless Otherwise Noted: OCS Technologies, Inc. certifies that the above listed instrument has been tested with a 2:1 Test Uncertainty Ratio (TUR) using standards that are traceable to the International System of Units (SI) through the National Institute of Standards & Technology (NIST), or through NIST accepted intrinsic standards of measurement, or through another National Metrology Institute (NMI). The item tested meets or exceeds all specifications as stated in the referenced procedure solely at the time of calibration. Measurement uncertainty if reported has been calculated at k=2 providing a 95% confidence interval and has been excluded from the Pass/Fail Result above. OCS is ISO/IEC 17025 accredited by the Laboratory Accreditation Bureau. Calibration performed in accordance with ISO 17025:2005 and ISO 10012:2003. This report may only be reproduced in full. Temperature and Humidity for on-site work may be reported above as the mean of high and low values recorded for all items on the day of service. If the data type is FOUND-LEFT then the As Found and As Left data are the same.

Remarks: . ALL READINGS TAKEN AFTER REPAIRS. UNIT DISPLAYED "-H" ON ARRIVAL TO OCS. DISASSEMBLED UNIT. FOUND AND REPAIRED BAD CONNECTIONS AT PCB BOARD. CHEMICALLY CLEANED PCB BOARD TO REMOVE DUST. RE-ASSEMBLED. ADJUSTED LINEARITY AND SHIFT ERRORS. TESTED OK.

Standards Used

Asset	Traceable Through	Description	Cal Date	Cal Due Date
1XUC	CERT#:188047	RICE LAKE 2MG-5KG CLASS 1 KIT (12222.220G TOTAL)	01 Jun 2011	01 Jun 2012

Test Results

Test Description	Range	True Value	Test Result	Lower Limit	Upper Limit		%TOL	Status
TESTED IN ACCORDANCE WITH NIST Handbook 44-2011 Section 2.20 Paragraphs N1.1, N1.3, N1.11, N.2,N.3.2 T.N.5 & Tables 4, T.11, 7A as Applicable.								
REPEATABILITY VERIFICATION:								
Result of Operator Evaluation								Pass
SHIFT TEST VERIFICATION:								
Result of Operator Evaluation								Pass
LINEARITY:								
0.00100 g		0.00100	0.0010	0.0009	0.0011	g	0	Pass
0.01000 g		0.01000	0.0100	0.0099	0.0101	g	0	Pass
0.10000 g		0.10000	0.1000	0.0999	0.1001	g	0	Pass
10.00000 g		10.00000	10.0000	9.9998	10.0002	g	0	Pass
50.00000 g		50.00000	50.0000	49.9995	50.0005	g	0	Pass

Uncertainty of Measurement is 0.0002 G

Certificate # 7BA5B0EA7A0CB1409EF5209605E54E61
Date Printed: 17 Feb 2012 Form No.: 133 Rev 09/2011 Page 1 of 1

Astronomical Applications Dept.
U.S. Naval Observatory
Washington, DC 20392-5420

COSHOCTON, OHIO
W 81° 50', N40° 16'

Altitude and Azimuth of the Sun
May 3, 2012
Eastern Standard Time

h m	Altitude °	Azimuth (E of N) °
04:20	-11.7	57.3
04:30	-10.0	59.1
04:40	-8.4	60.9
04:50	-6.7	62.6
05:00	-5.0	64.3
05:10	-3.3	66.0
05:20	-1.5	67.6
05:30	0.7	69.3
05:40	2.3	70.9
05:50	4.1	72.4
06:00	5.8	74.0
06:10	7.7	75.6
06:20	9.5	77.1
06:30	11.3	78.7
06:40	13.2	80.2
06:50	15.1	81.7
07:00	17.0	83.3
07:10	18.9	84.8
07:20	20.8	86.4
07:30	22.7	88.0
07:40	24.6	89.6
07:50	26.5	91.2
08:00	28.4	92.8
08:10	30.3	94.5
08:20	32.2	96.2
08:30	34.1	98.0
08:40	36.0	99.8
08:50	37.8	101.7
09:00	39.7	103.7
09:10	41.5	105.7
09:20	43.4	107.8
09:30	45.2	110.0
09:40	46.9	112.4
09:50	48.7	114.8
10:00	50.4	117.4
10:10	52.1	120.2
10:20	53.7	123.1
10:30	55.3	126.2
10:40	56.8	129.6
10:50	58.2	133.2
11:00	59.6	137.0
11:10	60.8	141.2
11:20	62.0	145.6

11:30	63.0	150.3
11:40	63.8	155.3
11:50	64.6	160.6
12:00	65.1	166.1
12:10	65.5	171.8
12:20	65.7	177.6
12:30	65.6	183.4
12:40	65.4	189.2
12:50	65.0	194.8
13:00	64.5	200.3
13:10	63.7	205.6
13:20	62.8	210.5
13:30	61.8	215.2
13:40	60.6	219.6
13:50	59.4	223.7
14:00	58.0	227.5
14:10	56.6	231.0
14:20	55.1	234.4
14:30	53.5	237.5
14:40	51.8	240.4
14:50	50.2	243.1
15:00	48.5	245.7
15:10	46.7	248.1
15:20	44.9	250.4
15:30	43.1	252.6
15:40	41.3	254.7
15:50	39.4	256.7
16:00	37.6	258.7
16:10	35.7	260.6
16:20	33.8	262.4
16:30	31.9	264.1
16:40	30.0	265.9
16:50	28.1	267.5
17:00	26.2	269.2
17:10	24.3	270.8
17:20	22.4	272.4
17:30	20.5	274.0
17:40	18.6	275.5
17:50	16.7	277.1
18:00	14.9	278.6
18:10	13.0	280.2
18:20	11.1	281.7
18:30	9.3	283.3
18:40	7.4	284.8
18:50	5.6	286.4
19:00	3.9	287.9
19:10	2.2	289.5
19:20	0.6	291.1
19:30	-1.7	292.8
19:40	-3.4	294.4
19:50	-5.2	296.1
20:00	-6.9	297.8
20:10	-8.5	299.5
20:20	-10.2	301.3
20:30	-11.8	303.1

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Estimated Value of Magnetic Declination

To compute the magnetic declination, you must enter the location and date of interest.

Checkout our new online calculators!
This calculator will be phased out May 2012.

If you are unsure about your city's latitude and longitude, look it up online! In the USA try entering your zip code in the box below or visit the U.S. Gazetteer. Outside the USA try the Getty Thesaurus.

Search for a place in the USA by Zip Code: Get Location

Enter Location: (latitude 90S to 90N, longitude 180W to 180E). See Instructions for details.

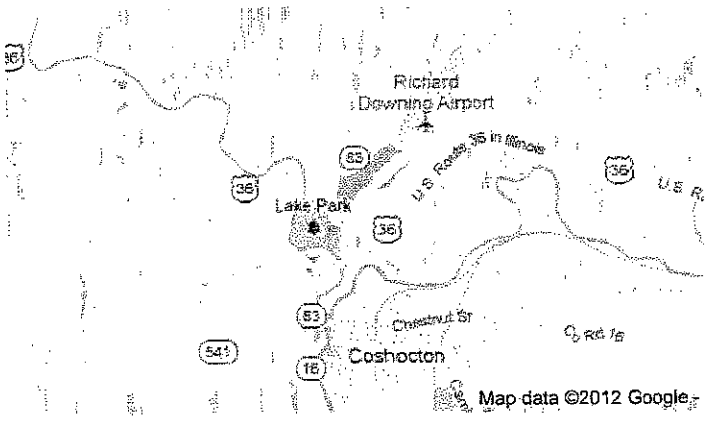
Latitude: 40.270198 N S **Longitude:** 81.86761 E W

Enter Date (1900-2015): Year: 2012 Month (1-12): 5 Day (1-31): 3

Compute Declination

Declination = 7° 49' W changing by 0° 2' W/year

For more information, visit:
Answers to some **frequently asked questions** | **Instructions** for use | **Today's Space Weather**



COMPLIANCE ASSURANCE ASSOCIATES INC.

Helping Industry Comply with Environmental Regulations

This is to acknowledge that

Kenneth Lievense

GAI120207-6650

successfully participated in Visible Emissions Evaluation field training and certification and pursuant to US EPA 40 CFR 60 Appendix A, Reference Method 9, as amended, is certified to evaluate Visible Emissions for a period of six (6) months from the date of this certification.

Steve Nelson	Gainesville, FL	02-07-2012
Instructor	Location	Date

Superior Quality Emission Testing.

Valid Results Guaranteed.

Air Compliance Testing, Inc.

Cleveland, Ohio and Gainesville, Florida
1-800-EPA-AIR1 www.aircomp.com

April 2, 2012

Kim Reinbold
Ohio EPA, SEDO DAPC
2195 Front St
Logan, OH 43138

Dear Kim:

This letter accompanies the attached Intent to Test (ITT) Notification Form that we have completed on the behalf of our client, Clow Water Systems Company, located in Coshocton, OH. The purpose of this emissions testing project is to satisfy the emission testing requirements pursuant to Appendix 3 Section III of the McWane, Inc. Consent Decree and the testing requirements outlined in 40 CFR Part 63, Subpart ZZZZZ.

The scope of this testing project is to measure Total Front-Half Particulate Matter (PM) using EPA Method 5 from the Cupola Emission System (P901) at the Scrubber System Exhaust Stack during Maximum Achievable Operations.

Please note that this scope of work also includes Visible Emissions using EPA Method 9 from the Cupola Emission System (P901) at the Shroud Area. This testing will be completed simultaneously with the aforementioned EPA Method 5 testing.

As is written in this ITT, a date of **May 3, 2012** has been selected as the test day with testing equipment set-up occurring on the day before. Typically Run No. 1's start time is targeted for 7:30 am. If this start time changes, Air Compliance Testing or facility personnel will contact you in advance to notify you of the new starting time.

If you have any questions regarding the scope of this testing project, the scheduled test day, or the process(es) being tested, please don't hesitate to call Heather Rainwater of Clow Water Systems Company at 740-622-6651, or myself, and we would be happy to assist you in any way possible.

Thank you again for your careful consideration, and I am looking forward to working with you on this upcoming compliance testing project.

Sincerely,

Air Compliance Testing, Inc.

By:_____
Tyson E. Houchin
Operations Director

cc: Heather Rainwater, Clow Water Systems Company

INTENT TO TEST NOTIFICATION (One Emissions Unit Per Sheet)

Agency use only	
Date Received	
Assigned	

Facility Premise No.	0616010006	Proposed Test Date	May 3, 2012
Emissions Unit PTI No.	P0105615	Proposed Start Time	7:30 am
SCC Number	30400301		

A. Facility Contact Information:

Name	Clow Water Systems Company
Address	PO Box 6001, Coshocton OH 43812-6001
Contact Person	Heather Rainwater
Telephone (O)	740-291-1087 (Cell) 740-502-0577
E-Mail	heather.rainwater@clowwater.com

Testing Firm Information:

Name	Air Compliance Testing, Inc.
Address	PO Box 41156, Cleveland OH 44141-0156
Contact Person	Tyson E. Houchin
Telephone (O)	216 525-0900 (Cell) 440-821-7805
E-Mail	tyson@aircomp.com

B. Test Location Information

Name	Clow Water Systems Co.	Address	S Sixth St, Coshocton OH 43812
Contact Person	Heather Rainwater	Telephone (O)	740-291-1087 (Cell) 740-502-0577

C. Test Plan and Emissions Unit Information Table: List the applicable information under each respective column heading.

Emission Unit	StackID	Test Location	Control Equipment	Monitoring Equipment	Pollutant(s) to be Tested	EPA Test Method	Number of Sampling Points	Total Time per Test Run (min)	Number of Sampling Runs
Cupola Emission System (P901)	A	Scrubber System Exhaust Stack	Scrubber System	Pressure Drop and Water Flow Rates	Volumetric Flow Rate	1, 2, 3, and 4	24	60	3
					PM	5	24	60	3
	B	Shroud Area	None	N/A	VEs	9	24	60	3 (if possible)
Flange / Fabrication Building	C	Central Roof Vent	None	N/A	VEs	22	24	60	3 (if possible)

Are *any* modifications or alternatives as spelled within the test methods being proposed? Yes [ ] No [X] If "no", then no modifications or alternatives, however minor, will be accepted. If yes, list each test method and section being modified, and attach a detailed modification description and justification.

Source is testing to comply with (check all that apply): McWane Consent Decree Appendix 3 Section III and 40 CFR Part 63, Subpart ZZZZZ

D. What is the maximum rated capacity or throughput of the emissions unit given its permit-to-install or permit-to-operate? 85 Tons / hour

Has the facility scheduled production or throughput so that the emissions unit can be operated at the maximum capacity given its permit-to-install or permit-to-operate during the test? Yes [X] No [ ]

Specify how the operating rate will be demonstrated during the testing: Normal facility process and recordkeeping procedures

Sampling Location(s): Inlet [ ] Outlet [X] Simultaneous [ ] Will cyclonic flow check(s) be conducted? Yes [X] No [ ]

Fuel Sampling: Coal-Proximate [ ] Ultimate [ ] Other [X] If other specify: N/A

Emission Rate to be calculated using: F-Factor [ ] Ultimate Coal Analysis [ ] Other [X] If other specify: As dictated by EPA Method 5 calculation algorithms in terms of lb/hr and lb/ton

Has any maintenance or parts replacement been performed on the emissions unit or the control equipment within the last year? Yes [X] No [ ] Preventative Maintenance

(Note: Some maintenance, such as installing new filter bags in a baghouse, or replacing the activated carbon in an adsorber, may disqualify the emissions unit from a performance test until a sufficient amount of time has elapsed to ensure a test which will be representative of normal operations.)

E. Sample Train Calibration: All affected measuring and monitoring equipment should be calibrated within 60 days of the scheduled testing.

THE FOLLOWING ADDITIONAL INFORMATION SHALL BE SUBMITTED AS ATTACHMENTS:

F. Sample Train Information:

1. A schematic diagram of each sampling train.
2. The type or types of capture media to be used to collect each gas stream pollutant. (Include filter specification sheets)
3. Sample tube type, (e.g., glass, teflon, stainless steel, etc.)
4. Probe cleaning method and solvent to be used, if applicable.

1. See attached Site-Specific Test Plan.
2. Type or types of capture media: M3 - Fyrite: The Fyrite analyzer utilizes a chromium chloride-zinc chloride-hydrochloric acid solution for O2 absorption and a potassium hydroxide solution for CO2 absorption. M4: Samples are condensed in H2O and adsorbed onto Silica Gel. M5: Samples are collected on Glass Filter (filter specification sheets attached). M9 / 22: N/A
3. Sample tube type: M3 - Fyrite: borosilicate glass or stainless steel with connecting borosilicate glassware. M4: borosilicate glass or stainless steel with connecting borosilicate glassware. M5: Probe liner is borosilicate glass or stainless steel with a borosilicate glass or stainless steel nozzle.
4. Probe cleaning method and solvent to be used: M1: N/A M2: N/A M3 - Fyrite: N/A M4: N/A M5: Reagent Grade Acetone. M9 / 22: N/A

G. Laboratory Analysis:

A description of the laboratory analysis methods to be used to determine the concentration of each pollutant.
M3 - Fyrite: A Fyrite analyzer will be used for the analysis in a manner consistent with manufacturer's specifications. M4: A gas sample is extracted at a constant rate (or isokinetically in conjunction with other methods) from the source; moisture is removed from the sample stream and determined either volumetrically or gravimetrically. M5: The analysis for Particulate Matter (PM) will be a gravimetric analysis.
M9 / 22: N/A

H. Description of Operations:

- A description of any operation, process, or activity that could vent exhaust gases to the stack being tested. This shall include the description and feed rate of all materials capable of producing pollutant emissions used in each separate operation. Maximum process weight rate, or coating rate, and parameters such as line speed, VOC content etc. should be specifically documented with calculations to confirm worst case scenario emissions.

Note 1: All compliance demonstration testing shall be performed at maximum rate capacity as specified by the equipment manufacturer or at the maximum rate actually used in the emissions unit operation, whichever is greater, or at any other rate as agreed upon with Ohio EPA.

Note 2: If the emissions unit is not operated at maximum capacity, or as close as possible thereto, the emissions unit might be derated to the production capacity achieved during the test.

The only operations, processes, and/or activities that could vent exhaust gases to the test stack are those described above in this document.

I. Stack and Vent Description:

- A dimensional sketch or sketches showing the plan and elevation view of the entire ducting and stack arrangement. The sketch should include the relative position of all processes or operations venting to the stack or vent to be tested. It should also include the position of the ports relative to the nearest upstream and downstream gas flow disturbance or duct dimensional change. The sketches should include the relative position, type, and manufacturer's claimed efficiency of all gas cleaning equipment.
- A cross sectional dimensional sketch of the stack or duct at the sampling ports, showing the position of sampling points. In case of a rectangular duct, show division of duct into equal areas.
- For Fugitive emissions testing, a sketch illustrating the specific emissions points to be observed must be included.

See attachments to this ITT.

J. Safety:

Describe all possible safety hazards including such items as the presence of toxic fumes, high noise levels, areas where eye protection is required, etc. Note: Conditions considered unsafe at the time of the test will cause postponement.
The Plant requires the use of safety glasses, safety shoes, hard hats, and hearing protection (in designated areas). At this time, and to the best of our belief and knowledge, there are no toxic fumes or other hazards expected to be on site at this facility that would cause you to formally prepare for your exposure to them. It is our recommendation however, to consult plant personnel regarding its safety policies before accessing the production areas on this site. Air Compliance Testing personnel will be required to wear safety shoes and safety glasses at all times while on site at the facility to comply with our own company policy.