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RESULTS OF THE JULY 30, 2014 RELATIVE ACCURACY TEST AUDIT OF THE $CO/SO_2/NO_x/CO_2$/FLOW CEM SYSTEM INSTALLED ON THE NO. 9 BOILER OUTLET DUCT AT THE MANITOWOC PUBLIC UTILITIES FACILITY IN MANITOWOC, WISCONSIN

Submitted to:

Mechanical Systems Inc.
480 Progress Way
Sun Prairie, WI 53590

Attention:

Rocky Orzechowski

Reviewed by:

Kathleen Eickstadt

Kathleen Eickstadt
Coordinator
Source Testing

Report Number 14-33413(No. 9)
August 22, 2014
KE/kce

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ABBREVIATIONS

ACFM	actual cubic feet per minute
cc (ml)	cubic centimeter (milliliter)
DSCFM	dry standard cubic foot of dry gas per minute
DSML	dry standard milliliter
DEG-F (°F)	degrees Fahrenheit
DIA.	Diameter
FT/SEC	feet per second
g	gram
GPM	gallons per minute
GR/ACF	grains per actual cubic foot
GR/DSCF	grains per dry standard cubic foot
g/dscm	grams per dry standard meter
HP	horsepower
HRS	hours
IN.	inches
IN.HG.	inches of mercury
IN.WC.	inches of water
LB	pound
LB/DSCF	pounds per dry standard cubic foot
LB/HR	pounds per hour
LB/10^6BTU	pounds per million British Thermal Units heat input
LB/MMBTU	pounds per million British Thermal Units heat input
MW	megawatt
mg/dscm	milligrams per dry standard cubic meter
ug/dscm	micrograms per dry standard cubic meter
microns (um)	micrometer
MIN.	minutes
ng	nanograms
PM	particulate matter
PPH	pounds per hour
PPM	parts per million
ppmC	parts per million carbon
ppm,d	parts per million, dry
ppm,w	parts per million, wet
ppt	parts per trillion
PSI	pounds per square inch
SQ.FT.	square feet
TPD	tons per day
ug	micrograms
v/v	percent by volume
w/w	percent by weight

Standard conditions are defined as 68 °F (20 °C) and 29.92 IN. of mercury pressure

1 INTRODUCTION

On July 30, 2014, Interpoll Laboratories personnel conducted a Relative Accuracy Test Audit (RATA) on the following Continuous Emission Monitoring (CEM) System installed on the Boiler 9 Outlet Duct at the Manitowoc Public Utilities Facility in Manitowoc, Wisconsin:

Monitor Type	Manufacturer	Model	Serial No.	Location
SO2	Thermo Electron	43i	43i0510511567	No. 9 Boiler
NOx	Thermo Electron	42i	42i0510511561	No. 9 Boiler
CO2	Thermo Electron	41i	410i0510511584	No. 9 Boiler
CO	Thermo Electron	48i	48i0510511587	No. 9 Boiler
Flow	United Sciences	150	1500188	No. 9 Boiler

On-site testing was performed by Aaron Wilson and Andrew Strong. Coordination between testing activities and plant operation was provided by Jim Fanning of Mechanical Systems, Inc and Tim Harding of Manitowoc Public Utilities. The test was not witnessed by a representative of the Wisconsin Department of Natural Resources.

The RATA was performed in accordance with EPA Methods 3A, 6C, 7E and 10, CFR Title 40, Part 60, Appendix A (revised July 1, 2014) and per Part 75. For oxygen analysis, a slip stream of sample gas was withdrawn from the exhaust gas stream using test ports on the stack adjacent to the CEMS using a heat-traced probe and filter assembly. After passing through the filter, the gas passed through two condenser-type moisture removal systems operating in series. The particulate-free dry gas was then transported to the oxygen analyzer with the excess exhausted to the atmosphere through a calibrated orifice, which was used to ensure that the flow from the stack exceeds the requirements of the analyzer. For CO, SO_2, NO_x, and CO_2 analysis, a dilution probe based system was used. In this system a slipstream of exhaust gas is drawn from the exhaust gas stream using an M&C dilution probe. The sample stream is filtered and diluted (approximate dilution during these tests was 100:1) before delivery to the analyzers. The analog response of the analyzers in both systems was recorded using a computer data logger. The analyzers were calibrated with EPA Protocol gases.

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The important results of the test are summarized in the following tables. Field data and all other supporting information are presented in the appendices.

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2 SUMMARY AND DISCUSSION

The results of the Relative Accuracy Test Audit are summarized in the following tables. An overview of the results is presented below:

NO. 9 BOILER RELATIVE ACCURACY RESULTS

Parameter	Units	Measured
NO_x	LB/10^6BTU	3.67
NO_x	ppm,w	3.03
SO_2	ppm,w	3.35
SO_2	LB/10^6BTU	4.35
CO_2	% v/v,w	1.15
Flow (low)	SCFH	0.66
Flow (mid)	SCFH	3.04
CO	ppm,w	3.61
CO	LB/10^6BTU	4.40

No difficulties were encountered in the field or in the evaluation of the data. On the basis of these facts and a complete review of the data and results, it is our opinion that the CO_2, SO_2 and NO_x concentrations reported herein are accurate and closely reflect the actual values, which existed at the time the test was performed.

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Summary of the Results of the July 30, 2014, Relative Accuracy Test Audit of the NOx Analyzer Installed on the No. 9 Boiler Breeching at the Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

					180 Klbs/Hr		
					Nox Lbs/mmBTU		
Run		Date	Time		RM	CEM	DIFF.
1	*	07/30/14	0:45 -	1:05	0.064	0.061	0.003
2		07/30/14	1:15 -	1:35	0.064	0.062	0.002
3		07/30/14	1:45 -	2:05	0.061	0.058	0.003
4		07/30/14	2:15 -	2:35	0.063	0.062	0.001
5		07/30/14	2:45 -	3:05	0.059	0.057	0.002
6		07/30/14	3:15 -	3:35	0.064	0.062	0.002
7		07/30/14	3:45 -	4:05	0.056	0.055	0.001
8		07/30/14	4:15 -	4:35	0.056	0.054	0.002
9		07/30/14	4:45 -	5:05	0.064	0.063	0.001
10		07/30/14	5:15 -	5:35	0.071	0.069	0.002
Average Diff.					0.062	0.061	0.001778
Standard Deviation							0.001
Confidence Coefficient							0.001
Relative Accuracy							3.67
Bias Test							Fail
Bias Adjustment Factor							1.029

* Run was not used in Relative Accuracy calculation

RM = Reference Method

CEM = Continuous Emission Monitor

Summary of the Results of the July 30, 2014, Relative Accuracy Test Audit of the NOx Analyzer Installed on the No. 9 Boiler Breeching at the Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

					180 Klbs/Hr		
					Nox ppm, wet		
Run	Date	Time			RM	CEM	DIFF.
1	* 07/30/14	0:45	-	1:05	30.10	28.90	1.20
2	07/30/14	1:15	-	1:35	30.10	29.50	0.60
3	07/30/14	1:45	-	2:05	28.90	27.70	1.20
4	07/30/14	2:15	-	2:35	30.30	30.10	0.20
5	07/30/14	2:45	-	3:05	28.60	27.70	0.90
6	07/30/14	3:15	-	3:35	30.60	30.20	0.40
7	07/30/14	3:45	-	4:05	27.10	26.70	0.40
8	07/30/14	4:15	-	4:35	27.60	26.50	1.10
9	07/30/14	4:45	-	5:05	30.80	30.60	0.20
10	07/30/14	5:15	-	5:35	34.20	33.60	0.60
Average Diff.					29.933	29.311	0.622
Standard Deviation							0.370
Confidence Coefficient							0.284
Relative Accuracy							3.03
Bias Test							Fail
Bias Adjustment Factor							1.021

* Run was not used in Relative Accuracy calculation

RM = Reference Method

CEM = Continuous Emission Monitor

Summary of the Results of the July 30, 2014, Relative Accuracy Test Audit of the SO2 Analyzer Installed on the No. 9 Boiler Breeching at the Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

					180 Klbs/Hr		
					SO_2 ppm, wet		
Run		Date	Time		RM	CEM	DIFF.
1		07/30/14	0:45 -	1:05	90.70	88.50	2.20
2		07/30/14	1:15 -	1:35	85.90	83.80	2.10
3	*	07/30/14	1:45 -	2:05	92.60	89.90	2.70
4		07/30/14	2:15 -	2:35	80.60	78.10	2.50
5		07/30/14	2:45 -	3:05	96.20	92.80	3.40
6		07/30/14	3:15 -	3:35	86.60	83.90	2.70
7		07/30/14	3:45 -	4:05	94.10	92.90	1.20
8		07/30/14	4:15 -	4:35	84.00	86.60	-2.60
9		07/30/14	4:45 -	5:05	79.10	76.40	2.70
10		07/30/14	5:15 -	5:35	73.40	74.00	-0.60
Average Diff.					85.222	83.789	1.433333
Standard Deviation							1.852
Confidence Coefficient							1.424
Relative Accuracy							3.35
Bias Test							Fail
Bias Adjustment Factor							1.017

* Run was not used in Relative Accuracy calculation

RM = Reference Method

CEM = Continuous Emission Monitor

Summary of the Results of the July 30, 2014, Relative Accuracy Test Audit of the SO2 Analyzer Installed on the No. 9 Boiler Breeching at the Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

					180 Klbs/Hr		
					SO_2 Lbs/mmBTU		
Run		Date	Time		RM	CEM	DIFF.
1		07/30/14	0:45	- 1:05	0.269	0.260	0.009
2		07/30/14	1:15	- 1:35	0.256	0.245	0.011
3	*	07/30/14	1:45	- 2:05	0.270	0.260	0.010
4		07/30/14	2:15	- 2:35	0.232	0.225	0.007
5		07/30/14	2:45	- 3:05	0.277	0.266	0.011
6		07/30/14	3:15	- 3:35	0.250	0.240	0.010
7		07/30/14	3:45	- 4:05	0.272	0.266	0.006
8		07/30/14	4:15	- 4:35	0.238	0.245	-0.007
9		07/30/14	4:45	- 5:05	0.230	0.218	0.012
10		07/30/14	5:15	- 5:35	0.211	0.212	-0.001
Average Diff.					0.253	0.247	0.006222
Standard Deviation							0.006
Confidence Coefficient							0.005
Relative Accuracy							4.35
Bias Test							Fail
Bias Adjustment Factor							1.025

* Run was not used in Relative Accuracy calculation

RM = Reference Method

CEM = Continuous Emission Monitor

Summary of the Results of the July 30, 2014, Relative Accuracy Test Audit on the CO2 Analyzer Installed on the No. 9 Boiler Breeching at the Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

180 Klbs/Hr

					CO_2, wet Summary		
Run		**Date**	**Time**		**RM**	**CEM**	**DIFF.**
1		07/30/14	0:45 -	1:05	10.30	10.40	-0.10
2		07/30/14	1:15 -	1:35	10.20	10.40	-0.20
3		07/30/14	1:45 -	2:05	10.40	10.50	-0.10
4		07/30/14	2:15 -	2:35	10.60	10.60	0.00
5		07/30/14	2:45 -	3:05	10.60	10.60	0.00
6		07/30/14	3:15 -	3:35	10.50	10.60	-0.10
7		07/30/14	3:45 -	4:05	10.50	10.60	-0.10
8	*	07/30/14	4:15 -	4:35	10.80	10.80	0.00
9		07/30/14	4:45 -	5:05	10.50	10.70	-0.20
10		07/30/14	5:15 -	5:35	10.60	10.60	0.00
Average Difference					10.533	10.600	-0.06667
Standard Deviation							0.071
Confidence Coefficient							0.054
Relative Accuracy							1.15
Bias Test							Pass
Bias Adjustment Factor							0.994

* Run was not used in Relative Accuracy calculation

RM = Reference Method

CEM = Continuous Emission Monitor

Summary of the Results of the July 30, 2014, Relative Accuracy Test Audit on the Flow Analyzer Installed on the No. 9 Boiler Breeching at the Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

180 Klbs/Hr

				Flow (SCFH) Summary		
Run	**Date**	**Time**		**RM**	**CEM**	**DIFF.**
1	* 07/30/14	0:45 -	0:55	4,413,000	4,577,000	-164,000
2	07/30/14	1:15 -	1:25	4,525,000	4,574,000	-49,000
3	07/30/14	1:45 -	1:55	4,577,000	4,618,000	-41,000
4	07/30/14	2:15 -	2:25	4,596,000	4,574,000	22,000
5	07/30/14	2:45 -	2:55	4,575,000	4,593,000	-18,000
6	07/30/14	3:15 -	3:25	4,579,000	4,590,000	-11,000
7	07/30/14	3:45 -	3:55	4,621,000	4,582,000	39,000
8	07/30/14	4:15 -	4:25	4,592,000	4,571,000	21,000
9	07/30/14	4:45 -	4:55	4,570,000	4,593,000	-23,000
10	07/30/14	5:15 -	5:25	4,586,000	4,591,000	-5,000
Average Difference				4580111.111	4587333.333	-7222.22222
Standard Deviation						29701.758
Confidence Coefficient						22830.752
Relative Accuracy						0.66
Bias Test						Pass
Bias Adjustment Factor						0.998

* Run was not used in Relative Accuracy calculation

RM = Reference Method

CEM = Continuous Emission Monitor

Results of the July 30th, 2014 Relative Accuracy Test Audit of the Flow Analyzer Installed on the No. 9 Boiler Breeching at the Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

				300 Klbs/Hr		
				Flow (SCFH)		
Run	Date	Time		RM	CEM	DIFF.
1	07/30/14	7:15 - 7:21		6,033,000	5,875,000	158,000
2	07/30/14	7:22 - 7:28		6,007,000	5,881,000	126,000
3	07/30/14	7:29 - 7:35		6,043,000	5,827,000	216,000
4	* 07/30/14	7:45 - 7:51		5,981,000	5,796,000	185,000
5	07/30/14	7:52 - 7:58		5,984,000	5,754,000	230,000
6	07/30/14	7:59 - 8:05		5,902,000	5,714,000	188,000
7	07/30/14	8:06 - 8:12		5,943,000	5,841,000	102,000
8	07/30/14	8:13 - 8:19		5,932,000	5,804,000	128,000
9	07/30/14	8:20 - 8:26		5,945,000	5,834,000	111,000
10	07/30/14	8:27 - 8:33		5,916,000	5,765,000	151,000
Average Diff.				5966888.889	5815222.222	151666.667
Confidence Coefficient						29708.246
Standard Deviation						38649.062
Relative Accuracy						3.04
Bias Test						Fail
Bias Adjustment Factor						1.026

* Run was not used in Relative Accuracy calculation

RM = Reference Method

CEM = Continuous Emission Monitor

Summary of the Results of the July 30, 2014, Relative Accuracy Test Audit of the CO Analyzer Installed on the No. 9 Boiler Breeching at the Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

						180 Klbs/Hr		
						CO ppm, wet		
Run		Date	Time			RM	CEM	DIFF.
1		07/30/14	0:45	-	1:05	28.90	27.00	1.90
2		07/30/14	1:15	-	1:35	28.20	27.90	0.30
3	*	07/30/14	1:45	-	2:05	29.90	29.20	0.70
4		07/30/14	2:15	-	2:35	28.00	27.70	0.30
5		07/30/14	2:45	-	3:05	28.70	28.10	0.60
6		07/30/14	3:15	-	3:35	28.60	27.40	1.20
7		07/30/14	3:45	-	4:05	29.80	29.20	0.60
8		07/30/14	4:15	-	4:35	29.10	29.50	-0.40
9		07/30/14	4:45	-	5:05	27.60	27.50	0.10
10		07/30/14	5:15	-	5:35	28.70	27.00	1.70
Average Diff.						28.733	28.167	0.566667
Standard Deviation								0.612
Confidence Coefficient								0.471
Relative Accuracy								3.61
Bias Test								Fail
Bias Adjustment Factor								1.020

* Run was not used in Relative Accuracy calculation

RM = Reference Method

CEM = Continuous Emission Monitor

Summary of the Results of the July 30, 2014, Relative Accuracy Test Audit of the SO2 Analyzer Installed on the No. 9 Boiler Breeching at the Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

					180 Klbs/Hr		
					CO Lbs/mmBTU		
Run		Date	Time		RM	CEM	DIFF.
1		07/30/14	0:45 -	1:05	0.037	0.035	0.002
2		07/30/14	1:15 -	1:35	0.037	0.036	0.001
3		07/30/14	1:45 -	2:05	0.038	0.037	0.001
4		07/30/14	2:15 -	2:35	0.035	0.035	0.000
5		07/30/14	2:45 -	3:05	0.036	0.035	0.001
6		07/30/14	3:15 -	3:35	0.036	0.034	0.002
7		07/30/14	3:45 -	4:05	0.038	0.037	0.001
8		07/30/14	4:15 -	4:35	0.036	0.037	-0.001
9		07/30/14	4:45 -	5:05	0.035	0.034	0.001
10	*	07/30/14	5:15 -	5:35	0.036	0.034	0.002
Average Diff.					0.036	0.036	0.000889
Standard Deviation							0.001
Confidence Coefficient							0.001
Relative Accuracy							4.40
Bias Test							Fail
Bias Adjustment Factor							1.025

* Run was not used in Relative Accuracy calculation

RM = Reference Method

CEM = Continuous Emission Monitor

APPENDIX A

SAMPLING EQUIPMENT CALIBRATION DATA

INTERPOLL LABORATORIES, INC.
(763) 786-6020

Stack Sampling Department - QA
Field Barometer Calibration Sheet

Date:	4/5/2014
Technician:	Aaron Wilson
Mercury Column Barometer Number:	Weighing Room Barometer
Aneroid Barometer Number:	Ultimeter #3

Reference Mercury Barometer Reading	Ambient Temperature	Temperature Correction Factor	Adjusted Mercury Barometer Reading	Initial Field Barometer Reading	Difference (P_{ba} - P_{bm})
29.27	76	0.124	29.15	29.13	-0.020

Weighing room barometer setup:

1) Using the set screw on the bottom of the barometer, adjust the level of the mercury reservoir to the point that the level indicator makes slight contact with the mercury. A flashlight can aid in seeing the dimple formed when the level indicator makes contact with the mercury.

2) Slide the measurement ruler on the barometer to the point where the bottom of the ruler is in line with the top of the mercury column's reverse meniscus. Record the reading (in. Hg)

3) Take a temperature reading and record the temperature correction factor from the lookup table near the barometer.

4) Apply the temperature correction factor to the mercury barometer.

5) Adjust the field barometer reading to within +/- 0.1 in. Hg of the reference barometer reading.

Has this barometer shown any consistent problems with calibration? Has the problem been alleviated?_____

Note: Aneroid barometers will be calibrated periodically against a mercury column barometer. The aneroid barometer to be calibrated should be placed in close proximity to the mercury barometer and left to equilibrate for 20 - 30 minutes before calibrating. Aneroid barometer will be calibrated to the adjusted mercury barometer readings.

Alternative Calibration Procedure:

1) Obtain the station value or absolute barometric pressure Pr from a nearby National Weather Service station and its elevation (A) in feet above sea level.
2) Determine the elevation (B) in feet above sea level of the site of the field barometer.(local airport)
3) Calculate the site barometric pressure (Pb) as follows:

$$Pb = Pr + 0.001\ (A-B)$$

4) Compare the field barometer reading against Pb obtained in step 3.
5) Adjust the field barometer reading to within +/- 0.1 in. Hg.

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INTERPOLL LABORATORIES, INC.
(763) 786-6020

Temperature Measurement Device Calibration Sheet

Unit under Test:

Vendor	SIGNSTEK	Serial Number	T378538
Model	6802II	Thermocouple Type	Type K
Range	0-2100	Technician	C. Warneke
Date of Calibration	7/3/2014	PDT Number	151 / T1

Method of Calibration:

Omega Model CL-300 Type K Thermocouple Simulator which provides 22 precise temperature equivalent millivolt signals. The CL-300 is cold junction compensated. Calibration accuracy is +/- 0.1 % of span(2100 °F) +/- 1 degree (for negative temperatures add +/- 2 degrees). The CL-300 simulated exactly the millivoltage of a Type K thermocouple at the indicated temperature.

Desired Temp. (°F) Nominal	Response of Unit Under Test (°F)	Deviation	
		Δ t (°F)	%
0	-2	2	0.435
100	97	3	0.536
200	199	1	0.152
300	297	3	0.395
400	397	3	0.349
500	498	2	0.208
600	600	0	0.000
700	699	1	0.086
800	801	1	0.079
900	899	1	0.074
1000	1001	1	0.068
1100	1100	0	0.000
1200	1199	1	0.060
1300	1300	0	0.000
1400	1400	0	0.000
1500	1500	0	0.000
1600	1600	0	0.000
1700	1699	1	0.046
1800	1800	0	0.000
1900	1898	2	0.085
2000	1999	1	0.041
2100	2097	3	0.117
	Average:	**1**	**0.124**

ND= no data available
OF = off scale response by unit under test (°F)

% dev = 100Δt/(460+t)

Unit was in tolerance
(Must be within +/- 1.5% absolute reference temperature)

Unit was not in tolerance : Recalibrated see new calibration sheet or unit put out of service.

INTERPOLL LABORATORIES, INC.
(763) 786-6020

Temperature Measurement Device Calibration Sheet

Unit under Test:

Vendor	CEN-TECH	Serial Number	5184628
Model	92242	Thermocouple Type	Type K
Range	0-1900	Technician	A Wilson
Date of Calibration	4/21/2014	PDT Number	131

Method of Calibration:

Omega Model CL-300 Type K Thermocouple Simulator which provides 22 precise temperature equivalent millivolt signals. The CL-300 is cold junction compensated. Calibration accuracy is +/- 0.1 % of span(2100 °F) +/- 1 degree (for negative temperatures add +/- 2 degrees). The CL-300 simulated exactly the millivoltage of a Type K thermocouple at the indicated temperature.

Desired Temp. (°F) Nominal	Response of Unit Under Test (°F)	Deviation	
		Δt (°F)	%
0	2	2	0.435
100	100	0	0.000
200	204	4	0.606
300	302	2	0.263
400	400	0	0.000
500	498	2	0.208
600	601	1	0.094
700	698	2	0.172
800	801	1	0.079
900	898	2	0.147
1000	1001	1	0.068
1100	1101	1	0.064
1200	1201	1	0.060
1300	1301	1	0.057
1400	1401	1	0.054
1500	1501	1	0.051
1600	1601	1	0.049
1700	1698	2	0.093
1800	1798	2	0.088
1900	1898	2	0.085
2000	OF		
2100	OF		
	Average:	1	**0.134**

ND= no data available
OF = off scale response by unit under test (°F)

% dev = 100Δt/(460+t)

☐ **Unit was in tolerance**
(Must be within +/- 1.5% absolute reference temperature)

☐ **Unit was not in tolerance : Recalibrated see new calibration sheet or unit put out of service.**

Environmental Supply Company, Inc.

Quality Source Sampling Systems & Accessories

Wind Tunnel Pitot Calibration

Customer:	**Interpoll Laboratories**		
S-type Pitot ID:	**04-5+P1**	Date:	**1-Apr-13**
Standard Pitot ID:	**001**	Personnel:	**DH**
Cp(std):	**0.99**	Cp(actual):	**0.831**
Part Number:		P(bar):	**29.35**
Test Velocity (fps):	**30 - 60 - 90**	T(°F):	**56**

Calibration Results

Velocity (fps)	Nominal ΔPs [inches H_2O]	$Cp_{(s)}$ A-Side	$Cp_{(s)}$ B-Side	$Cp_{(s)}$ Average
30	0.284	0.834	0.836	0.835
60	1.142	0.825	0.833	0.829
90	2.623	0.824	0.833	0.828
			Overall Average	0.831

Pitot tube S/N 04-5+P1 was calibrated in accordance with the Code of Federal Regulations, Title 40, Part 60 Appendix A, Method 2, Section 10.

Signature

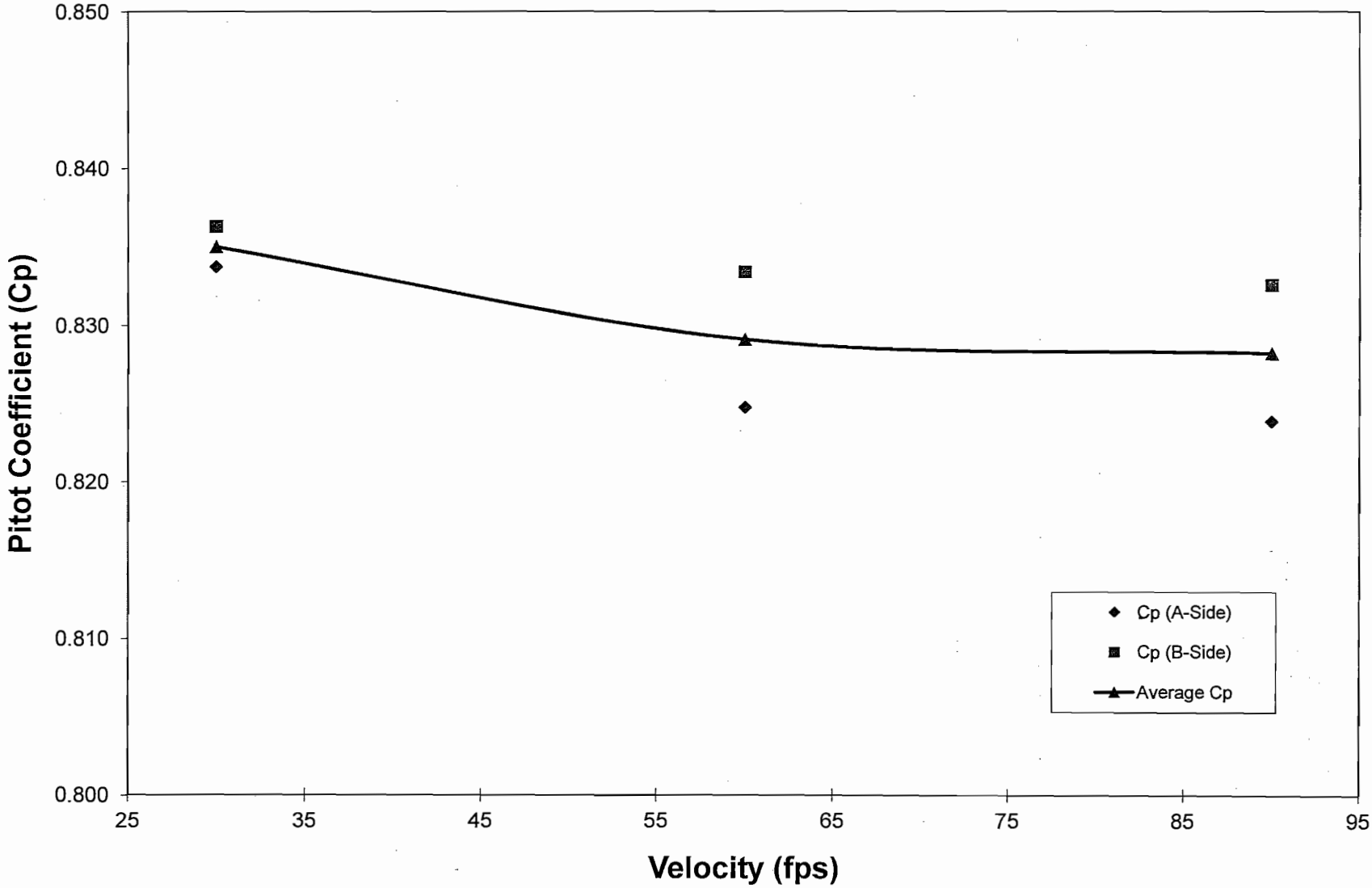
4/1/13
Date

708 E. Club Blvd., Durham, North Carolina 27704 www.environsupply.com 919-956-9688 FAX: 919-682-0333

MPU02787

S-Type Pitot (S/N 04-5+P1) - Pitot Coefficient (Cp) vs Velocity (fps)

Environmental Supply Company Wind Tunnel - 04/01/2013



MPU02788

Wind Tunnel Pitot Calibration

S-type Pitot ID:	**04-5+P1**	Date:	**1-Apr-13**
Standard Pitot ID:	**001**	Personnel:	**DH**
Cp(std):	**0.99**	Cp(actual):	**0.835**
Part Number:		P(bar):	**29.35**
Test Velocity (fps):	**30**	T(°F):	**56**

A-SIDE

ΔP_{std} (in. H_2O)	ΔP_s (in. H_2O)	Cp(s)	Deviation*
0.202	**0.283**	**0.837**	0.003
0.202	**0.285**	**0.834**	0.000
0.202	**0.286**	**0.831**	-0.003
0.201	**0.285**	**0.833**	-0.001
	AVERAGE	**0.834**	0.002
		Std deviation	0.003

B-SIDE

ΔP_{std} (in. H_2O)	ΔP_s (in. H_2O)	Cp(s)	Deviation*
0.202	**0.282**	**0.839**	0.003
0.202	**0.283**	**0.836**	0.000
0.202	**0.284**	**0.835**	-0.002
0.201	**0.283**	**0.835**	-0.001
	AVERAGE	**0.836**	0.001
		Std deviation	0.002

$$Cp(s) = Cp(std)\sqrt{\frac{\Delta P(std)}{\Delta P(s)}}$$

Cp(A) - Cp(B) = 0.003 {must be <0.010}

*Deviation = {Cp(s) - *AVG* Cp(s)} {must be <0.010}

Standard deviation of the deviations must be less than 0.02 for both

Pitot tube S/N 04-5+P1 was calibrated in accordance with the CFR 40, Part 60 Appendix A, Method 2, Section 10.

Wind Tunnel Pitot Calibration

S-type Pitot ID:	**04-5+P1**	Date:	**1-Apr-13**
Standard Pitot ID:	**001**	Personnel:	**DH**
Cp(std):	**0.99**	Cp(actual):	**0.829**
Part Number:		P(bar):	**29.35**
Test Velocity (fps):	**60**	T(°F):	**56**

A-SIDE

ΔP_{std} (in. H_2O)	ΔP_s (in. H_2O)	Cp(s)	Deviation*
0.799	**1.154**	**0.824**	-0.001
0.803	**1.153**	**0.827**	0.002
0.800	**1.152**	**0.825**	0.000
0.802	**1.159**	**0.824**	-0.001
	AVERAGE	**0.825**	0.001
		Std deviation	0.001

B-SIDE

ΔP_{std} (in. H_2O)	ΔP_s (in. H_2O)	Cp(s)	Deviation*
0.799	**1.132**	**0.832**	-0.002
0.803	**1.129**	**0.835**	0.002
0.800	**1.130**	**0.833**	0.000
0.802	**1.131**	**0.834**	0.000
	AVERAGE	**0.833**	0.001
		Std deviation	0.001

$$Cp(s) = Cp(std)\sqrt{\frac{\Delta P(std)}{\Delta P(s)}}$$

Cp(A) - Cp(B) = 0.009 {must be <0.010}

*Deviation = {Cp(s) - *AVG* Cp(s)} {must be <0.010}

Standard deviation of the deviations must be less than 0.02 for both

Pitot tube S/N 04-5+P1 was calibrated in accordance with the CFR 40, Part 60 Appendix A, Method 2, Section 10.

Wind Tunnel Pitot Calibration

S-type Pitot ID:	**04-5+P1**	Date:	**1-Apr-13**
Standard Pitot ID:	**001**	Personnel:	**DH**
Cp(std):	**0.99**	Cp(actual):	**0.828**
Part Number:		P(bar):	**29.35**
Test Velocity (fps):	**90**	T(°F):	**56**

A-SIDE

ΔP_{std} (in. H_2O)	ΔP_s (in. H_2O)	Cp(s)	Deviation*
1.837	**2.657**	**0.823**	-0.001
1.836	**2.652**	**0.824**	0.000
1.832	**2.642**	**0.824**	0.001
1.837	**2.651**	**0.824**	0.000
	AVERAGE	**0.824**	0.000
		Std deviation	0.001

B-SIDE

ΔP_{std} (in. H_2O)	ΔP_s (in. H_2O)	Cp(s)	Deviation*
1.837	**2.603**	**0.832**	-0.001
1.836	**2.594**	**0.833**	0.000
1.832	**2.588**	**0.833**	0.000
1.837	**2.597**	**0.833**	0.000
	AVERAGE	**0.833**	0.000
		Std deviation	0.001

$$Cp(s) = Cp(std)\sqrt{\frac{\Delta P(std)}{\Delta P(s)}}$$

Cp(A) - Cp(B) = 0.009 {must be <0.010}

*Deviation = {Cp(s) - *AVG* Cp(s)} {must be <0.010}

Standard deviation of the deviations must be less than 0.02 for both

Pitot tube S/N 04-5+P1 was calibrated in accordance with the CFR 40, Part 60 Appendix A, Method 2, Section 10.

APPENDIX B

FIELD DATA SHEETS

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	No. 9 Boiler				
Test	2N	Run 9	Date	7/30/2014	
Stack Diameter (in.)	108				
Dry Bulb (°F)	313		Wet Bulb (°F)	128	
Moisture Content (%)	8.06				
Monometer	Normal				
Barometric Pressure	29.09				
Static Pressure +/-	-0.75				
Operators	Aaron Wilson / Andrew Strong				
Pitot No.	2G		Pitot Coeff.	0.813	

Cross-section View	Elevation View

180 Klbs/Hr

Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):	11.50	Start Time:	4:45 AM
A-1	0.032	3.46	14.96	0.190	313
A-2	0.105	11.34	22.84	0.220	313
A-3	0.194	20.95	32.45	0.200	313
A-4	0.323	34.88	46.38	0.190	313
A-5	0.677	73.12	84.62	0.200	313
A-6	0.806	87.05	98.55	0.200	313
A-7	0.895	96.66	108.16	0.190	313
A-8	0.968	104.54	116.04	0.200	313
B-1				0.200	312
B-2				0.200	312
B-3				0.190	312
B-4				0.190	312
B-5				0.230	312
B-6				0.240	312
B-7				0.250	312
B-8				0.240	312
Digital Numbers Used:		131, 151		End Time:	4:55 AM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	No. 9 Boiler				
Test	2N	Run 10	Date	7/30/2014	
Stack Diameter (in.)	108				
Dry Bulb (°F)	312	Wet Bulb (°F)	128		
Moisture Content (%)	8.12				
Monometer	Normal				
Barometric Pressure	29.09				
Static Pressure +/-	-0.74				
Operators	Aaron Wilson / Andrew Strong				
Pitot No.	2G	Pitot Coeff.	0.813		

Cross-section View	Elevation View

180 Klbs/Hr

Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):	11.50	Start Time:	5:15 AM
A-1	0.032	3.46	14.96	0.190	312
A-2	0.105	11.34	22.84	0.190	312
A-3	0.194	20.95	32.45	0.200	312
A-4	0.323	34.88	46.38	0.210	312
A-5	0.677	73.12	84.62	0.210	312
A-6	0.806	87.05	98.55	0.210	312
A-7	0.895	96.66	108.16	0.180	312
A-8	0.968	104.54	116.04	0.190	312
B-1				0.190	310
B-2				0.190	310
B-3				0.220	310
B-4				0.210	310
B-5				0.220	310
B-6				0.250	310
B-7				0.230	310
B-8				0.260	310
Digital Numbers Used:		131, 151		End Time:	5:25 AM

Interpoll Laboratories
(763) 786-6020
EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	No. 9 Boiler				
Test	2N	Run	1	Date	7/30/2014
Stack Diameter (in.)	108				
Dry Bulb (°F)	310	Wet Bulb (°F)	128		
Moisture Content (%)	8.19				
Monometer	Normal				
Barometric Pressure	29.09				
Static Pressure +/-	-0.74				
Operators	Aaron Wilson / Andrew Strong				
Pitot No.	2G	Pitot Coeff.	0.813		

Cross-section View	Elevation View

180 Klbs/Hr

Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):	11.50	Start Time:	12:45 AM
A-1	0.032	3.46	14.96	0.180	310
A-2	0.105	11.34	22.84	0.200	310
A-3	0.194	20.95	32.45	0.190	310
A-4	0.323	34.88	46.38	0.190	310
A-5	0.677	73.12	84.62	0.180	310
A-6	0.806	87.05	98.55	0.180	310
A-7	0.895	96.66	108.16	0.190	310
A-8	0.968	104.54	116.04	0.190	310
B-1				0.190	308
B-2				0.190	308
B-3				0.180	308
B-4				0.150	308
B-5				0.190	308
B-6				0.220	308
B-7				0.210	308
B-8				0.260	308
Digital Numbers Used:		131, 151		End Time:	12:55 AM

Interpoll Laboratories
(763) 786-6020
EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU			
Source	No. 9 Boiler			
Test	2N	Run 2	Date	7/30/2014
Stack Diameter (in.)	108			
Dry Bulb (°F)	311	Wet Bulb (°F)	127	
Moisture Content (%)	7.70			
Monometer	Normal			
Barometric Pressure	29.09			
Static Pressure +/-	-0.74			
Operators	Aaron Wilson / Andrew Strong			
Pitot No.	2G	Pitot Coeff.	0.813	

Cross-section View	Elevation View

180 Klbs/Hr

Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):	11.50	Start Time:	1:15 AM
A-1	0.032	3.46	14.96	0.170	311
A-2	0.105	11.34	22.84	0.150	311
A-3	0.194	20.95	32.45	0.150	311
A-4	0.323	34.88	46.38	0.150	311
A-5	0.677	73.12	84.62	0.180	311
A-6	0.806	87.05	98.55	0.170	311
A-7	0.895	96.66	108.16	0.160	311
A-8	0.968	104.54	116.04	0.170	311
B-1				0.180	310
B-2				0.200	310
B-3				0.210	310
B-4				0.240	310
B-5				0.230	310
B-6				0.300	310
B-7				0.330	310
B-8				0.320	310
Digital Numbers Used:		131, 151		End Time:	1:25 AM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	No. 9 Boiler				
Test	2N	Run 3	Date	7/30/2014	
Stack Diameter (in.)	108				
Dry Bulb (°F)	310	Wet Bulb (°F)	128		
Moisture Content (%)	8.13				
Monometer	Normal				
Barometric Pressure	29.09				
Static Pressure +/-	-0.69				
Operators	Aaron Wilson / Andrew Strong				
Pitot No.	2G	Pitot Coeff.	0.813		

Cross-section View	Elevation View

180 Klbs/Hr

Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):	11.50	Start Time:	1:45 AM
A-1	0.032	3.46	14.96	0.170	310
A-2	0.105	11.34	22.84	0.170	310
A-3	0.194	20.95	32.45	0.180	310
A-4	0.323	34.88	46.38	0.190	310
A-5	0.677	73.12	84.62	0.210	310
A-6	0.806	87.05	98.55	0.200	310
A-7	0.895	96.66	108.16	0.190	310
A-8	0.968	104.54	116.04	0.220	310
B-1				0.190	311
B-2				0.190	311
B-3				0.200	311
B-4				0.220	311
B-5				0.230	311
B-6				0.230	311
B-7				0.260	311
B-8				0.290	311
Digital Numbers Used:		131, 151		End Time:	1:55 AM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	No. 9 Boiler				
Test	2N	Run 4	Date	7/30/2014	
Stack Diameter (in.)	108				
Dry Bulb (°F)	311	Wet Bulb (°F)	128		
Moisture Content (%)	8.10				
Monometer	Normal				
Barometric Pressure	29.09				
Static Pressure +/-	-0.75				
Operators	Aaron Wilson / Andrew Strong				
Pitot No.	2G	Pitot Coeff.	0.813		

Cross-section View	Elevation View

180 Klbs/Hr

Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):	11.50	Start Time:	2:15 AM
A-1	0.032	3.46	14.96	0.220	311
A-2	0.105	11.34	22.84	0.200	311
A-3	0.194	20.95	32.45	0.190	311
A-4	0.323	34.88	46.38	0.200	311
A-5	0.677	73.12	84.62	0.220	311
A-6	0.806	87.05	98.55	0.220	311
A-7	0.895	96.66	108.16	0.210	311
A-8	0.968	104.54	116.04	0.200	311
B-1				0.190	312
B-2				0.190	312
B-3				0.180	312
B-4				0.200	312
B-5				0.200	312
B-6				0.210	312
B-7				0.240	312
B-8				0.300	312
Digital Numbers Used:		131, 151		End Time:	2:25 AM

Interpoll Laboratories
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EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	No. 9 Boiler				
Test	2N	Run 5	Date	7/30/2014	
Stack Diameter (in.)	108				
Dry Bulb (°F)	310		Wet Bulb (°F)	128	
Moisture Content (%)	8.13				
Monometer	Normal				
Barometric Pressure	29.09				
Static Pressure +/-	-0.70				
Operators	Aaron Wilson / Andrew Strong				
Pitot No.	2G		Pitot Coeff.	0.813	

Cross-section View	Elevation View

180 Klbs/Hr

Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):	11.50	Start Time:	2:45 AM
A-1	0.032	3.46	14.96	0.170	310
A-2	0.105	11.34	22.84	0.180	310
A-3	0.194	20.95	32.45	0.190	310
A-4	0.323	34.88	46.38	0.190	310
A-5	0.677	73.12	84.62	0.230	310
A-6	0.806	87.05	98.55	0.210	310
A-7	0.895	96.66	108.16	0.200	310
A-8	0.968	104.54	116.04	0.220	310
B-1				0.180	311
B-2				0.170	311
B-3				0.180	311
B-4				0.200	311
B-5				0.250	311
B-6				0.240	311
B-7				0.260	311
B-8				0.270	311
Digital Numbers Used:		131, 151		End Time:	2:55 AM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	No. 9 Boiler				
Test	2N	Run 6	Date	7/30/2014	
Stack Diameter (in.)	108				
Dry Bulb (°F)	311		Wet Bulb (°F)	128	
Moisture Content (%)	8.15				
Monometer	Normal				
Barometric Pressure	29.09				
Static Pressure +/-	-0.76				
Operators	Aaron Wilson / Andrew Strong				
Pitot No.	2G		Pitot Coeff.	0.813	

Cross-section View	Elevation View

180 Klbs/Hr

Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):	11.50	Start Time:	3:15 AM
A-1	0.032	3.46	14.96	0.210	311
A-2	0.105	11.34	22.84	0.220	311
A-3	0.194	20.95	32.45	0.200	311
A-4	0.323	34.88	46.38	0.210	311
A-5	0.677	73.12	84.62	0.220	311
A-6	0.806	87.05	98.55	0.190	311
A-7	0.895	96.66	108.16	0.200	311
A-8	0.968	104.54	116.04	0.190	311
B-1				0.190	309
B-2				0.180	309
B-3				0.190	309
B-4				0.220	309
B-5				0.230	309
B-6				0.210	309
B-7				0.240	309
B-8				0.230	309
Digital Numbers Used:		131, 151		End Time:	3:25 AM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU			
Source	No. 9 Boiler			
Test	2N	Run 7	Date	7/30/2014
Stack Diameter (in.)	108			
Dry Bulb (°F)	312	Wet Bulb (°F)	137	
Moisture Content (%)	12.40			
Monometer	Normal			
Barometric Pressure	29.09			
Static Pressure +/-	-0.71			
Operators	Aaron Wilson / Andrew Strong			
Pitot No.	2G	Pitot Coeff.	0.813	

Cross-section View	Elevation View

180 Klbs/Hr

Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):	11.50	Start Time:	3:45 AM
A-1	0.032	3.46	14.96	0.200	312
A-2	0.105	11.34	22.84	0.220	312
A-3	0.194	20.95	32.45	0.210	312
A-4	0.323	34.88	46.38	0.200	312
A-5	0.677	73.12	84.62	0.200	312
A-6	0.806	87.05	98.55	0.200	312
A-7	0.895	96.66	108.16	0.200	312
A-8	0.968	104.54	116.04	0.190	312
B-1				0.170	311
B-2				0.180	311
B-3				0.210	311
B-4				0.220	311
B-5				0.220	311
B-6				0.240	311
B-7				0.240	311
B-8				0.250	311
Digital Numbers Used:		131, 151		End Time:	3:55 AM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	No. 9 Boiler				
Test	2N	Run 8	Date	7/30/2014	
Stack Diameter (in.)	108				
Dry Bulb (°F)	313	Wet Bulb (°F)	128		
Moisture Content (%)	8.08				
Monometer	Normal				
Barometric Pressure	29.09				
Static Pressure +/-	-0.75				
Operators	Aaron Wilson / Andrew Strong				
Pitot No.	2G	Pitot Coeff.	0.813		

Cross-section View	Elevation View

180 Klbs/Hr

Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):	11.50	Start Time:	4:15 AM
A-1	0.032	3.46	14.96	0.190	313
A-2	0.105	11.34	22.84	0.200	313
A-3	0.194	20.95	32.45	0.180	313
A-4	0.323	34.88	46.38	0.190	313
A-5	0.677	73.12	84.62	0.200	313
A-6	0.806	87.05	98.55	0.210	313
A-7	0.895	96.66	108.16	0.230	313
A-8	0.968	104.54	116.04	0.210	313
B-1				0.180	311
B-2				0.190	311
B-3				0.200	311
B-4				0.210	311
B-5				0.200	311
B-6				0.250	311
B-7				0.260	311
B-8				0.270	311
Digital Numbers Used:		131, 151		End Time:	4:25 AM

Interpoll Laboratories
(763) 786-6020
EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	No. 9 Boiler				
Test	2M	Run 1	Date	7/30/2014	
Stack Diameter (in.)	108				
Dry Bulb (°F)	328	Wet Bulb (°F)	136		
Moisture Content (%)	11.24				
Monometer	Fluid				
Barometric Pressure	29.12				
Static Pressure +/-	-0.37				
Operators	AW / AS				
Pitot No.	2G	Pitot Coeff.	0.8130		

Cross-section View	Elevation View

300 Klbs/Hr

Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):	11.50	Start Time:	7:15 AM
A-1	0.032	3.46	14.96	0.370	328
A-2	0.105	11.34	22.84	0.380	328
A-3	0.194	20.95	32.45	0.340	328
A-4	0.323	34.88	46.38	0.390	328
A-5	0.677	73.12	84.62	0.350	328
A-6	0.806	87.05	98.55	0.340	328
A-7	0.895	96.66	108.16	0.330	328
A-8	0.968	104.54	116.04	0.340	328
B-1				0.380	330
B-2				0.380	330
B-3				0.370	330
B-4				0.420	330
B-5				0.420	330
B-6				0.410	330
B-7				0.350	330
B-8				0.330	330
Digital Numbers Used:		131, 151		End Time:	7:21 AM

Interpoll Laboratories
(763) 786-6020
EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	No. 9 Boiler				
Test	2M	Run 2	Date	7/30/2014	
Stack Diameter (in.)	108				
Dry Bulb (°F)	330	Wet Bulb (°F)	137		
Moisture Content (%)	11.69				
Monometer	Fluid				
Barometric Pressure	29.12				
Static Pressure +/-	-0.34				
Operators	AW / AS				
Pitot No.	2G	Pitot Coeff.	0.8130		

Cross-section View	Elevation View

300 Klbs/Hr

Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):	11.50	Start Time:	7:22 AM
A-1	0.032	3.46	14.96	0.300	330
A-2	0.105	11.34	22.84	0.320	330
A-3	0.194	20.95	32.45	0.380	330
A-4	0.323	34.88	46.38	0.400	330
A-5	0.677	73.12	84.62	0.370	330
A-6	0.806	87.05	98.55	0.400	330
A-7	0.895	96.66	108.16	0.420	330
A-8	0.968	104.54	116.04	0.370	330
B-1				0.320	331
B-2				0.330	331
B-3				0.360	331
B-4				0.330	331
B-5				0.440	331
B-6				0.410	331
B-7				0.330	331
B-8				0.380	331
Digital Numbers Used:		131, 151		End Time:	7:28 AM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	No. 9 Boiler				
Test	2M	Run 3	Date	7/30/2014	
Stack Diameter (in.)	108				
Dry Bulb (°F)	327	Wet Bulb (°F)	136		
Moisture Content (%)	11.28				
Monometer	Fluid				
Barometric Pressure	29.12				
Static Pressure +/-	-0.38				
Operators	AW / AS				
Pitot No.	2G	Pitot Coeff.	0.8130		

Cross-section	Elevation
View	View

300 Klbs/Hr

Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):	11.50	Start Time:	7:29 AM
A-1	0.032	3.46	14.96	0.320	327
A-2	0.105	11.34	22.84	0.350	327
A-3	0.194	20.95	32.45	0.380	327
A-4	0.323	34.88	46.38	0.370	327
A-5	0.677	73.12	84.62	0.360	327
A-6	0.806	87.05	98.55	0.390	327
A-7	0.895	96.66	108.16	0.410	327
A-8	0.968	104.54	116.04	0.400	327
B-1				0.310	328
B-2				0.330	328
B-3				0.370	328
B-4				0.360	328
B-5				0.370	328
B-6				0.400	328
B-7				0.430	328
B-8				0.360	328
Digital Numbers Used:		131, 151		End Time:	7:35 AM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	No. 9 Boiler				
Test	2M	Run 4	Date	7/30/2014	Cross-section View / Elevation View
Stack Diameter (in.)	108				
Dry Bulb (°F)	328	Wet Bulb (°F)	138		
Moisture Content (%)	12.29				
Monometer	Fluid				
Barometric Pressure	29.12				
Static Pressure +/-	-0.35				
Operators	AW / AS				
Pitot No.	2G	Pitot Coeff.	0.8130		

300 Klbs/Hr

Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):	11.50	Start Time:	7:45 AM
A-1	0.032	3.46	14.96	0.300	328
A-2	0.105	11.34	22.84	0.320	328
A-3	0.194	20.95	32.45	0.340	328
A-4	0.323	34.88	46.38	0.370	328
A-5	0.677	73.12	84.62	0.410	328
A-6	0.806	87.05	98.55	0.420	328
A-7	0.895	96.66	108.16	0.420	328
A-8	0.968	104.54	116.04	0.380	328
B-1				0.330	329
B-2				0.340	329
B-3				0.350	329
B-4				0.360	329
B-5				0.360	329
B-6				0.360	329
B-7				0.370	329
B-8				0.360	329
Digital Numbers Used:		131, 151		End Time:	7:51 AM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	No. 9 Boiler				
Test	2M	Run 5	Date	7/30/2014	
Stack Diameter (in.)	108				
Dry Bulb (°F)	330	Wet Bulb (°F)	137		
Moisture Content (%)	11.69				
Monometer	Fluid				
Barometric Pressure	29.12				
Static Pressure +/-	-0.35				
Operators	AW / AS				
Pitot No.	2G	Pitot Coeff.	0.8130		

Cross-section View	Elevation View

300 Klbs/Hr

Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):	11.50	Start Time:	7:52 AM
A-1	0.032	3.46	14.96	0.360	330
A-2	0.105	11.34	22.84	0.350	330
A-3	0.194	20.95	32.45	0.400	330
A-4	0.323	34.88	46.38	0.400	330
A-5	0.677	73.12	84.62	0.400	330
A-6	0.806	87.05	98.55	0.420	330
A-7	0.895	96.66	108.16	0.410	330
A-8	0.968	104.54	116.04	0.420	330
B-1				0.350	329
B-2				0.340	329
B-3				0.350	329
B-4				0.330	329
B-5				0.330	329
B-6				0.320	329
B-7				0.350	329
B-8				0.290	329
Digital Numbers Used:		131, 151		End Time:	7:58 AM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	No. 9 Boiler				
Test	2M	Run 6	Date	7/30/2014	Cross-section View / Elevation View
Stack Diameter (in.)	108				
Dry Bulb (°F)	333	Wet Bulb (°F)	137		
Moisture Content (%)	11.58				
Monometer	Fluid				
Barometric Pressure	29.12				
Static Pressure +/-	-0.39				
Operators	AW / AS				
Pitot No.	2G	Pitot Coeff.	0.8130		

300 Klbs/Hr

Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):	11.50	Start Time:	7:59 AM
A-1	0.032	3.46	14.96	0.340	333
A-2	0.105	11.34	22.84	0.360	333
A-3	0.194	20.95	32.45	0.310	333
A-4	0.323	34.88	46.38	0.300	333
A-5	0.677	73.12	84.62	0.300	333
A-6	0.806	87.05	98.55	0.320	333
A-7	0.895	96.66	108.16	0.310	333
A-8	0.968	104.54	116.04	0.320	333
B-1				0.340	332
B-2				0.360	332
B-3				0.380	332
B-4				0.390	332
B-5				0.400	332
B-6				0.440	332
B-7				0.420	332
B-8				0.400	332
Digital Numbers Used:		131, 151		End Time:	8:05 AM

Interpoll Laboratories
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EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	No. 9 Boiler				
Test	2M	Run 7	Date	7/30/2014	
Stack Diameter (in.)	108				
Dry Bulb (°F)	330	Wet Bulb (°F)	138		
Moisture Content (%)	12.22				
Monometer	Fluid				
Barometric Pressure	29.12				
Static Pressure +/-	-0.35				
Operators	AW / AS				
Pitot No.	2G	Pitot Coeff.	0.8130		

Cross-section View	Elevation View

300 Klbs/Hr

Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):	11.50	Start Time:	8:06 AM
A-1	0.032	3.46	14.96	0.360	330
A-2	0.105	11.34	22.84	0.380	330
A-3	0.194	20.95	32.45	0.360	330
A-4	0.323	34.88	46.38	0.330	330
A-5	0.677	73.12	84.62	0.320	330
A-6	0.806	87.05	98.55	0.320	330
A-7	0.895	96.66	108.16	0.310	330
A-8	0.968	104.54	116.04	0.320	330
B-1				0.370	331
B-2				0.320	331
B-3				0.330	331
B-4				0.330	331
B-5				0.390	331
B-6				0.420	331
B-7				0.460	331
B-8				0.420	331
Digital Numbers Used:		131, 151		End Time:	8:12 AM

Interpoll Laboratories
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EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	No. 9 Boiler				
Test	2M	Run 8	Date	7/30/2014	Cross-section View / Elevation View
Stack Diameter (in.)	108				
Dry Bulb (°F)	330	Wet Bulb (°F)	138		
Moisture Content (%)	12.22				
Monometer	Fluid				
Barometric Pressure	29.12				
Static Pressure +/-	-0.35				
Operators	AW / AS				
Pitot No.	2G	Pitot Coeff.	0.8130		

300 Klbs/Hr

Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):	11.50	Start Time:	8:13 AM
A-1	0.032	3.46	14.96	0.360	330
A-2	0.105	11.34	22.84	0.390	330
A-3	0.194	20.95	32.45	0.340	330
A-4	0.323	34.88	46.38	0.320	330
A-5	0.677	73.12	84.62	0.310	330
A-6	0.806	87.05	98.55	0.360	330
A-7	0.895	96.66	108.16	0.340	330
A-8	0.968	104.54	116.04	0.360	330
B-1				0.330	328
B-2				0.320	328
B-3				0.310	328
B-4				0.310	328
B-5				0.360	328
B-6				0.390	328
B-7				0.450	328
B-8				0.460	328
Digital Numbers Used:		131, 151		End Time:	8:19 AM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	No. 9 Boiler				
Test	2M	Run	9	Date	7/30/2014
Stack Diameter (in.)	108				
Dry Bulb (°F)	331	Wet Bulb (°F)	138		
Moisture Content (%)	12.18				
Monometer	Fluid				
Barometric Pressure	29.12				
Static Pressure +/-	-0.37				
Operators	AW / AS				
Pitot No.	2G	Pitot Coeff.	0.8130		

Cross-section View	Elevation View

300 Klbs/Hr

Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):	11.50	Start Time:	8:20 AM
A-1	0.032	3.46	14.96	0.360	331
A-2	0.105	11.34	22.84	0.380	331
A-3	0.194	20.95	32.45	0.320	331
A-4	0.323	34.88	46.38	0.310	331
A-5	0.677	73.12	84.62	0.350	331
A-6	0.806	87.05	98.55	0.340	331
A-7	0.895	96.66	108.16	0.360	331
A-8	0.968	104.54	116.04	0.360	331
B-1				0.330	330
B-2				0.330	330
B-3				0.340	330
B-4				0.320	330
B-5				0.370	330
B-6				0.400	330
B-7				0.420	330
B-8				0.450	330
Digital Numbers Used:		131, 151		End Time:	8:26 AM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	No. 9 Boiler				
Test	2M	Run 10	Date	7/30/2014	Cross-section View / Elevation View
Stack Diameter (in.)	108				
Dry Bulb (°F)	332	Wet Bulb (°F)	138		
Moisture Content (%)	12.14				
Monometer	Fluid				
Barometric Pressure	29.12				
Static Pressure +/-	-0.37				
Operators	AW / AS				
Pitot No.	2G	Pitot Coeff.	0.8130		

300 Klbs/Hr

Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):	11.50	Start Time:	8:27 AM
A-1	0.032	3.46	14.96	0.350	332
A-2	0.105	11.34	22.84	0.380	332
A-3	0.194	20.95	32.45	0.340	332
A-4	0.323	34.88	46.38	0.320	332
A-5	0.677	73.12	84.62	0.330	332
A-6	0.806	87.05	98.55	0.350	332
A-7	0.895	96.66	108.16	0.340	332
A-8	0.968	104.54	116.04	0.360	332
B-1				0.350	333
B-2				0.320	333
B-3				0.310	333
B-4				0.320	333
B-5				0.360	333
B-6				0.410	333
B-7				0.420	333
B-8				0.440	333
Digital Numbers Used:		131, 151		End Time:	8:33 AM

APPENDIX C

REFERENCE METHOD COMPUTER PRINTOUTS

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

7/30/2014
Test 2N Run 1
180 Klbs/Hr

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.180	0.424	310	12:45 AM
2	A-2	0.200	0.447	310	
3	A-3	0.190	0.436	310	
4	A-4	0.190	0.436	310	
5	A-5	0.180	0.424	310	
6	A-6	0.180	0.424	310	
7	A-7	0.190	0.436	310	
8	A-8	0.190	0.436	310	
9	B-1	0.190	0.436	308	
10	B-2	0.190	0.436	308	
11	B-3	0.180	0.424	308	
12	B-4	0.150	0.387	308	
13	B-5	0.190	0.436	308	
14	B-6	0.220	0.469	308	
15	B-7	0.210	0.458	308	
16	B-8	0.260	0.510	308	12:55 AM
Average		0.193	0.439	309	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	309		
Wet Bulb (°F)	128.0	Static Pressure	-0.74
TRA	1.14	Pitot Coefficient	0.813
Vapor Pressure of Water	4.29		
ZT	181.00	Duct Width (in.)	0.0
PM	237.75	Duct Length (in.)	0.0
Barometric Pressure	29.09	Duct Area (ft^2)	0.0
		Stack Diameter (in.)	108.0
		Stack Area (ft^2)	63.6173
Moisture Content	8.19		
		Molecular Weight (dry)	30.153
O_2 %	9.08	Molecular Weight (wet)	29.157
CO_2 %	11.184	Stack Pressure	29.036
		Feet per Second	28.918
Standard CFH	4,412,886	Actual CFM	110381.14
K Standard CFH	73.548	DSCFM	67525.72

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration
O_2 (dry)	9.10	0.05	11.11	11.10	**9.08**
CO_2 (wet)	10.42	0.04	8.50	8.36	**10.27**
NOx (wet)	29.82	0.06	49.95	50.40	**30.07**
SO_2 (wet)	90.59	0.07	49.35	49.40	**90.74**
CO (wet)	28.88	0.05	50.35	50.40	**28.89**

Moisture	8.19	**Standard CFH**	**4,412,886**
Fuel Factor	1833	K Standard CFM	73.548
DSCFM	67526		

Results

Start	**12:45 AM**	**Gases Start**	**12:45 AM**
Stop	**12:55 AM**	**Gases Stop**	**1:05 AM**

CO_2 %, wet	**10.3**
NOX ppm, wet	**30.1**
NOx LB/mmBTU	**0.064**
SO_2 ppm, wet	**90.7**
SO_2 LB/mmBTU	**0.269**
CO ppm, wet	**28.89**
CO LB/mmBTU	**0.037**
SCFH	**4,413,000**
WAF applied	**0.9950**

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
7/30/2014
Run 1

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	$\% CO_2$, w	CO ppm, w
0:45	89.997712	28.904912	8.99595	10.52594	29.161827
0:46	94.250312	28.562156	8.955236	10.44005	29.162297
0:47	94.814448	29.052736	8.962396	10.56334	29.167749
0:48	96.034768	29.359328	9.014634	10.46703	28.50519
0:49	93.951904	29.942488	9.011708	10.42906	29.018101
0:50	90.934928	29.941468	9.078854	10.44827	28.229441
0:51	89.732528	29.818668	9.019396	10.57826	29.444908
0:52	84.904272	30.578252	9.098226	10.34847	29.229272
0:53	87.300976	30.608008	9.12306	10.52388	29.941322
0:54	88.164064	30.731828	9.081422	10.66605	29.300759
0:55	91.853736	29.868376	9.055268	10.4693	29.589668
0:56	95.431352	30.686372	9.126704	10.48369	28.162842
0:57	90.639144	30.291012	9.21595	10.23662	29.229272
0:58	87.32396	30.226184	9.173286	10.33941	28.236303
0:59	88.455392	29.532664	9.144584	10.48121	28.580578
1:00	88.771528	30.016024	9.174572	10.29956	28.574186
1:01	86.979384	30.020552	9.191974	10.26924	28.439296
1:02	90.33932	30.286588	9.119404	10.44543	29.160934
1:03	93.02008	29.084488	9.163358	10.34294	29.373985
1:04	90.924544	29.353436	9.175122	10.31337	28.162372
1:05	88.46584	29.375852	9.138202	10.24743	27.833466
Average	**90.585**	**29.821**	**9.096**	**10.425**	**28.881**

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

7/30/2014
Test 2N **Run 2**
180 Klbs/Hr

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.170	0.412	311	1:15 AM
2	A-2	0.150	0.387	311	
3	A-3	0.150	0.387	311	
4	A-4	0.150	0.387	311	
5	A-5	0.180	0.424	311	
6	A-6	0.170	0.412	311	
7	A-7	0.160	0.400	311	
8	A-8	0.170	0.412	311	
9	B-1	0.180	0.424	310	
10	B-2	0.200	0.447	310	
11	B-3	0.210	0.458	310	
12	B-4	0.240	0.490	310	
13	B-5	0.230	0.480	310	
14	B-6	0.300	0.548	310	
15	B-7	0.330	0.574	310	
16	B-8	0.320	0.566	310	1:25 AM
Average		0.207	0.451	311	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	311		
Wet Bulb (°F)	127.0	Static Pressure	-0.74
TRA	1.14	Pitot Coefficient	0.813
Vapor Pressure of Water	4.18		
ZT	183.50	Duct Width (in.)	0.00
PM	223.69	Duct Length (in.)	0.00
Barometric Pressure	29.09	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	108.00
		Stack Area (ft^2)	63.62
Moisture Content	7.70		
		Molecular Weight (dry)	30.137
O_2 %	9.07	Molecular Weight (wet)	29.202
CO_2 %	11.089	Stack Pressure	29.036
		Feet per Second	29.708
Standard CFH	4,524,566	Actual CFM	113395.39
K Standard CFH	75.409	DSCFM	69599.94

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration
O_2 (dry)	9.09	0.04	11.12	11.10	**9.07**
CO_2 (wet)	10.40	0.05	8.50	8.36	**10.23**
NOx (wet)	29.75	0.08	49.74	50.40	**30.12**
SO_2 (wet)	85.90	0.12	49.43	49.40	**85.94**
CO (wet)	28.16	0.05	50.28	50.40	**28.21**

Moisture	7.70	**Standard CFH**	**4,524,566**
Fuel Factor	1833	K Standard CFM	75.409
DSCFM	69600		

Results

Start	**1:15 AM**	**Gases Start**	**1:15 AM**
Stop	**1:25 AM**	**Gases Stop**	**1:35 AM**

CO_2 %, wet	**10.2**
NOX ppm, wet	**30.1**
NOx LB/mmBTU	**0.064**
SO_2 ppm, wet	**85.9**
SO_2 LB/mmBTU	**0.256**
CO ppm, wet	**28.21**
CO LB/mmBTU	**0.037**
SCFH	**4,525,000**
WAF applied	**0.9950**

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
7/30/2014
Run 2

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	$\% CO_2$, w	CO ppm, w
1:15	81.905144	29.27076	9.062758	10.20984	27.79972
1:16	85.831032	29.06486	9.055266	10.25219	28.354388
1:17	83.062992	29.787156	9.020124	10.14888	28.354848
1:18	80.989568	30.22698	9.11174	10.57933	28.98468
1:19	82.19028	30.119852	9.172538	10.36095	27.226422
1:20	85.217568	29.243872	9.131632	10.13266	28.702884
1:21	88.763168	29.393732	9.12087	10.30097	28.079722
1:22	86.124864	29.901072	9.125062	10.47395	28.078848
1:23	83.97676	29.333324	9.08288	10.35846	28.429368
1:24	84.623848	29.845192	9.032758	10.19941	29.26459
1:25	87.006344	30.255972	9.03257	10.50979	28.222874
1:26	81.594672	31.278468	9.145686	10.42369	27.943194
1:27	80.103304	30.505732	9.145686	10.35908	28.151022
1:28	88.790192	28.368108	9.049224	10.67346	28.711302
1:29	88.499064	29.156628	9.037882	10.29131	28.987302
1:30	88.77152	28.950676	9.039712	10.40832	27.73164
1:31	90.937008	29.31096	9.010782	10.03691	28.22108
1:32	89.742968	29.914436	9.062216	10.57094	27.383696
1:33	89.411136	30.947012	9.17858	10.73786	27.52395
1:34	87.590824	30.231452	9.124338	10.62947	27.455226
1:35	88.759056	29.72454	9.122694	10.65695	27.79926
Average	**85.900**	**29.754**	**9.089**	**10.396**	**28.162**

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

7/30/2014
Test 2N Run 3
180 Klbs/Hr

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.170	0.412	310	1:45 AM
2	A-2	0.170	0.412	310	
3	A-3	0.180	0.424	310	
4	A-4	0.190	0.436	310	
5	A-5	0.210	0.458	310	
6	A-6	0.200	0.447	310	
7	A-7	0.190	0.436	310	
8	A-8	0.220	0.469	310	
9	B-1	0.190	0.436	311	
10	B-2	0.190	0.436	311	
11	B-3	0.200	0.447	311	
12	B-4	0.220	0.469	311	
13	B-5	0.230	0.480	311	
14	B-6	0.230	0.480	311	
15	B-7	0.260	0.510	311	
16	B-8	0.290	0.539	311	1:55 AM
Average		0.209	0.456	311	

Moisture Content Data	
Dry Bulb (°F)	311
Wet Bulb (°F)	128.0
TRA	1.14
Vapor Pressure of Water	4.29
ZT	182.50
PM	236.14
Barometric Pressure	29.09
Moisture Content	8.13
O_2 %	8.988
CO_2 %	11.362
Standard CFH	4,576,614
K Standard CFH	76.277

Flow Rate Data	
Static Pressure	-0.69
Pitot Coefficient	0.813
Duct Width (in.)	0.00
Duct Length (in.)	0.00
Duct Area (ft^2)	0.00
Stack Diameter (in.)	108.00
Stack Area (ft^2)	63.62
Molecular Weight (dry)	30.177
Molecular Weight (wet)	29.187
Stack Pressure	29.039
Feet per Second	30.046
Actual CFM	114685.29
DSCFM	70074.16

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration
O_2 (dry)	9.00	0.04	11.11	11.1	**8.99**
CO_2 (wet)	10.59	0.05	8.50	8.4	**10.44**
NOx (wet)	28.60	0.07	49.89	50.4	**28.87**
SO_2 (wet)	92.50	0.12	49.41	49.4	**92.58**
CO (wet)	29.86	0.05	50.27	50.40	**29.92**

Moisture	8.13	**Standard CFH**	**4,576,614**
Fuel Factor	1833	K Standard CFM	76.277
DSCFM	70074		

Results

Start	**1:45 AM**	**Gases Start**	**1:45 AM**
Stop	**1:55 AM**	**Gases Stop**	**2:05 AM**

CO_2 %, wet	**10.4**
NOX ppm, wet	**28.9**
NOx LB/mmBTU	**0.061**
SO_2 ppm, wet	**92.6**
SO_2 LB/mmBTU	**0.270**
CO ppm, wet	**29.92**
CO LB/mmBTU	**0.038**
SCFH	**4,577,000**
WAF applied	**0.9950**

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
7/30/2014
Run 3

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	$\% CO_2$, w	CO ppm, w
1:45	105.02876	26.655502	9.011332	10.84712	30.98172
1:46	101.39334	28.143672	9.021036	10.6293	30.573488
1:47	102.27736	27.596576	9.044288	10.63282	29.168216
1:48	100.8203	28.533052	9.005832	10.61123	30.167192
1:49	98.123768	28.265392	8.978334	10.63642	29.572664
1:50	98.422304	28.38398	8.93594	10.52365	29.839436
1:51	97.523912	27.895748	8.941638	10.69267	28.770632
1:52	95.151064	28.017792	8.936126	10.70704	30.038008
1:53	93.946096	28.443224	9.005646	10.49152	29.97192
1:54	92.762104	28.62874	9.03129	10.6641	29.969368
1:55	86.435128	28.906824	9.014262	10.55459	30.309928
1:56	81.573648	29.303912	8.999416	10.69343	29.97148
1:57	85.839384	29.361556	9.00034	10.35537	29.768024
1:58	88.163984	29.02526	9.017374	10.54878	29.634132
1:59	86.135304	28.906952	9.042456	10.55155	29.633296
2:00	90.932832	28.970032	8.98347	10.6503	30.377028
2:01	91.231848	29.391276	9.043188	10.52476	29.168216
2:02	86.418552	29.378048	9.00034	10.29236	30.102424
2:03	87.870232	28.251496	8.97228	10.87639	29.099136
2:04	86.106424	29.668796	9.056974	10.72344	30.779716
2:05	86.391752	28.970208	9.036658	10.26802	29.241168
Average	**92.502**	**28.605**	**9.004**	**10.594**	**29.864**

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

7/30/2014
Test 2N Run 4
180 Klbs/Hr

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.220	0.469	311	2:15 AM
2	A-2	0.200	0.447	311	
3	A-3	0.190	0.436	311	
4	A-4	0.200	0.447	311	
5	A-5	0.220	0.469	311	
6	A-6	0.220	0.469	311	
7	A-7	0.210	0.458	311	
8	A-8	0.200	0.447	311	
9	B-1	0.190	0.436	312	
10	B-2	0.190	0.436	312	
11	B-3	0.180	0.424	312	
12	B-4	0.200	0.447	312	
13	B-5	0.200	0.447	312	
14	B-6	0.210	0.458	312	
15	B-7	0.240	0.490	312	
16	B-8	0.300	0.548	312	2:25 AM
Average		0.211	0.458	312	

Moisture Content Data	
Dry Bulb (°F)	312
Wet Bulb (°F)	128.0
TRA	1.14
Vapor Pressure of Water	4.29
ZT	183.50
PM	235.12
Barometric Pressure	29.09
Moisture Content	8.10
O_2 %	8.942
CO_2 %	11.505
Standard CFH	4,595,581
K Standard CFH	76.593

Flow Rate Data	
Static Pressure	-0.75
Pitot Coefficient	0.813
Duct Width (in.)	0
Duct Length (in.)	0
Duct Area (ft^2)	0
Stack Diameter (in.)	108
Stack Area (ft^2)	63.6172512
Molecular Weight (dry)	30.198
Molecular Weight (wet)	29.211
Stack Pressure	29.035
Feet per Second	30.214
Actual CFM	115327.56
DSCFM	70390.73

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration
O_2 (dry)	8.94	0.04	11.09	11.1	**8.94**
CO_2 (wet)	10.68	0.06	8.46	8.4	**10.57**
NOx (wet)	30.08	0.06	49.92	50.4	**30.35**
SO_2 (wet)	80.50	0.09	49.37	49.4	**80.61**
CO (wet)	27.92	0.05	50.25	50.40	**27.98**
Moisture	8.10		**Standard CFH**		**4,595,581**
Fuel Factor	1833		K Standard CFM		76.593
DSCFM	70391				

Results

Start	**2:15 AM**	**Gases Start**	**2:15 AM**
Stop	**2:25 AM**	**Gases Stop**	**2:35 AM**

CO_2 %, wet	**10.6**
NOX ppm, wet	**30.3**
NOx LB/mmBTU	**0.063**
SO_2 ppm, wet	**80.6**
SO_2 LB/mmBTU	**0.232**
CO ppm, wet	**27.98**
CO LB/mmBTU	**0.035**
SCFH	**4,596,000**
WAF applied	**0.9950**

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
7/30/2014
Run 4

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	$\% CO_2$, w	CO ppm, w
2:15	78.631096	29.81484	8.988838	10.54602	28.250054
2:16	78.90888	29.834888	8.975636	10.16606	28.575736
2:17	82.799728	28.999372	8.963532	10.73392	27.668135
2:18	80.427752	30.02004	9.00974	10.83351	28.448628
2:19	78.047416	29.582588	8.883602	10.81797	27.384507
2:20	81.334368	29.970948	8.970868	9.841698	28.576596
2:21	83.672784	29.736652	8.951966	10.99052	27.730657
2:22	81.019112	29.875032	8.915236	10.82155	28.64316
2:23	84.661616	29.886188	8.943708	10.10205	27.386141
2:24	85.839616	30.211768	8.925888	11.05492	28.123462
2:25	87.601496	28.379356	8.783098	10.898	27.533803
2:26	82.211336	30.120432	8.91468	10.37514	27.85755
2:27	80.998152	30.675192	8.9505	10.64305	27.858754
2:28	78.053688	30.229656	8.922032	11.0361	28.967724
2:29	81.598944	30.523716	9.024942	10.91534	27.259979
2:30	81.286048	30.136004	8.963894	10.98048	28.052211
2:31	81.901064	29.781324	8.875874	11.06035	27.190749
2:32	81.000176	30.843804	8.91156	11.02767	27.378659
2:33	59.907208	33.007244	8.94132	10.50468	27.192426
2:34	75.31524	30.178356	8.94407	10.87022	27.981304
2:35	85.201008	29.77238	9.01725	10.00234	28.248807
Average	**80.496**	**30.075**	**8.942**	**10.677**	**27.919**

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

7/30/2014
Test 2N **Run 5**
180 Klbs/Hr

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.170	0.412	310	2:45 AM
2	A-2	0.180	0.424	310	
3	A-3	0.190	0.436	310	
4	A-4	0.190	0.436	310	
5	A-5	0.230	0.480	310	
6	A-6	0.210	0.458	310	
7	A-7	0.200	0.447	310	
8	A-8	0.220	0.469	310	
9	B-1	0.180	0.424	311	
10	B-2	0.170	0.412	311	
11	B-3	0.180	0.424	311	
12	B-4	0.200	0.447	311	
13	B-5	0.250	0.500	311	
14	B-6	0.240	0.490	311	
15	B-7	0.260	0.510	311	
16	B-8	0.270	0.520	311	2:55 AM
Average		0.209	0.456	311	

Moisture Content Data	
Dry Bulb (°F)	311
Wet Bulb (°F)	128.0
TRA	1.14
Vapor Pressure of Water	4.29
ZT	182.50
PM	236.15
Barometric Pressure	29.09
Moisture Content	8.13
O_2 %	8.888
CO_2 %	11.505
Standard CFH	4,574,648
K Standard CFH	76.244

Flow Rate Data	
Static Pressure	-0.70
Pitot Coefficient	0.813
Duct Width (in.)	0
Duct Length (in.)	0
Duct Area (ft^2)	0
Stack Diameter (in.)	108
Stack Area (ft^2)	63.6172512
Molecular Weight (dry)	30.196
Molecular Weight (wet)	29.204
Stack Pressure	29.039
Feet per Second	30.034
Actual CFM	114638.94
DSCFM	70043.78

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration
O_2 (dry)	8.89	0.04	11.09	11.1	**8.89**
CO_2 (wet)	10.68	0.05	8.46	8.4	**10.57**
NOx (wet)	28.32	0.07	49.93	50.4	**28.56**
SO_2 (wet)	96.04	0.06	49.34	49.4	**96.22**
CO (wet)	28.62	0.05	50.23	50.40	**28.70**

Moisture	8.13	**Standard CFH**	**4,574,648**
Fuel Factor	1833	**K** Standard CFM	76.244
DSCFM	70044		

Results

Start	**2:45 AM**	**Gases Start**	**2:45 AM**
Stop	**2:55 AM**	**Gases Stop**	**3:05 AM**

CO_2 %, wet	**10.6**
NOX ppm, wet	**28.6**
NOx LB/mmBTU	**0.059**
SO_2 ppm, wet	**96.2**
SO_2 LB/mmBTU	**0.277**
CO ppm, wet	**28.70**
CO LB/mmBTU	**0.036**
SCFH	**4,575,000**
WAF applied	**0.9950**

MPU02822

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
7/30/2014
Run 5

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	% CO_2, w	CO ppm, w
2:45	95.45468	28.046488	8.997092	10.50461	28.119334
2:46	97.821472	28.35028	9.00937	10.06716	28.315844
2:47	100.23888	27.894564	9.037022	10.54602	28.708047
2:48	95.448488	27.745248	9.045076	10.58742	29.424513
2:49	97.565448	27.40362	8.974354	10.67949	28.64316
2:50	97.835824	27.619504	8.889674	10.83915	29.035148
2:51	94.557632	28.2947	8.962064	10.59849	28.906793
2:52	93.967216	28.69214	8.991776	10.52885	29.689178
2:53	95.747296	28.47982	8.960596	10.76012	28.383913
2:54	96.054128	27.954064	8.927356	10.9692	29.097756
2:55	99.32996	27.107958	8.86649	11.06327	28.44407
2:56	96.642192	27.777312	8.811352	10.26648	28.898967
2:57	95.1494	28.415836	8.83887	10.61121	27.920674
2:58	93.057904	27.987764	8.81154	10.72766	28.053845
2:59	90.354368	29.05762	8.78714	10.38368	28.508269
3:00	93.919776	28.603924	8.709954	10.75524	28.765409
3:01	93.34884	29.148144	8.71474	10.84334	28.571608
3:02	95.714344	28.964292	8.770246	11.0395	27.855056
3:03	99.0306	29.265636	8.816488	10.88035	28.245496
3:04	99.016184	28.628768	8.835364	10.86419	28.183877
3:05	96.633968	29.329256	8.898134	10.70919	29.353348
Average	**96.042**	**28.322**	**8.888**	**10.677**	**28.625**

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

7/30/2014
Test 2N **Run 6**
180 Klbs/Hr

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.210	0.458	311	3:15 AM
2	A-2	0.220	0.469	311	
3	A-3	0.200	0.447	311	
4	A-4	0.210	0.458	311	
5	A-5	0.220	0.469	311	
6	A-6	0.190	0.436	311	
7	A-7	0.200	0.447	311	
8	A-8	0.190	0.436	311	
9	B-1	0.190	0.436	309	
10	B-2	0.180	0.424	309	
11	B-3	0.190	0.436	309	
12	B-4	0.220	0.469	309	
13	B-5	0.230	0.480	309	
14	B-6	0.210	0.458	309	
15	B-7	0.240	0.490	309	
16	B-8	0.230	0.480	309	3:25 AM
Average		0.208	0.456	310	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	310		
Wet Bulb (°F)	128.0	Static Pressure	-0.76
TRA	1.14	Pitot Coefficient	0.813
Vapor Pressure of Water	4.29		
ZT	182.00	Duct Width (in.)	0.00
PM	236.71	Duct Length (in.)	0.00
Barometric Pressure	29.09	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	108.00
		Stack Area (ft^2)	63.62
Moisture Content	8.15		
		Molecular Weight (dry)	30.189
O_2 %	8.876	Molecular Weight (wet)	29.195
CO_2 %	11.461	Stack Pressure	29.034
		Feet per Second	30.044
Standard CFH	4,578,590	Actual CFM	114680.69
K Standard CFH	76.31	DSCFM	70088.53

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration
O_2 (dry)	8.89	0.06	11.11	11.1	**8.88**
CO_2 (wet)	10.63	0.02	8.45	8.4	**10.53**
NOx (wet)	30.35	0.08	49.87	50.4	**30.64**
SO_2 (wet)	86.43	0.06	49.33	49.4	**86.59**
CO (wet)	28.57	0.05	50.25	50.40	**28.64**
Moisture	8.15		**Standard CFH**		**4,578,590**
Fuel Factor	1833		K Standard CFM		76.31
DSCFM	70089				

Results

Start	**3:15 AM**	**Gases Start**	**3:15 AM**
Stop	**3:25 AM**	**Gases Stop**	**3:35 AM**
CO_2 %, wet	**10.5**		
NOX ppm, wet	**30.6**		
NOx LB/mmBTU	**0.064**		
SO_2 ppm, wet	**86.6**		
SO_2 LB/mmBTU	**0.250**		
CO ppm, wet	**28.64**		
CO LB/mmBTU	**0.036**		
SCFH	**4,579,000**		
WAF applied	**0.9950**		

MPU02824

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
7/30/2014
Run 6

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	$\% CO_2$, w	CO ppm, w
3:15	88.967496	29.251992	8.885258	10.28239	28.774108
3:16	89.531424	30.055768	8.837946	9.63267	29.44326
3:17	92.86952	29.904076	8.86281	11.2993	28.970084
3:18	89.877072	29.937488	8.875874	10.60709	28.640084
3:19	89.872968	29.799156	8.88397	11.077	27.891776
3:20	87.099408	29.763432	8.828404	11.01184	28.022632
3:21	82.30808	31.163568	8.884158	11.01184	27.4417
3:22	83.506232	30.795364	8.886176	10.62718	28.020476
3:23	83.778568	30.523716	8.96482	10.88571	27.892656
3:24	83.791096	29.817048	8.985908	11.01363	27.955312
3:25	84.69684	30.305368	8.86907	9.478178	28.10874
3:26	85.616864	30.008884	8.788972	11.01542	28.503244
3:27	85.625152	31.237284	8.92497	11.2792	27.886232
3:28	86.503264	30.65962	8.901264	10.12199	28.501572
3:29	82.255784	31.174724	8.93967	9.78061	28.901532
3:30	85.608504	30.92652	8.953436	10.88232	29.035072
3:31	88.585528	30.332204	8.877354	10.17582	28.901092
3:32	87.095232	30.485892	8.885258	11.01935	29.100016
3:33	86.796824	29.828204	8.829692	11.11623	29.239892
3:34	83.747152	30.456952	8.892986	10.6496	28.973912
3:35	86.79264	30.81988	8.951598	10.36061	29.704928
Average	**86.425**	**30.345**	**8.891**	**10.635**	**28.567**

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

7/30/2014
Test 2N **Run 7**
180 Klbs/Hr

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.200	0.447	312	3:45 AM
2	A-2	0.220	0.469	312	
3	A-3	0.210	0.458	312	
4	A-4	0.200	0.447	312	
5	A-5	0.200	0.447	312	
6	A-6	0.200	0.447	312	
7	A-7	0.200	0.447	312	
8	A-8	0.190	0.436	312	
9	B-1	0.170	0.412	311	
10	B-2	0.180	0.424	311	
11	B-3	0.210	0.458	311	
12	B-4	0.220	0.469	311	
13	B-5	0.220	0.469	311	
14	B-6	0.240	0.490	311	
15	B-7	0.240	0.490	311	
16	B-8	0.250	0.500	311	3:55 AM
Average		0.209	0.457	312	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	312		
Wet Bulb (°F)	137.0	Static Pressure	-0.71
TRA	1.13	Pitot Coefficient	0.813
Vapor Pressure of Water	5.45		
ZT	174.50	Duct Width (in.)	0.00
PM	360.01	Duct Length (in.)	0.00
Barometric Pressure	29.09	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	108.00
		Stack Area (ft^2)	63.62
Moisture Content	12.40		
		Molecular Weight (dry)	30.279
O_2 %	8.885	Molecular Weight (wet)	28.756
CO_2 %	12.02	Stack Pressure	29.038
		Feet per Second	30.378
Standard CFH	4,621,051	Actual CFM	115955.
K Standard CFH	77.018	DSCFM	67468.92

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration
O_2 (dry)	8.91	0.08	11.11	11.1	**8.89**
CO_2 (wet)	10.65	0.02	8.46	8.4	**10.53**
NOx (wet)	26.81	0.07	49.87	50.4	**27.07**
SO_2 (wet)	93.92	0.07	49.33	49.4	**94.12**
CO (wet)	29.72	0.04	50.25	50.40	**29.79**

Moisture	12.40	**Standard CFH**	**4,621,051**
Fuel Factor	1833	K Standard CFM	77.018
DSCFM	67469		

Results

Start	**3:45 AM**	**Gases Start**	**3:45 AM**
Stop	**3:55 AM**	**Gases Stop**	**4:05 AM**
CO_2 %, wet	**10.5**		
NOX ppm, wet	**27.1**		
NOx LB/mmBTU	**0.056**		
SO_2 ppm, wet	**94.1**		
SO_2 LB/mmBTU	**0.272**		
CO ppm, wet	**29.79**		
CO LB/mmBTU	**0.038**		
SCFH	**4,621,000**		
WAF applied	**0.9950**		

MPU02826

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
7/30/2014
Run 7

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	% CO_2, w	CO ppm, w
3:45	92.87896	27.686132	8.917254	10.74877	29.540208
3:46	88.064512	28.964268	8.919646	10.59622	29.950816
3:47	77.531576	29.980192	8.81612	10.9918	28.60468
3:48	77.21592	28.64068	8.94407	10.88141	28.275384
3:49	86.482704	27.853988	8.929012	10.48171	29.668556
3:50	90.123456	27.903184	8.96885	10.73766	29.470292
3:51	92.839808	26.836992	8.919458	10.72138	29.944964
3:52	97.610712	27.106708	8.970868	10.99531	29.602512
3:53	96.712448	27.414432	9.03519	10.63679	30.07318
3:54	96.118264	27.692908	9.020542	10.72007	29.807068
3:55	101.83966	26.71392	8.933792	10.29528	30.20716
3:56	97.022312	26.618196	8.935622	10.58234	29.87584
3:57	99.69136	25.374368	8.846422	10.74871	30.006476
3:58	99.09844	25.314108	8.899972	10.48302	29.467344
3:59	99.38992	24.558418	8.855076	10.59256	30.547852
4:00	97.32584	25.86727	8.902184	10.61924	30.34422
4:01	95.219056	25.623682	8.814658	10.90623	30.009424
4:02	97.331976	25.897	8.805666	10.07268	29.203696
4:03	97.639352	25.467482	8.794294	10.54526	29.466904
4:04	96.722696	25.62341	8.842368	10.66042	30.682976
4:05	95.536808	25.896078	8.93526	10.63589	29.271456
Average	**93.924**	**26.811**	**8.905**	**10.650**	**29.715**

MSI / Manitowoc PU	**7/30/2014**	
Manitowoc, WI	**Test 2N**	**Run 8**
No. 9 Boiler	**180 Klbs/Hr**	

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.190	0.436	313	4:15 AM
2	A-2	0.200	0.447	313	
3	A-3	0.180	0.424	313	
4	A-4	0.190	0.436	313	
5	A-5	0.200	0.447	313	
6	A-6	0.210	0.458	313	
7	A-7	0.230	0.480	313	
8	A-8	0.210	0.458	313	
9	B-1	0.180	0.424	311	
10	B-2	0.190	0.436	311	
11	B-3	0.200	0.447	311	
12	B-4	0.210	0.458	311	
13	B-5	0.200	0.447	311	
14	B-6	0.250	0.500	311	
15	B-7	0.260	0.510	311	
16	B-8	0.270	0.520	311	4:25 AM
Average		0.211	0.458	312	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	312		
Wet Bulb (°F)	128.0	Static Pressure	-0.75
TRA	1.14	Pitot Coefficient	0.813
Vapor Pressure of Water	4.29		
ZT	184.00	Duct Width (in.)	0.00
PM	234.59	Duct Length (in.)	0.00
Barometric Pressure	29.09	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	108.00
		Stack Area (ft^2)	63.62
Moisture Content	8.08		
		Molecular Weight (dry)	30.224
O_2 %	8.794	Molecular Weight (wet)	29.236
CO_2 %	11.702	Stack Pressure	29.035
		Feet per Second	30.209
Standard CFH	4,591,853	Actual CFM	115308.71
K Standard CFH	76.531	DSCFM	70347.58

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration
O_2 (dry)	8.81	0.10	11.10	11.1	**8.79**
CO_2 (wet)	10.91	0.03	8.49	8.4	**10.76**
NOx (wet)	27.32	0.05	49.93	50.4	**27.56**
SO_2 (wet)	83.87	0.06	49.33	49.4	**84.03**
CO (wet)	29.03	0.03	50.26	50.40	**29.10**

Moisture	8.08	**Standard CFH**	**4,591,853**
Fuel Factor	1833	K Standard CFM	76.531
DSCFM	70348		

Results

Start	**4:15 AM**	**Gases Start**	**4:15 AM**
Stop	**4:25 AM**	**Gases Stop**	**4:35 AM**

CO_2 %, wet	**10.8**
NOX ppm, wet	**27.6**
NOx LB/mmBTU	**0.056**
SO_2 ppm, wet	**84.0**
SO_2 LB/mmBTU	**0.238**
CO ppm, wet	**29.10**
CO LB/mmBTU	**0.036**
SCFH	**4,592,000**
WAF applied	**0.9950**

MPU02828

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
7/30/2014
Run 8

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	$\%CO_2$, w	CO ppm, w
4:15	90.845832	25.93284	8.880666	10.78389	30.0069
4:16	95.328504	26.174368	8.915236	10.88923	29.510544
4:17	90.557128	26.366134	8.877904	9.987134	29.702316
4:18	88.743288	26.422736	8.880104	10.80222	28.546392
4:19	83.037592	26.907034	8.843292	10.92724	29.506134
4:20	81.193632	26.69581	8.755368	10.97	29.060304
4:21	82.45108	27.389052	8.842918	10.11886	29.639358
4:22	82.409376	27.574304	8.904938	10.74303	29.1879
4:23	83.625048	27.906836	8.888206	11.01653	29.639778
4:24	85.387128	26.45481	8.796132	11.20989	29.05791
4:25	86.30008	26.055442	8.838494	11.46741	29.82084
4:26	83.337688	27	8.882504	11.18636	29.701098
4:27	87.831616	26.301646	8.764192	11.25757	29.76519
4:28	90.257904	26.937758	8.742872	11.44498	29.4462
4:29	82.995816	27.8461	8.785484	10.77752	29.12742
4:30	80.881208	27.935532	8.754082	9.76447	28.416192
4:31	78.181304	28.340676	8.731664	11.07426	28.872228
4:32	79.402976	28.792484	8.697996	11.28313	27.721386
4:33	75.822672	29.340812	8.786952	10.84714	27.337842
4:34	74.956216	29.637096	8.83426	10.91532	27.337842
4:35	77.625728	27.752244	8.697258	11.61891	28.286412
Average	**83.865**	**27.322**	**8.814**	**10.909**	**29.033**

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

7/30/2014
Test 2N Run 9
180 Klbs/Hr

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.190	0.436	313	4:45 AM
2	A-2	0.220	0.469	313	
3	A-3	0.200	0.447	313	
4	A-4	0.190	0.436	313	
5	A-5	0.200	0.447	313	
6	A-6	0.200	0.447	313	
7	A-7	0.190	0.436	313	
8	A-8	0.200	0.447	313	
9	B-1	0.200	0.447	312	
10	B-2	0.200	0.447	312	
11	B-3	0.190	0.436	312	
12	B-4	0.190	0.436	312	
13	B-5	0.230	0.480	312	
14	B-6	0.240	0.490	312	
15	B-7	0.250	0.500	312	
16	B-8	0.240	0.490	312	4:55 AM
Average		0.208	0.456	313	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	313		
Wet Bulb (°F)	128.0	Static Pressure	-0.75
TRA	1.14	Pitot Coefficient	0.813
Vapor Pressure of Water	4.29		
ZT	184.50	Duct Width (in.)	0.00
PM	234.06	Duct Length (in.)	0.00
Barometric Pressure	29.09	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	108.00
		Stack Area (ft^2)	63.62
Moisture Content	8.06		
		Molecular Weight (dry)	30.175
O_2 %	8.861	Molecular Weight (wet)	29.193
CO_2 %	11.378	Stack Pressure	29.035
		Feet per Second	30.085
Standard CFH	4,570,069	Actual CFM	114836.
K Standard CFH	76.168	DSCFM	70027.71

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration
O_2 (dry)	8.89	0.10	11.11	**11.1**	**8.86**
CO_2 (wet)	10.58	0.05	8.47	8.4	**10.46**
NOx (wet)	30.50	0.04	49.95	50.4	**30.76**
SO_2 (wet)	78.95	0.06	49.33	49.4	**79.10**
CO (wet)	27.51	0.03	50.24	50.40	**27.59**

Moisture	8.06	**Standard CFH**	**4,570,069**
Fuel Factor	1833	K Standard CFM	76.168
DSCFM	70028		

Results

Start	**4:45 AM**	**Gases Start**	**4:45 AM**
Stop	**4:55 AM**	**Gases Stop**	**5:05 AM**

CO_2 %, wet	**10.5**
NOX ppm, wet	**30.8**
NOx LB/mmBTU	**0.064**
SO_2 ppm, wet	**79.1**
SO_2 LB/mmBTU	**0.230**
CO ppm, wet	**27.59**
CO LB/mmBTU	**0.035**
SCFH	**4,570,000**
WAF applied	**0.9950**

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
7/30/2014
Run 9

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	% CO_2, w	CO ppm, w
4:45	78.829984	29.978356	8.847342	10.71708	27.268971
4:46	77.601568	29.853448	8.814102	10.81922	27.720815
4:47	80.647792	30.212336	8.862442	10.7701	27.721675
4:48	83.921264	29.76874	8.88379	10.87721	27.718794
4:49	83.346752	30.272524	8.857286	10.79883	27.268111
4:50	79.772784	30.15888	8.945176	11.18	28.386713
4:51	78.863944	30.423948	8.95729	10.76448	27.925667
4:52	79.457392	29.980568	8.95674	9.778584	28.189429
4:53	78.263832	30.254692	8.875324	10.46557	27.928118
4:54	76.991208	30.588732	8.924418	10.425	27.722879
4:55	75.533056	30.766776	8.940402	10.44836	28.520099
4:56	76.706816	30.82492	8.911004	9.633616	27.594911
4:57	77.29864	31.088696	8.882684	10.84472	27.927731
4:58	78.259584	30.080904	8.843106	9.391976	26.876596
4:59	78.268	31.119896	8.922952	10.91939	26.550054
5:00	77.969864	30.827128	8.85084	10.32817	27.785745
5:01	82.448432	29.808884	8.814658	10.97686	27.46174
5:02	80.93904	30.459136	8.883028	10.71982	27.137778
5:03	77.569936	31.510248	8.914654	10.25789	26.550355
5:04	77.948816	31.063688	8.892962	10.70637	26.677033
5:05	77.307248	31.536976	8.899028	11.36984	26.745059
Average	**78.950**	**30.504**	**8.889**	**10.581**	**27.508**

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

7/30/2014
Test 2N **Run 10**
180 Klbs/Hr

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.190	0.436	312	5:15 AM
2	A-2	0.190	0.436	312	
3	A-3	0.200	0.447	312	
4	A-4	0.210	0.458	312	
5	A-5	0.210	0.458	312	
6	A-6	0.210	0.458	312	
7	A-7	0.180	0.424	312	
8	A-8	0.190	0.436	312	
9	B-1	0.190	0.436	310	
10	B-2	0.190	0.436	310	
11	B-3	0.220	0.469	310	
12	B-4	0.210	0.458	310	
13	B-5	0.220	0.469	310	
14	B-6	0.250	0.500	310	
15	B-7	0.230	0.480	310	
16	B-8	0.260	0.510	310	5:25 AM
Average		0.209	0.457	311	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	311		
Wet Bulb (°F)	128.0	Static Pressure	-0.74
TRA	1.14	Pitot Coefficient	0.813
Vapor Pressure of Water	4.29		
ZT	183.00	Duct Width (in.)	0.00
PM	235.64	Duct Length (in.)	0.00
Barometric Pressure	29.09	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	108.00
		Stack Area (ft^2)	63.62
Moisture Content	8.12		
		Molecular Weight (dry)	30.197
O_2 %	8.878	Molecular Weight (wet)	29.207
CO_2 %	11.512	Stack Pressure	29.036
		Feet per Second	30.132
Standard CFH	4,586,274	Actual CFM	115016.51
K Standard CFH	76.438	DSCFM	70234.56

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration
O_2 (dry)	8.90	0.09	11.11	11.1	**8.88**
CO_2 (wet)	10.69	0.06	8.46	8.4	**10.58**
NOx (wet)	33.87	0.04	49.92	50.4	**34.18**
SO_2 (wet)	73.30	0.06	49.34	49.4	**73.41**
CO (wet)	28.63	0.04	50.22	50.40	**28.72**

Moisture	8.12	**Standard CFH**	**4,586,274**
Fuel Factor	1833	K Standard CFM	76.438
DSCFM	70235		

Results

Start	**5:15 AM**	**Gases Start**	**5:15 AM**
Stop	**5:25 AM**	**Gases Stop**	**5:35 AM**

CO_2 %, wet	**10.6**
NOX ppm, wet	**34.2**
NOx LB/mmBTU	**0.071**
SO_2 ppm, wet	**73.4**
SO_2 LB/mmBTU	**0.211**
CO ppm, wet	**28.72**
CO LB/mmBTU	**0.036**
SCFH	**4,586,000**
WAF applied	**0.9950**

MPU02832

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
7/30/2014
Run 10

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	% CO_2, w	CO ppm, w
5:15	70.131192	33.61126	8.91686	11.06988	27.589144
5:16	71.320984	34.046584	9.01359	11.71532	27.659707
5:17	70.12176	33.56678	8.934718	10.9541	28.511924
5:18	70.735696	33.797848	8.918542	10.87373	28.897677
5:19	69.504584	33.553416	8.889684	9.46232	29.027279
5:20	70.727136	34.406064	8.966472	11.01727	27.722659
5:21	73.502312	33.236424	8.948852	9.79455	29.289536
5:22	73.502312	33.296452	8.917992	11.22376	29.814394
5:23	72.227136	33.992132	8.843284	11.10821	28.896086
5:24	74.346992	33.925472	8.792654	9.669512	28.571995
5:25	73.191912	33.983292	8.865018	10.46691	28.634904
5:26	72.572768	34.094108	8.90549	10.61927	29.154817
5:27	69.812488	35.101624	8.91928	10.03159	27.787374
5:28	72.587728	35.364104	8.841996	10.95116	28.375743
5:29	71.92244	35.395252	8.898136	11.11548	28.243991
5:30	70.119928	35.57308	9.014322	9.453478	28.112024
5:31	75.327528	32.97806	8.958212	10.73742	29.555663
5:32	78.008968	33.30968	8.962436	11.2942	28.765538
5:33	82.145992	31.94344	8.816504	11.55371	29.217124
5:34	80.97452	32.692948	8.842914	11.15225	28.631722
5:35	76.495424	33.334092	8.822552	10.21728	28.826598
Average	**73.299**	**33.867**	**8.904**	**10.690**	**28.633**

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

7/30/2014
Test 2M **Run 1**
300 Klbs/Hr

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.370	0.608	328	7:15 AM
2	A-2	0.380	0.616	328	
3	A-3	0.340	0.583	328	
4	A-4	0.390	0.624	328	
5	A-5	0.350	0.592	328	
6	A-6	0.340	0.583	328	
7	A-7	0.330	0.574	328	
8	A-8	0.340	0.583	328	
9	B-1	0.380	0.616	330	
10	B-2	0.380	0.616	330	
11	B-3	0.370	0.608	330	
12	B-4	0.420	0.648	330	
13	B-5	0.420	0.648	330	
14	B-6	0.410	0.640	330	
15	B-7	0.350	0.592	330	
16	B-8	0.330	0.574	330	7:21 AM
Average		0.369	0.607	329	

Moisture Content Data	
Dry Bulb (°F)	328
Wet Bulb (°F)	136.0
TRA	1.13
Vapor Pressure of Water	5.30
ZT	192.00
PM	327.12
Barometric Pressure	29.12
Standard Meter Volume	
Moisture Content	11.24
O_2 %	6.755
CO_2 %	14.264
Standard CFH	6,032,560
K Standard CFH	100.543

Flow Rate Data	
Static Pressure	-0.37
Pitot Coefficient	0.813
Duct Width (in.)	0.0
Duct Length (in.)	0.0
Duct Area (ft^2)	0.0
Stack Diameter (in.)	108.0
Stack Area (ft^2)	63.6173
Molecular Weight (dry)	30.552
Molecular Weight (wet)	29.141
Stack Pressure	29.093
Feet per Second	40.48
Actual CFM	154514.65
DSCFM	89237.71

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	6.76	0.05	11.09	11.10	**6.76**	dry
CO_2 (wet)	12.90	0.04	8.54	8.36	**12.66**	wet

Moisture	11.24	**Standard CFH**	**6,032,560**
Fuel Factor C	1833	K Standard CFM	100.543
DSCFM	89238		

Results

Start Time	**7:15 AM**
Stop Time	**7:21 AM**
Standard CFH	**6,033,000**
CO_2 %, wet	**12.66**
WAF applied	**0.9950**

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

7/30/2014
Test 2M **Run 2**
300 Klbs/Hr

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.300	0.548	330	7:22 AM
2	A-2	0.320	0.566	330	
3	A-3	0.380	0.616	330	
4	A-4	0.400	0.632	330	
5	A-5	0.370	0.608	330	
6	A-6	0.400	0.632	330	
7	A-7	0.420	0.648	330	
8	A-8	0.370	0.608	330	
9	B-1	0.320	0.566	331	
10	B-2	0.330	0.574	331	
11	B-3	0.360	0.600	331	
12	B-4	0.330	0.574	331	
13	B-5	0.440	0.663	331	
14	B-6	0.410	0.640	331	
15	B-7	0.330	0.574	331	
16	B-8	0.380	0.616	331	7:28 AM
Average		0.366	0.604	331	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	330		
Wet Bulb (°F)	137.0	Static Pressure	-0.34
TRA	1.13	Pitot Coefficient	0.81
Vapor Pressure of Water	5.45		
ZT	193.00	Duct Width (in.)	0.00
PM	340.05	Duct Length (in.)	0.00
Barometric Pressure	29.12	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	108.00
Standard Meter Volume		Stack Area (ft^2)	63.62
Moisture Content	11.69		
		Molecular Weight (dry)	30.564
O_2 %	6.755	Molecular Weight (wet)	29.095
CO_2 %	14.335	Stack Pressure	29.095
		Feet per Second	40.383
Standard CFH	6,007,094	Actual CFM	154143.2
K Standard CFH	100.118	DSCFM	88416.91

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	6.76	0.05	11.09	11.10	**6.76**	dry
CO_2 (wet)	12.90	0.04	8.54	8.36	**12.66**	wet

Moisture	11.69	**Standard CFH**	**6,007,094**
Fuel Factor C	1833	K Standard CFM	100.118
DSCFM	88417		

Results

Start Time	**7:22 AM**
Stop Time	**7:28 AM**
Standard CFH	**6,007,000**
CO_2 %, wet	**12.66**
WAF applied	**0.9950**

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
7/30/2014
Run 1-3

Time	$\%O_2$, d	$\%\ CO_2$, w
7:15	7.031183	12.325986
7:16	6.912484	13.1791
7:17	6.942817	13.361836
7:18	6.811991	14.25738
7:19	6.628863	1.534169
7:20	6.755561	12.48915
7:21	6.636095	14.211774
7:22	6.719898	13.616986
7:23	6.751773	14.089526
7:24	6.829872	12.241774
7:25	7.137578	13.18225
7:26	7.216239	13.901376
7:27	7.243799	12.406382
7:28	6.966066	13.757858
7:29	6.797885	13.7677
7:30	6.503357	14.537682
7:31	6.469056	13.708206
7:32	6.611816	14.337
7:33	6.564933	13.781348
7:34	6.315064	13.711406
7:35	6.194776	12.589252
Average	**6.764**	**12.904**

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

7/30/2014
Test 2M **Run 3**
300 Klbs/Hr

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.320	0.566	327	7:29 AM
2	A-2	0.350	0.592	327	
3	A-3	0.380	0.616	327	
4	A-4	0.370	0.608	327	
5	A-5	0.360	0.600	327	
6	A-6	0.390	0.624	327	
7	A-7	0.410	0.640	327	
8	A-8	0.400	0.632	327	
9	B-1	0.310	0.557	328	
10	B-2	0.330	0.574	328	
11	B-3	0.370	0.608	328	
12	B-4	0.360	0.600	328	
13	B-5	0.370	0.608	328	
14	B-6	0.400	0.632	328	
15	B-7	0.430	0.656	328	
16	B-8	0.360	0.600	328	7:35 AM
Average		0.369	0.607	328	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	327		
Wet Bulb (°F)	136.0	Static Pressure	-0.38
TRA	1.13	Pitot Coefficient	0.813
Vapor Pressure of Water	5.30		
ZT	191.00	Duct Width (in.)	0.00
PM	328.18	Duct Length (in.)	0.00
Barometric Pressure	29.12	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	108.00
Standard Meter Volume		Stack Area (ft^2)	63.62
Moisture Content	11.28		
		Molecular Weight (dry)	30.553
O_2 %	6.755	Molecular Weight (wet)	29.137
CO_2 %	14.269	Stack Pressure	29.092
		Feet per Second	40.474
Standard CFH	6,042,981	Actual CFM	154491.2
K Standard CFH	100.716	DSCFM	89354.72

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	6.76	0.05	11.09	11.10	**6.76**	dry
CO_2 (wet)	12.90	0.04	8.54	8.36	**12.66**	wet

Moisture	11.28	**Standard CFH**	**6,042,981**
Fuel Factor C	1833	K Standard CFM	100.716
DSCFM	89355		

Results

Start Time	**7:29 AM**
Stop Time	**7:35 AM**
Standard CFH	**6,043,000**
CO_2 %, wet	**12.66**
WAF applied	**0.9950**

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

7/30/2014
Test 2M **Run 4**
300 Klbs/Hr

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.300	0.548	328	7:45 AM
2	A-2	0.320	0.566	328	
3	A-3	0.340	0.583	328	
4	A-4	0.370	0.608	328	
5	A-5	0.410	0.640	328	
6	A-6	0.420	0.648	328	
7	A-7	0.420	0.648	328	
8	A-8	0.380	0.616	328	
9	B-1	0.330	0.574	329	
10	B-2	0.340	0.583	329	
11	B-3	0.350	0.592	329	
12	B-4	0.360	0.600	329	
13	B-5	0.360	0.600	329	
14	B-6	0.360	0.600	329	
15	B-7	0.370	0.608	329	
16	B-8	0.360	0.600	329	7:51 AM
Average		0.362	0.601	329	

Moisture Content Data	
Dry Bulb (°F)	328
Wet Bulb (°F)	138.0
TRA	1.12
Vapor Pressure of Wate	5.59
ZT	190.00
PM	357.55
Barometric Pressure	29.12
Standard Meter Volume	
Moisture Content	12.29
O_2 %	4.695
CO_2 %	15.383
Standard CFH	5,981,498
K Standard CFH	99.692

Flow Rate Data	
Static Pressure	-0.35
Pitot Coefficient	0.813
Duct Width (in.)	0
Duct Length (in.)	0
Duct Area (ft^2)	0
Stack Diameter (in.)	108
Stack Area (ft^2)	63.6172512
Molecular Weight (dry)	30.649
Molecular Weight (wet)	29.095
Stack Pressure	29.094
Feet per Second	40.11
Actual CFM	153101.93
DSCFM	87440.16

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	4.73	0.07	11.08	11.10	**4.70**	dry
CO_2 (wet)	13.75	0.04	8.54	8.36	**13.49**	wet

Moisture	12.29	**Standard CFH**	**5,981,498**
Fuel Factor C	1833	K Standard CFM	99.692
DSCFM	87440		

Results

Start Time	**7:45 AM**
Stop Time	**7:51 AM**
Standard CFH	**5,981,000**
CO_2 %, wet	**13.49**
WAF applied	**0.9950**

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

7/30/2014
Test 2M **Run 5**
300 Klbs/Hr

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.360	0.600	330	7:52 AM
2	A-2	0.350	0.592	330	
3	A-3	0.400	0.632	330	
4	A-4	0.400	0.632	330	
5	A-5	0.400	0.632	330	
6	A-6	0.420	0.648	330	
7	A-7	0.410	0.640	330	
8	A-8	0.420	0.648	330	
9	B-1	0.350	0.592	329	
10	B-2	0.340	0.583	329	
11	B-3	0.350	0.592	329	
12	B-4	0.330	0.574	329	
13	B-5	0.330	0.574	329	
14	B-6	0.320	0.566	329	
15	B-7	0.350	0.592	329	
16	B-8	0.290	0.539	329	7:58 AM
Average		0.364	0.602	330	

Moisture Content Data	
Dry Bulb (°F)	330
Wet Bulb (°F)	137.0
TRA	1.13
Vapor Pressure of Water	5.45
ZT	193.00
PM	340.05
Barometric Pressure	29.12
Standard Meter Volume	
Moisture Content	11.69
O_2 %	4.669
CO_2 %	15.298
Standard CFH	5,984,487
K Standard CFH	99.741

Flow Rate Data	
Static Pressure	-0.35
Pitot Coefficient	0.813
Duct Width (in.)	0
Duct Length (in.)	0
Duct Area (ft^2)	0
Stack Diameter (in.)	108
Stack Area (ft^2)	63.6172512
Molecular Weight (dry)	30.635
Molecular Weight (wet)	29.158
Stack Pressure	29.094
Feet per Second	40.181
Actual CFM	153372.7
DSCFM	88083.69

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	4.73	0.10	11.10	11.10	**4.67**	dry
CO_2 (wet)	13.75	0.03	8.52	8.36	**13.51**	wet

Moisture	11.69	**Standard CFH**	**5,984,487**
Fuel Factor C	1833	K Standard CFM	99.741
DSCFM	88084		

Results

Start Time	**7:52 AM**
Stop Time	**7:58 AM**
Standard CFH	**5,984,000**
CO_2 %, wet	**13.51**
WAF applied	**0.9950**

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

7/30/2014
Test 2M **Run 6**
300 Klbs/Hr

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.340	0.583	333	7:59 AM
2	A-2	0.360	0.600	333	
3	A-3	0.310	0.557	333	
4	A-4	0.300	0.548	333	
5	A-5	0.300	0.548	333	
6	A-6	0.320	0.566	333	
7	A-7	0.310	0.557	333	
8	A-8	0.320	0.566	333	
9	B-1	0.340	0.583	332	
10	B-2	0.360	0.600	332	
11	B-3	0.380	0.616	332	
12	B-4	0.390	0.624	332	
13	B-5	0.400	0.632	332	
14	B-6	0.440	0.663	332	
15	B-7	0.420	0.648	332	
16	B-8	0.400	0.632	332	8:05 AM
Average		0.356	0.595	333	

Moisture Content Data	
Dry Bulb (°F)	333
Wet Bulb (°F)	137.0
TRA	1.13
Vapor Pressure of Water	5.45
ZT	196.00
PM	336.90
Barometric Pressure	29.12
Standard Meter Volume	
Moisture Content	11.58
O_2 %	4.669
CO_2 %	15.28
Standard CFH	5,901,913
K Standard CFH	98.365

Flow Rate Data	
Static Pressure	-0.39
Pitot Coefficient	0.813
Duct Width (in.)	0.00
Duct Length (in.)	0.00
Duct Area (ft^2)	0.00
Stack Diameter (in.)	108.00
Stack Area (ft^2)	63.62
Molecular Weight (dry)	30.632
Molecular Weight (wet)	29.169
Stack Pressure	29.091
Feet per Second	39.781
Actual CFM	151846.57
DSCFM	86973.89

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	4.73	0.10	11.10	11.10	**4.67**	dry
CO_2 (wet)	13.75	0.03	8.52	8.36	**13.51**	wet

Moisture	11.58	**Standard CFH**	**5,901,913**
Fuel Factor C	1833	K Standard CFM	98.365
DSCFM	86974		

Results

Start Time	**7:59 AM**
Stop Time	**8:05 AM**
Standard CFH	**5,902,000**
CO_2 %, wet	**13.51**
WAF applied	**0.9950**

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
7/30/2014
Run 4-6

Time	$\%O_2$, d	$\%\ CO_2$, w
7:45	4.751364	13.430494
7:46	4.770802	13.663934
7:47	4.726795	13.746972
7:48	4.701556	13.712324
7:49	4.814562	12.761998
7:50	4.85669	12.46714
7:51	4.742517	13.042982
7:52	4.671391	13.990616
7:53	4.726009	13.911154
7:54	4.773358	13.833594
7:55	4.794948	13.71931
7:56	4.676884	13.727592
7:57	4.735641	13.448642
7:58	4.723227	14.242994
7:59	4.751916	13.782468
8:00	4.69896	14.103528
8:01	4.693867	13.203642
8:02	4.69974	13.81356
8:03	4.689751	13.9429
8:04	4.676446	13.712544
8:05	4.689564	13.718406
8:06	4.774104	15.388796
8:07	4.71794	14.260556
8:08	4.690344	14.298656
8:09	4.642928	13.73644
8:10	4.68212	14.561284
8:11	4.660179	13.50814
8:12	4.796866	14.084476
8:13	4.855472	13.219622
8:14	4.649938	14.233654
8:15	4.677678	14.183876
8:16	4.66009	14.18675
8:17	4.650488	14.184896
8:18	4.603605	13.671932
8:19	4.718424	13.489164
8:20	4.64931	14.25492
8:21	4.742805	13.70902
8:22	4.7595	13.99844
8:23	4.738279	13.812936
8:24	4.794432	13.538412
8:25	4.778933	12.995748
8:26	4.852639	13.435096
8:27	4.8403	13.388988
8:28	4.728061	13.76731
8:29	4.75557	13.653766
8:30	4.803257	12.711994
8:31	4.69787	13.86972
8:32	4.649693	13.651384
8:33	4.703937	13.995668
Average	**4.727**	**13.750**

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

7/30/2014
Test 2M **Run 7**
300 Klbs/Hr

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.360	0.600	330	8:06 AM
2	A-2	0.380	0.616	330	
3	A-3	0.360	0.600	330	
4	A-4	0.330	0.574	330	
5	A-5	0.320	0.566	330	
6	A-6	0.320	0.566	330	
7	A-7	0.310	0.557	330	
8	A-8	0.320	0.566	330	
9	B-1	0.370	0.608	331	
10	B-2	0.320	0.566	331	
11	B-3	0.330	0.574	331	
12	B-4	0.330	0.574	331	
13	B-5	0.390	0.624	331	
14	B-6	0.420	0.648	331	
15	B-7	0.460	0.678	331	
16	B-8	0.420	0.648	331	8:12 AM
Average		0.359	0.598	331	

Moisture Content Data	
Dry Bulb (°F)	330
Wet Bulb (°F)	138.0
TRA	1.12
Vapor Pressure of Water	5.59
ZT	192.00
PM	355.43
Barometric Pressure	29.12
Standard Meter Volume	
Moisture Content	12.22
O_2 %	4.669
CO_2 %	15.39
Standard CFH	5,942,756
K Standard CFH	99.046

Flow Rate Data	
Static Pressure	-0.35
Pitot Coefficient	0.813
Duct Width (in.)	0.00
Duct Length (in.)	0.00
Duct Area (ft^2)	0.00
Stack Diameter (in.)	108.00
Stack Area (ft^2)	63.62
Molecular Weight (dry)	30.649
Molecular Weight (wet)	29.104
Stack Pressure	29.094
Feet per Second	39.951
Actual CFM	152496.12
DSCFM	86945.94

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	4.73	0.10	11.10	11.1	**4.67**	dry
CO_2 (wet)	13.75	0.03	8.52	8.4	**13.51**	wet

Moisture	12.22	**Standard CFH**	**5,942,756**
Fuel Factor C	1833	K Standard CFM	99.046
DSCFM	86946		

Results

Start Time	**8:06 AM**
Stop Time	**8:12 AM**
Standard CFH	**5,943,000**
CO_2 %, wet	**13.51**
WAF applied	**0.9950**

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

7/30/2014
Test 2M **Run 8**
300 Klbs/Hr

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.360	0.600	330	8:13 AM
2	A-2	0.390	0.624	330	
3	A-3	0.340	0.583	330	
4	A-4	0.320	0.566	330	
5	A-5	0.310	0.557	330	
6	A-6	0.360	0.600	330	
7	A-7	0.340	0.583	330	
8	A-8	0.360	0.600	330	
9	B-1	0.330	0.574	328	
10	B-2	0.320	0.566	328	
11	B-3	0.310	0.557	328	
12	B-4	0.310	0.557	328	
13	B-5	0.360	0.600	328	
14	B-6	0.390	0.624	328	
15	B-7	0.450	0.671	328	
16	B-8	0.460	0.678	328	8:19 AM
Average		0.357	0.596	329	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	330		
Wet Bulb (°F)	138.0	Static Pressure	-0.35
TRA	1.12	Pitot Coefficient	0.813
Vapor Pressure of Water	5.59		
ZT	192.00	Duct Width (in.)	0.00
PM	355.43	Duct Length (in.)	0.00
Barometric Pressure	29.12	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	108.00
Standard Meter Volume		Stack Area (ft^2)	63.62
Moisture Content	12.22		
		Molecular Weight (dry)	30.649
O_2 %	4.669	Molecular Weight (wet)	29.104
CO_2 %	15.39	Stack Pressure	29.094
		Feet per Second	39.805
Standard CFH	5,932,182	Actual CFM	151935.94
K Standard CFH	98.87	DSCFM	86791.24

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	4.73	0.10	11.10	11.1	**4.67**	dry
CO_2 (wet)	13.75	0.03	8.52	8.4	**13.51**	wet

Moisture	12.22	**Standard CFH**	**5,932,182**
Fuel Factor C	1833	K Standard CFM	98.87
DSCFM	86791		

Results

Start Time	**8:13 AM**
Stop Time	**8:19 AM**
Standard CFH	**5,932,000**
CO_2 %, wet	**13.51**
WAF applied	**0.9950**

MPU02843

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

7/30/2014
Test 2M **Run 9**
300 Klbs/Hr

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.360	0.600	331	8:20 AM
2	A-2	0.380	0.616	331	
3	A-3	0.320	0.566	331	
4	A-4	0.310	0.557	331	
5	A-5	0.350	0.592	331	
6	A-6	0.340	0.583	331	
7	A-7	0.360	0.600	331	
8	A-8	0.360	0.600	331	
9	B-1	0.330	0.574	330	
10	B-2	0.330	0.574	330	
11	B-3	0.340	0.583	330	
12	B-4	0.320	0.566	330	
13	B-5	0.370	0.608	330	
14	B-6	0.400	0.632	330	
15	B-7	0.420	0.648	330	
16	B-8	0.450	0.671	330	8:26 AM
Average		0.359	0.598	331	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	331		
Wet Bulb (°F)	138.0	Static Pressure	-0.37
TRA	1.12	Pitot Coefficient	0.813
Vapor Pressure of Water	5.59		
ZT	193.00	Duct Width (in.)	0.00
PM	354.38	Duct Length (in.)	0.00
Barometric Pressure	29.12	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	108.00
Standard Meter Volume		Stack Area (ft^2)	63.62
Moisture Content	12.18		
		Molecular Weight (dry)	30.648
O_2 %	4.669	Molecular Weight (wet)	29.108
CO_2 %	15.384	Stack Pressure	29.093
		Feet per Second	39.969
Standard CFH	5,944,995	Actual CFM	152561.3
K Standard CFH	99.083	DSCFM	87013.82

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	4.73	0.10	11.10	11.1	**4.67**	dry
CO_2 (wet)	13.75	0.03	8.52	8.4	**13.51**	wet

Moisture	12.18	**Standard CFH**	**5,944,995**
Fuel Factor C	1833	K Standard CFM	99.083
DSCFM	87014		

Results

Start Time	**8:20 AM**
Stop Time	**8:26 AM**
Standard CFH	**5,945,000**
CO_2 %, wet	**13.51**
WAF applied	**0.9950**

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
7/30/2014
Run 7-9

Time	$\%O_2$, d	$\%\ CO_2$, w
7:45	4.751364	13.430494
7:46	4.770802	13.663934
7:47	4.726795	13.746972
7:48	4.701556	13.712324
7:49	4.814562	12.761998
7:50	4.85669	12.46714
7:51	4.742517	13.042982
7:52	4.671391	13.990616
7:53	4.726009	13.911154
7:54	4.773358	13.833594
7:55	4.794948	13.71931
7:56	4.676884	13.727592
7:57	4.735641	13.448642
7:58	4.723227	14.242994
7:59	4.751916	13.782468
8:00	4.69896	14.103528
8:01	4.693867	13.203642
8:02	4.69974	13.81356
8:03	4.689751	13.9429
8:04	4.676446	13.712544
8:05	4.689564	13.718406
8:06	4.774104	15.388796
8:07	4.71794	14.260556
8:08	4.690344	14.298656
8:09	4.642928	13.73644
8:10	4.68212	14.561284
8:11	4.660179	13.50814
8:12	4.796866	14.084476
8:13	4.855472	13.219622
8:14	4.649938	14.233654
8:15	4.677678	14.183876
8:16	4.66009	14.18675
8:17	4.650488	14.184896
8:18	4.603605	13.671932
8:19	4.718424	13.489164
8:20	4.64931	14.25492
8:21	4.742805	13.70902
8:22	4.7595	13.99844
8:23	4.738279	13.812936
8:24	4.794432	13.538412
8:25	4.778933	12.995748
8:26	4.852639	13.435096
8:27	4.8403	13.388988
8:28	4.728061	13.76731
8:29	4.75557	13.653766
8:30	4.803257	12.711994
8:31	4.69787	13.86972
8:32	4.649693	13.651384
8:33	4.703937	13.995668
Average	**4.727**	**13.750**

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
7/30/2014
Run 10

Time	$\%O_2$, d	$\%\ CO_2$, w
7:45	4.751364	13.430494
7:46	4.770802	13.663934
7:47	4.726795	13.746972
7:48	4.701556	13.712324
7:49	4.814562	12.761998
7:50	4.85669	12.46714
7:51	4.742517	13.042982
7:52	4.671391	13.990616
7:53	4.726009	13.911154
7:54	4.773358	13.833594
7:55	4.794948	13.71931
7:56	4.676884	13.727592
7:57	4.735641	13.448642
7:58	4.723227	14.242994
7:59	4.751916	13.782468
8:00	4.69896	14.103528
8:01	4.693867	13.203642
8:02	4.69974	13.81356
8:03	4.689751	13.9429
8:04	4.676446	13.712544
8:05	4.689564	13.718406
8:06	4.774104	15.388796
8:07	4.71794	14.260556
8:08	4.690344	14.298656
8:09	4.642928	13.73644
8:10	4.68212	14.561284
8:11	4.660179	13.50814
8:12	4.796866	14.084476
8:13	4.855472	13.219622
8:14	4.649938	14.233654
8:15	4.677678	14.183876
8:16	4.66009	14.18675
8:17	4.650488	14.184896
8:18	4.603605	13.671932
8:19	4.718424	13.489164
8:20	4.64931	14.25492
8:21	4.742805	13.70902
8:22	4.7595	13.99844
8:23	4.738279	13.812936
8:24	4.794432	13.538412
8:25	4.778933	12.995748
8:26	4.852639	13.435096
8:27	4.8403	13.388988
8:28	4.728061	13.76731
8:29	4.75557	13.653766
8:30	4.803257	12.711994
8:31	4.69787	13.86972
8:32	4.649693	13.651384
8:33	4.703937	13.995668
Average	**4.727**	**13.750**

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

7/30/2014
Test 2M **Run 10**
300 Klbs/Hr

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.350	0.592	332	8:27 AM
2	A-2	0.380	0.616	332	
3	A-3	0.340	0.583	332	
4	A-4	0.320	0.566	332	
5	A-5	0.330	0.574	332	
6	A-6	0.350	0.592	332	
7	A-7	0.340	0.583	332	
8	A-8	0.360	0.600	332	
9	B-1	0.350	0.592	333	
10	B-2	0.320	0.566	333	
11	B-3	0.310	0.557	333	
12	B-4	0.320	0.566	333	
13	B-5	0.360	0.600	333	
14	B-6	0.410	0.640	333	
15	B-7	0.420	0.648	333	
16	B-8	0.440	0.663	333	8:33 AM
Average		0.356	0.596	333	

Moisture Content Data	
Dry Bulb (°F)	332
Wet Bulb (°F)	138.0
TRA	1.12
Vapor Pressure of Water	5.59
ZT	194.00
PM	353.32
Barometric Pressure	29.12
Standard Meter Volume	
Moisture Content	12.14
O_2 %	4.669
CO_2 %	15.378
Standard CFH	5,916,349
K Standard CFH	98.606

Flow Rate Data	
Static Pressure	-0.37
Pitot Coefficient	0.813
Duct Width (in.)	0.00
Duct Length (in.)	0.00
Duct Area (ft^2)	0.00
Stack Diameter (in.)	108.00
Stack Area (ft^2)	63.62
Molecular Weight (dry)	30.647
Molecular Weight (wet)	29.111
Stack Pressure	29.093
Feet per Second	39.877
Actual CFM	152210.29
DSCFM	86630.43

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	4.73	0.10	11.10	11.1	**4.67**	dry
CO_2 (wet)	13.75	0.03	8.52	8.4	**13.51**	wet

Moisture	12.14	**Standard CFH**	**5,916,349**
Fuel Factor C	1833	K Standard CFM	98.606
DSCFM	86630		

Results

Start Time	**8:27 AM**
Stop Time	**8:33 AM**
Standard CFH	**5,916,000**
CO_2 %, wet	**13.51**
WAF applied	**0.9950**

APPENDIX D

MEASUREMENT SYSTEMS PERFORMANCE SPECIFICATIONS

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
7/30/2014
Test 2N

SO_2(TEI Model 43i)

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	% of Span
Zero	0.00	0.04	0.04	111.00	0.04
Low Level	49.40	49.29	0.11	111.00	0.10
Mid Level	111.00	110.56	0.44	111.00	0.40
High Level	257.00	256.30	0.70	257.00	0.27

NOx (TEI Model 42i)

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	% of Span
Zero	0.00	0.05	0.05	117.00	0.04
Mid Level	50.40	50.30	0.10	117.00	0.09
High Level	117.00	116.30	0.70	117.00	0.60

CO_2 (TEI Model 410i)

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (%)	% of Span
Zero	0.00	0.03	0.03	16.50	0.18
Mid Level	8.36	8.52	0.16	16.50	0.97
High Level	16.50	16.33	0.17	16.50	1.03

O_2 (Servomex Series 1400)

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (%)	% of Span
Zero	0.00	0.05	0.05	21.10	0.24
Mid Level	11.10	11.11	0.01	21.10	0.05
High Level	21.10	20.94	0.16	21.10	0.76

CO (TECO 48i)

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (%)	% of Span
Zero	0.00	0.05	0.05	117.00	0.04
Mid Level	50.40	50.40	0.00	117.00	0.00
High Level	117.00	116.00	1.00	117.00	0.85

**** All Calibrations must be within 2% of the span value...

Calibration Drift

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
7/30/2014
Test 2N

O_2

		Initial	Pre-Cal Bias	Final	Post-cal Bias	Avg.	% Drift of Span
1	Zero	0.05	0.00%	0.04	-0.05%	**0.05**	**-0.05%**
	Upscale	11.11	0.00%	11.11	0.00%	**11.11**	**0.00%**
2	Zero	0.04	-0.05%	0.03	-0.09%	**0.04**	**-0.05%**
	Upscale	11.11	0.00%	11.12	0.05%	**11.12**	**0.05%**
3	Zero	0.03	-0.09%	0.05	0.00%	**0.04**	**0.09%**
	Upscale	11.12	0.05%	11.10	-0.05%	**11.11**	**-0.09%**
4	Zero	0.05	0.00%	0.03	-0.09%	**0.04**	**-0.09%**
	Upscale	11.10	-0.05%	11.08	-0.14%	**11.09**	**-0.09%**
5	Zero	0.03	-0.09%	0.05	0.00%	**0.04**	**0.09%**
	Upscale	11.08	-0.14%	11.10	-0.05%	**11.09**	**0.09%**
6	Zero	0.05	0.00%	0.06	0.05%	**0.06**	**0.05%**
	Upscale	11.10	-0.05%	11.11	0.00%	**11.11**	**0.05%**
7	Zero	0.06	0.05%	0.10	0.24%	**0.08**	**0.19%**
	Upscale	11.11	0.00%	11.10	-0.05%	**11.11**	**-0.05%**
8	Zero	0.10	0.24%	0.10	0.24%	**0.10**	**0.00%**
	Upscale	11.10	-0.05%	11.10	-0.05%	**11.10**	**0.00%**
9	Zero	0.10	0.24%	0.10	0.24%	**0.10**	**0.00%**
	Upscale	11.10	-0.05%	11.12	0.05%	**11.11**	**0.09%**
10	Zero	0.10	0.24%	0.08	0.14%	**0.09**	**-0.09%**
	Upscale	11.12	0.05%	11.10	-0.05%	**11.11**	**-0.09%**

	Cylinder Value	Analyzer Value
Zero	0.00 %	0.05 %
Upscale	11.10 %	11.11 %
Span	21.10 %	21.10 %

** All Drift Calibrations must be within 3% of the span value...
** All Bias Calibrations must be within 5% of the span value...

Calibration Drift

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
7/30/2014
Test 2N

CO_2

		Initial	Pre-Cal Bias	Final	Post-Cal Bias	Avg.	% Drift of Span
1	Zero	0.03	0.00%	0.05	0.12%	**0.04**	**0.12%**
	Upscale	8.52	0.00%	8.47	-0.30%	**8.50**	**-0.30%**
2	Zero	0.05	0.12%	0.04	0.06%	**0.05**	**-0.06%**
	Upscale	8.47	-0.30%	8.53	0.06%	**8.50**	**0.36%**
3	Zero	0.04	0.06%	0.06	0.18%	**0.05**	**0.12%**
	Upscale	8.53	0.06%	8.46	-0.36%	**8.50**	**-0.42%**
4	Zero	0.06	0.18%	0.06	0.18%	**0.06**	**0.00%**
	Upscale	8.46	-0.36%	8.45	-0.42%	**8.46**	**-0.06%**
5	Zero	0.06	0.18%	0.03	0.00%	**0.05**	**-0.18%**
	Upscale	8.45	-0.42%	8.46	-0.36%	**8.46**	**0.06%**
6	Zero	0.03	0.00%	0.01	-0.12%	**0.02**	**-0.12%**
	Upscale	8.46	-0.36%	8.44	-0.48%	**8.45**	**-0.12%**
7	Zero	0.01	-0.12%	0.03	0.00%	**0.02**	**0.12%**
	Upscale	8.44	-0.48%	8.48	-0.24%	**8.46**	**0.24%**
8	Zero	0.03	0.00%	0.03	0.00%	**0.03**	**0.00%**
	Upscale	8.48	-0.24%	8.49	-0.18%	**8.49**	**0.06%**
9	Zero	0.03	0.00%	0.06	0.18%	**0.05**	**0.18%**
	Upscale	8.49	-0.18%	8.44	-0.48%	**8.47**	**-0.30%**
10	Zero	0.06	0.18%	0.05	0.12%	**0.06**	**-0.06%**
	Upscale	8.44	-0.48%	8.48	-0.24%	**8.46**	**0.24%**

	Cylinder Value	Analyzer Response
Zero	0.00 ppm	0.03 ppm
Upscale	8.36 ppm	8.52 ppm
Span	16.50 ppm	16.50 ppm

** All Drift Calibrations must be within 3% of the span value...
** All Bias Calibrations must be within 5% of the span value...

Calibration Drift

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
7/30/2014
Test 2N

Nox

		Initial	Pre-Cal Bias	Final	Post-Cal Bias	Avg.	% Drift of Span
1	Zero	0.05	0.00%	0.07	0.02%	**0.06**	**0.02%**
	Upscale	50.30	0.00%	49.59	-0.61%	**49.95**	**-0.61%**
2	Zero	0.07	0.02%	0.08	0.03%	**0.08**	**0.01%**
	Upscale	49.59	-0.61%	49.89	-0.35%	**49.74**	**0.26%**
3	Zero	0.08	0.03%	0.05	0.00%	**0.07**	**-0.03%**
	Upscale	49.89	-0.35%	49.88	-0.36%	**49.89**	**-0.01%**
4	Zero	0.05	0.00%	0.06	0.01%	**0.06**	**0.01%**
	Upscale	49.88	-0.36%	49.95	-0.30%	**49.92**	**0.06%**
5	Zero	0.06	0.01%	0.07	0.02%	**0.07**	**0.01%**
	Upscale	49.95	-0.30%	49.90	-0.34%	**49.93**	**-0.04%**
6	Zero	0.07	0.02%	0.08	0.03%	**0.08**	**0.01%**
	Upscale	49.90	-0.34%	49.84	-0.39%	**49.87**	**-0.05%**
7	Zero	0.08	0.03%	0.06	0.01%	**0.07**	**-0.02%**
	Upscale	49.84	-0.39%	49.89	-0.35%	**49.87**	**0.04%**
8	Zero	0.06	0.01%	0.04	-0.01%	**0.05**	**-0.02%**
	Upscale	49.89	-0.35%	49.97	-0.28%	**49.93**	**0.07%**
9	Zero	0.04	-0.01%	0.04	-0.01%	**0.04**	**0.00%**
	Upscale	49.97	-0.28%	49.93	-0.32%	**49.95**	**-0.03%**
10	Zero	0.04	-0.01%	0.04	-0.01%	**0.04**	**0.00%**
	Upscale	49.93	-0.32%	49.91	-0.33%	**49.92**	**-0.02%**

	Cylinder Value	Analyzer Response
Zero	0.00 ppm	0.05 ppm
Upscale	50.40 ppm	50.30 ppm
Span	117.00 ppm	117.00 ppm

** All Drift Calibrations must be within 3% of the span value...
** All Bias Calibrations must be within 5% of the span value...

Calibration Drift

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
7/30/2014
Test 2N

SO_2

		Initial	Pre-Cal Bias	Final	Post-Cal Bias	Avg.	% Drift of Span
1	Zero	0.04	0.00%	0.10	0.05%	**0.07**	**0.05%**
	Upscale	49.29	0.00%	49.41	0.11%	**49.35**	**0.11%**
2	Zero	0.10	0.05%	0.13	0.08%	**0.12**	**0.03%**
	Upscale	49.41	0.11%	49.44	0.14%	**49.43**	**0.03%**
3	Zero	0.13	0.08%	0.10	0.05%	**0.12**	**-0.03%**
	Upscale	49.44	0.14%	49.38	0.08%	**49.41**	**-0.05%**
4	Zero	0.10	0.05%	0.07	0.03%	**0.09**	**-0.03%**
	Upscale	49.38	0.08%	49.35	0.05%	**49.37**	**-0.03%**
5	Zero	0.07	0.03%	0.05	0.01%	**0.06**	**-0.02%**
	Upscale	49.35	0.05%	49.33	0.04%	**49.34**	**-0.02%**
6	Zero	0.05	0.01%	0.07	0.03%	**0.06**	**0.02%**
	Upscale	49.33	0.04%	49.33	0.04%	**49.33**	**0.00%**
7	Zero	0.07	0.03%	0.06	0.02%	**0.07**	**-0.01%**
	Upscale	49.33	0.04%	49.33	0.04%	**49.33**	**0.00%**
8	Zero	0.06	0.02%	0.06	0.02%	**0.06**	**0.00%**
	Upscale	49.33	0.04%	49.32	0.03%	**49.33**	**-0.01%**
9	Zero	0.06	0.02%	0.05	0.01%	**0.06**	**-0.01%**
	Upscale	49.32	0.03%	49.33	0.04%	**49.33**	**0.01%**
10	Zero	0.05	0.01%	0.06	0.02%	**0.06**	**0.01%**
	Upscale	49.33	0.04%	49.35	0.05%	**49.34**	**0.02%**

	Cylinder Value	Analyzer Response
Zero	0.00 ppm	0.04 ppm
Upscale	49.40 ppm	49.29 ppm
Span	111.00 ppm	111.00 ppm

** All Drift Calibrations must be within 3% of the span value...
** All Bias Calibrations must be within 5% of the span value...

Calibration Drift

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
7/30/2014
Test 2N

CO

		Initial	Pre-Cal Bias	Final	Post-Cal Bias	Avg.	% Drift of Span
1	Zero	0.05	0.00%	0.04	-0.01%	**0.05**	**-0.01%**
	Upscale	50.40	0.00%	50.30	-0.09%	**50.35**	**-0.09%**
2	Zero	0.04	-0.01%	0.05	0.00%	**0.05**	**0.01%**
	Upscale	50.30	-0.09%	50.26	-0.12%	**50.28**	**-0.03%**
3	Zero	0.05	0.00%	0.05	0.00%	**0.05**	**0.00%**
	Upscale	50.26	-0.12%	50.28	-0.10%	**50.27**	**0.02%**
4	Zero	0.05	0.00%	0.05	0.00%	**0.05**	**0.00%**
	Upscale	50.28	-0.10%	50.22	-0.15%	**50.25**	**-0.05%**
5	Zero	0.05	0.00%	0.05	0.00%	**0.05**	**0.00%**
	Upscale	50.22	-0.15%	50.24	-0.14%	**50.23**	**0.02%**
6	Zero	0.05	0.00%	0.04	-0.01%	**0.05**	**-0.01%**
	Upscale	50.24	-0.14%	50.25	-0.13%	**50.25**	**0.01%**
7	Zero	0.04	-0.01%	0.04	-0.01%	**0.04**	**0.00%**
	Upscale	50.25	-0.13%	50.25	-0.13%	**50.25**	**0.00%**
8	Zero	0.04	-0.01%	0.02	-0.03%	**0.03**	**-0.02%**
	Upscale	50.25	-0.13%	50.26	-0.12%	**50.26**	**0.01%**
9	Zero	0.02	-0.03%	0.03	-0.02%	**0.03**	**0.01%**
	Upscale	50.26	-0.12%	50.21	-0.16%	**50.24**	**-0.04%**
10	Zero	0.03	-0.02%	0.04	-0.01%	**0.04**	**0.01%**
	Upscale	50.21	-0.16%	50.22	-0.15%	**50.22**	**0.01%**

	Cylinder Value	Analyzer Response
Zero	0.00 ppm	0.05 ppm
Upscale	50.40 ppm	50.40 ppm
Span	117.00 ppm	117.00 ppm

** All Drift Calibrations must be within 3% of the span value...
** All Bias Calibrations must be within 5% of the span value...

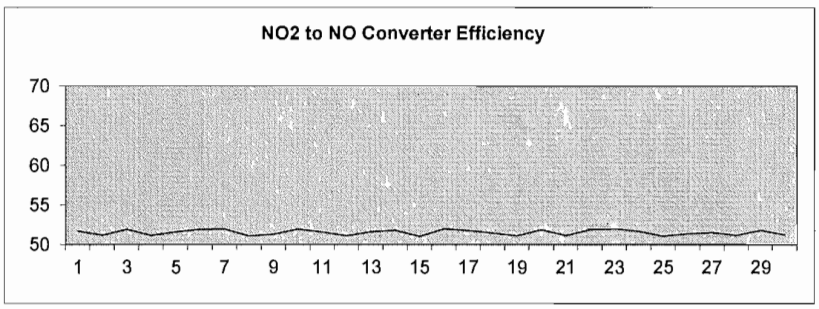
Interpoll Laboratories
(763) 786-6020

Stationary Gas Turbine Nox Determination
Method 20 NO_2 to NO Converter Efficiency Datasheet

Job	MSI / Manitowoc PU
Source	No. 9 Boiler
Date	7/29/2014
Operator	Aaron Wilson / Andrew Strong
Analyzer	TECO Model 42i (NOx)
Analyzer S/N	510511561

Time (min)	NOx Response
11:11 PM	51.69
11:12 PM	51.18
11:13 PM	51.91
11:14 PM	51.14
11:15 PM	51.55
11:16 PM	51.90
11:17 PM	51.96
11:18 PM	51.06
11:19 PM	51.30
11:20 PM	51.94
11:21 PM	51.54
11:22 PM	51.11
11:23 PM	51.60
11:24 PM	51.78
11:25 PM	51.01
11:26 PM	51.97
11:27 PM	51.75
11:28 PM	51.43
11:29 PM	51.09
11:30 PM	51.87
11:31 PM	51.15
11:32 PM	51.88
11:33 PM	51.97
11:34 PM	51.66
11:35 PM	51.06
11:36 PM	51.38
11:37 PM	51.52
11:38 PM	51.19
11:39 PM	51.83
11:40 PM	51.27
Highest Peak Value	51.97
Percent Drift	1.4%
System Pass of Fail	**PASS**

Instructions: Add mid-level gas to a leak-free Tedlar bag. Dilute the gas with 20.9% Oxygen to approximately 1:1. Then immediately attach the bag to the instrument and record the Nox Reponses for 30 minutes. The system is OK if the response at the end is less than 2.0 % of the highest response.



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EPA Appendix A Stratification Test

Job:	MSI / Manitowoc PU	**Date:**	7/30/2014
Source:	No. 9 Boiler	**Personnel:**	Aaron Wilson / Andrew Strong
Test	2N	**Bar. Press. (in. Hg)**	29.09
PDT Number	131, 151		
Measurement Response Time:		98	seconds

Stack Diameter 108.00 **in.** **Port Length in.** 11.50

Traverse Point	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Time (min)	SO2 ppm (wet)	Nox ppm (wet)	O2 % (dry)	CO_2 % (wet)
1	0.17	18.00	**29.50**	0:45	92.82	29.37	9.01	10.49
2	0.50	54.00	**65.50**	0:52	89.37	30.43	9.12	10.44
3	0.83	90.00	**101.50**	0:59	89.57	29.67	9.16	10.34
Average					**90.59**	**29.82**	**9.10**	**10.42**
			Largest Value		92.82	30.43	9.16	10.49
			Smallest Value		89.37	29.37	9.01	10.34
			%Deviation		**3.85%**	**3.60%**	**1.70%**	**1.45%**

* A three point traverse was used for each test run.

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
7/30/2014
Stratification Test Data

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	$\% CO_2$, w
0:45:01	90.00	28.90	9.00	10.53
0:46:01	94.25	28.56	8.96	10.44
0:47:01	94.81	29.05	8.96	10.56
0:48:01	96.03	29.36	9.01	10.47
0:49:01	93.95	29.94	9.01	10.43
0:50:01	90.93	29.94	9.08	10.45
0:51:01	89.73	29.82	9.02	10.58
Average	**92.82**	**29.37**	**9.01**	**10.49**

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	$\% CO_2$, w
0:52:01	84.90	30.58	9.10	10.35
0:53:01	87.30	30.61	9.12	10.52
0:54:01	88.16	30.73	9.08	10.67
0:55:01	91.85	29.87	9.06	10.47
0:56:01	95.43	30.69	9.13	10.48
0:57:01	90.64	30.29	9.22	10.24
0:58:01	87.32	30.23	9.17	10.34
Average	**89.37**	**30.43**	**9.12**	**10.44**

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	$\% CO_2$, w
0:59:01	88.46	29.53	9.14	10.48
1:00:01	88.77	30.02	9.17	10.30
1:01:01	86.98	30.02	9.19	10.27
1:02:01	90.34	30.29	9.12	10.45
1:03:01	93.02	29.08	9.16	10.34
1:04:01	90.92	29.35	9.18	10.31
1:05:01	88.47	29.38	9.14	10.25
Average	**89.57**	**29.67**	**9.16**	**10.34**

MPU02857

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
7/30/2014
Test 2M

CO_2 (TEI Model 410i)

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	% of Span
Zero	0.00	0.03	0.03	16.50	0.18
Mid Level	8.36	8.52	0.16	16.50	0.97
High Level	16.50	16.33	0.17	16.50	1.03

O_2 (Servomex Series 1400)

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	% of Span
Zero	0.00	0.05	0.05	21.20	0.24
Mid Level	11.10	11.11	0.01	21.20	0.05
High Level	21.20	20.94	0.26	21.20	1.23

**** All Calibrations must be within 2% of the span value...

Calibration Drift

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
7/30/2014
Test 2M

O_2

		Initial	Pre-Cal Bias	Final	Post-cal Bias	Avg.	% Drift of Span
1	Zero	0.05	0.00%	0.04	-0.05%	**0.05**	**-0.05%**
	Upscale	11.11	0.00%	11.06	-0.24%	**11.09**	**-0.24%**
2	Zero	0.05	0.00%	0.04	-0.05%	**0.05**	**-0.05%**
	Upscale	11.11	0.00%	11.06	-0.24%	**11.09**	**-0.24%**
3	Zero	0.05	0.00%	0.04	-0.05%	**0.05**	**-0.05%**
	Upscale	11.11	0.00%	11.06	-0.24%	**11.09**	**-0.24%**
4	Zero	0.04	-0.05%	0.10	0.24%	**0.07**	**0.28%**
	Upscale	11.06	-0.24%	11.10	-0.05%	**11.08**	**0.19%**
5	Zero	0.10	0.24%	0.10	0.24%	**0.10**	**0.00%**
	Upscale	11.10	-0.05%	11.10	-0.05%	**11.10**	**0.00%**
6	Zero	0.10	0.24%	0.10	0.24%	**0.10**	**0.00%**
	Upscale	11.10	-0.05%	11.10	-0.05%	**11.10**	**0.00%**
7	Zero	0.10	0.24%	0.10	0.24%	**0.10**	**0.00%**
	Upscale	11.10	-0.05%	11.10	-0.05%	**11.10**	**0.00%**
8	Zero	0.10	0.24%	0.10	0.24%	**0.10**	**0.00%**
	Upscale	11.10	-0.05%	11.10	-0.05%	**11.10**	**0.00%**
9	Zero	0.10	0.24%	0.10	0.24%	**0.10**	**0.00%**
	Upscale	11.10	-0.05%	11.10	-0.05%	**11.10**	**0.00%**
10	Zero	0.10	0.24%	0.10	0.24%	**0.10**	**0.00%**
	Upscale	11.10	-0.05%	11.10	-0.05%	**11.10**	**0.00%**

	Cylinder Value	Analyzer Value
Zero	0.00 %	0.05 %
Upscale	11.10 %	11.11 %
Span	21.20 %	21.2 %

** All Drift Calibrations must be within 3% of the span value...
** All Bias Calibrations must be within 5% of the span value...

Calibration Drift

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
7/30/2014
Test 2M

CO_2

		Initial	Pre-Cal Bias	Final	Post-Cal Bias	Avg.	% Drift of Span
1	Zero	0.03	0.00%	0.05	0.12%	**0.04**	**0.12%**
	Upscale	8.52	0.00%	8.55	0.18%	**8.54**	**0.18%**
2	Zero	0.03	0.00%	0.05	0.12%	**0.04**	**0.12%**
	Upscale	8.52	0.00%	8.55	0.18%	**8.54**	**0.18%**
3	Zero	0.03	0.00%	0.05	0.12%	**0.04**	**0.12%**
	Upscale	8.52	0.00%	8.55	0.18%	**8.54**	**0.18%**
4	Zero	0.05	0.12%	0.03	0.00%	**0.04**	**-0.12%**
	Upscale	8.55	0.18%	8.52	0.00%	**8.54**	**-0.18%**
5	Zero	0.03	0.00%	0.03	0.00%	**0.03**	**0.00%**
	Upscale	8.52	0.00%	8.52	0.00%	**8.52**	**0.00%**
6	Zero	0.03	0.00%	0.03	0.00%	**0.03**	**0.00%**
	Upscale	8.52	0.00%	8.52	0.00%	**8.52**	**0.00%**
7	Zero	0.03	0.00%	0.03	0.00%	**0.03**	**0.00%**
	Upscale	8.52	0.00%	8.52	0.00%	**8.52**	**0.00%**
8	Zero	0.03	0.00%	0.03	0.00%	**0.03**	**0.00%**
	Upscale	8.52	0.00%	8.52	0.00%	**8.52**	**0.00%**
9	Zero	0.03	0.00%	0.03	0.00%	**0.03**	**0.00%**
	Upscale	8.52	0.00%	8.52	0.00%	**8.52**	**0.00%**
10	Zero	0.03	0.00%	0.03	0.00%	**0.03**	**0.00%**
	Upscale	8.52	0.00%	8.52	0.00%	**8.52**	**0.00%**

	Cylinder Value	Analyzer Response
Zero	0.00 ppm	0.03 ppm
Upscale	8.36 ppm	8.52 ppm
Span	16.50 ppm	16.50 ppm

** All Drift Calibrations must be within 3% of the span value...
** All Bias Calibrations must be within 5% of the span value...

APPENDIX E

CALIBRATION GAS CERTIFICATION SHEETS

LIQUID TECHNOLOGY CORPORATION

"INDUSTRY LEADER IN SPECIALTY GASES"

Certificate of Analysis

- EPA PROTOCOL GAS -

Customer	Minneapolis Oxygen (Minneapolis, MN)
Date	November 05, 2013
Delivery Receipt	DR-49110
Gas Standard	17.0% CO2, 21.0% Oxygen/Nitrogen - EPA PROTOCOL
Final Analysis Date	October 31, 2013
Expiration Date	October 31, 2021
Part Number	SPC NAE03001

Component	Carbon Dioxide, Oxygen
Balance Gas	Nitrogen

Analytical Data:

DO NOT USE BELOW 100 psig

EPA Protocol, Section No. 2.2, Procedure G-1

Reported Concentrations

Carbon Dioxide: 16.5% +/- 0.16%

Oxygen: 21.2% +/- 0.20%

Nitrogen: Balance

Reference Standards:

SRM/GMIS:	GMIS/GMIS	GMIS
Cylinder Number:	EB-0026839/CC-184404	CC-159090
Concentration:	6.847% CO2/19.87% CO2	20.68% Oxygen/Nitrogen
Expiration Date:	10/03/20 - 02/04/15	04/06/14

Certification Instrumentation

Component:	Carbon Dioxide	Oxygen
Make/Model:	Nicolet 6700	Servomex 244a
Serial Number:	APW1100563	1847
Principal of Measurement:	FTIR	Paramagnetic
Last Calibration:	October 16, 2013	October 17, 2013

Cylinder Data

Cylinder Serial Number:	CC-231281	Cylinder Outlet:	CGA 590
Cylinder Volume:	133 Cubic Feet	Cylinder Pressure:	1900 psig, 70°F

Analytical Uncertainty and NIST Traceability are in compliance with EPA-600/R-12/531.

Certified by: Cole Dylewski

Cole Dylewski

PGVP Vendor ID: E12013

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LIQUID TECHNOLOGY CORPORATION

"INDUSTRY LEADER IN SPECIALTY GASES"

Certificate of Analysis

- EPA PROTOCOL GAS -

Customer	Minneapolis Oxygen (Minneapolis, MN)
Date	May 09, 2014
Delivery Receipt	DR-51558
Gas Standard	112.5 ppm CO, 112.5 ppm NO, 112.5 ppm SO2/Nitrogen - EPA PROTOCOL
Final Analysis Date	May 09, 2014
Expiration Date	May 09, 2022
Part Number	SPC NAE04050

DO NOT USE BELOW 100 psig

Analytical Data:
EPA Protocol, Section No. 2.2, Procedure G-1.

Reported Concentrations
Carbon Monoxide: 117 ppm +/- 1.0 ppm
Nitric Oxide: 111 ppm +/- 1.0 ppm
Sulfur Dioxide: 111 ppm +/- 1.1 ppm
Nitrogen: Balance
Total NOx: 111 ppm
**** NOx for Reference Use Only ****

Reference Standards

SRM/GMIS:	GMIS/GMIS	GMIS/GMIS	GMIS/GMIS
Cylinder Number:	EB-0015869/CC-185111	ND-45697/ND-45699	CC-54548/CC-251490
Concentration:	106.09 ppm/257.47 ppm CO	97.467 ppm/245.47 ppm NO	102.43 ppm/507.87 ppm SO2
Expiration Date:	12/07/20 - 12/07/20	08/23/15 - 08/23/20	06/14/20 - 11/02/20

Certification Instrumentation

Component:	Carbon Monoxide	Nitric Oxide	Sulfur Dioxide
Make/Model:	NEXUS 6700	NEXUS 6700	NEXUS 6700
Serial Number:	APW1100563	APW1100563	APW1100563
Principal of Measurement:	FTIR	FTIR	FTIR
Last Calibration:	April 10, 2014	April 10, 2014	April 10, 2014

Cylinder Data

Cylinder Number:	EB-0051534	Cylinder Volume:	138 Cubic Feet
Cylinder Outlet:	CGA 660	Cylinder Pressure:	1975 psig, 70°F
Expiration Date:	May 09, 2022		

Analytical Uncertainty and NIST Traceability are in compliance with EPA-600/R-12/531.

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Certified by:

Cole Dylewski

PGVP Vendor ID: E12014

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LIQUID TECHNOLOGY CORPORATION

"INDUSTRY LEADER IN SPECIALTY GASES"

Certificate of Analysis

- EPA PROTOCOL GAS -

Customer	Minneapolis Oxygen (Minneapolis, MN)
Date	February 07, 2014
Delivery Receipt	DR-50310
Gas Standard	50.0 ppm CO, 50.0 ppm NO, 50.0 ppm SO2/Nitrogen - EPA PROTOCOL
Final Analysis Date	February 07, 2014
Expiration Date	February 07, 2017
Part Number:	SPC NAE04019

DO NOT USE BELOW 100 psig

Analytical Data:
EPA Protocol, Section No. 2.2, Procedure G-1.

Reported Concentrations

Carbon Monoxide: 50.4 ppm +/- 0.48 ppm
Nitric Oxide: 49.0 ppm +/- 0.43 ppm
Sulfur Dioxide: 49.4 ppm +/- 0.48 ppm
Nitrogen: Balance
Total NOx: 49.1 ppm
**** NOx for Reference Use Only ****

Reference Standards

SRM/GMIS:	GMIS	GMIS	GMIS
Cylinder Number:	EB-0017129	ND-45512	EB-0014698
Concentration:	50.81 ppm CO	49.98 ppm NO	50.67 ppm SO2
Expiration Date:	10/20/14	07/18/15	09/20/14

Certification Instrumentation

Component:	Carbon Monoxide	Nitric Oxide	Sulfur Dioxide
Make/Model:	Nicolet 6700	Nicolet 6700	Nicolet 6700
Serial Number:	APW1100563	APW1100563	APW1100563
Principal of Measurement:	FTIR	FTIR	FTIR
Last Calibration:	January 08, 2014	January 15, 2014	January 15, 2014

Cylinder Data

Cylinder Number:	EB-0026779	Cylinder Volume:	136 Cubic Feet
Cylinder Outlet:	CGA 660	Cylinder Pressure:	1950 psig, 70°F
Expiration Date:	February 07, 2017		

Analytical Uncertainty and NIST Traceability are in compliance with EPA-600/R-12/531.

Cole Dylewski

Certified by:

Cole Dylewski

PGVP Vendor ID: E12014

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LIQUID TECHNOLOGY CORPORATION

"INDUSTRY LEADER IN SPECIALTY GASES"

Certificate of Analysis

- EPA PROTOCOL GAS -

Customer	Minneapolis Oxygen (Minneapolis, MN)
Date	April 04, 2014
Delivery Receipt	DR-51095
Gas Standard	8.50% CO2, 11.0% Oxygen/Nitrogen - EPA PROTOCOL
Part Number:	SPC NAE 03075
Final Analysis Date	March 10, 2014
Expiration Date	March 10, 2022

DO NOT USE BELOW 100 psig

Cylinder Data

Cylinder Serial Number:	EB-0052778	Cylinder Outlet:	CGA 590
Cylinder Volume:	136 Cubic Feet	Cylinder Pressure:	1950 psig, 70°F
Expiration Date:	March 10, 2022		

Analytical Data

EPA Protocol, Section No. 2.2, Procedure G-1

Replicate Concentrations

Carbon Dioxide: 8.36% +/- 0.06%

Oxygen: 11.1% +/- 0.05%

Nitrogen: Balance

Reference Standard(s):

GMIS/SRM:	GMIS/GMIS	GMIS
Cylinder Number:	EB-0026839/CC-185129	CC-231332
Concentration:	6.847% CO2/13.92% CO2	9.97% Oxygen
Expiration Date:	10/13/20 - 06/24/14	04/06/14

Certification Instrumentation

Component:	Carbon Dioxide	Oxygen
Make/Model:	Nicolet 6700	Servomex 244a
Serial Number:	APW1200289	1847
Principal of Measurement:	FTIR	Paramagnetic
Last Calibration:	March 05, 2014	March 05, 2014

Analytical uncertainty and NIST Traceability are in compliance with EPA-600/R-12/531.

Certified by: Cole Dylewski

Cole Dylewski

PGVP Vendor ID: E12014

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APPENDIX F

GAS ANALYZER SPECIFICATIONS

MODEL 1420 SERVOMEX PARAMAGNETIC O_2 ANALYZER SPECIFICATIONS

Repeatability:	Better than ± 0.2% O2 under constant conditions
Drift	Less than 0.2% O2 per week under constant conditions. (Excluding variation due to barometric pressure changes; reading is proportional to barometric pressure
Outputs	
Display	3 ½ digit LCD reading 0.0 to 100.0% oxygen with over range capability
Output	0 to 1V (non-isolated) for 0 to 100% oxygen available on 'D' type connector located on the back panel of the instrument. Output impedance is less than 10 ohms.
Option	4 – 20mA isolated, Max impedance 500 ohms
Flow alarm output	Change over relay contact rated at 3A/115V ac, 1A/240V ac or 1A/28V dc. 4 sets of single pole changeover contacts. Alarm becomes active when sample gas flow through the analyzer fails
Sample Requirements	
Condition	Clean, dry gas with dew point 5 deg C below ambient temperature
Inlet pressure	0.5 to 3 psig (3.5 to 21kPa). Inlet pressure changes within this range will change the reading by less than 0.1% O2. May be operated up to 10 psig (70kPa) with degraded stability
Flow rate	1.5 to 6 litres/minute approximately depending on sample pressure
Filtering	0.6 micron replaceable filter integral to the automatic flow control device.
Response time	Less than 15 secs. To 90% at an inlet pressure of 3 psig (21kPa)
Inlet/vent connections	¼ inch OD tube (stainless steel) suitable for 6mm ID flexible tubing or ¼ inch OD compression fittings.

Materials exposed to the sample	Stainless steel, Pyrex glass, brass, platinum, epoxy resin, viton, polypropylene and glass fibre filter
Physical Characteristics	
Case	Steel and aluminum finished in epoxy powder paint
Case Classification	IP 20 (IEC 529) when fitted into the Servomex 1400 series 19 inch case
Weight	10Kg (22 lb) approximately
Electrical	
AC Supply	110 to 120V AC or 220 to 240V AC, ±10%, 48 to 62Hz. Voltage selected by a voltage selector integral to the IEC supply plug
Power required	15VA maximum

NO_2, and NO_x concentrations to the front panel display, the analog outputs, and also makes the data available over the serial or ethernet connection.

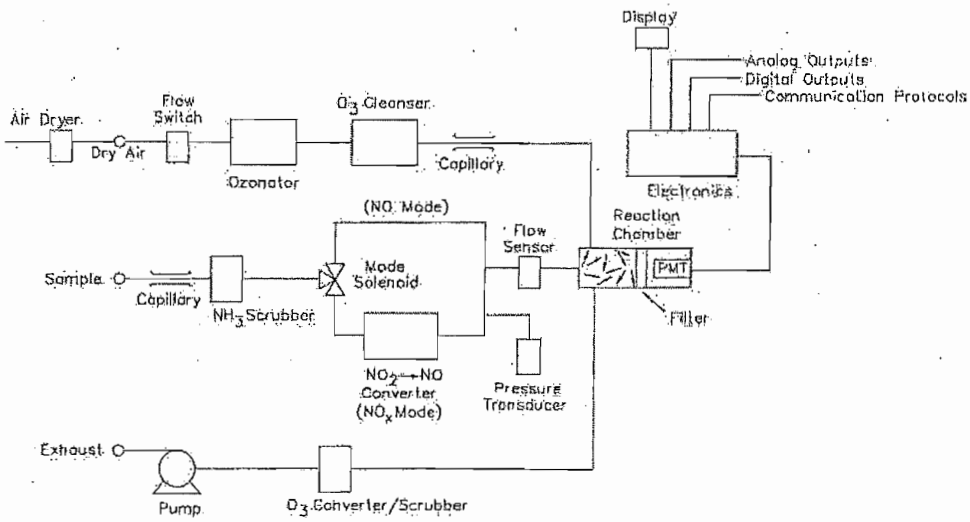

Figure 1-1. Model 42*i* Low Source Flow Schematic

Specifications

Table 1-1. Model 42*i* Low Source Specifications

Preset ranges	0-0.2, 0.5, 1, 2, 5, 10, 20, 50, 100 ppm 0-0.5, 1, 2, 5, 10, 20, 50, 100, 150 mg/m^3
Extended ranges	0-1, 2, 5, 10, 20, 50, 100, 200, 500 ppm 0-2, 5, 10, 20, 50, 100, 200, 500, 750 mg/m^3
Custom ranges	0-0.2 to 100 ppm (0-1 to 500 ppm in extended ranges) 0-0.5 to 150 mg/m^3 (0-2 to 750 mg/m^3 in extended ranges)
Zero noise	0.005 ppm RMS (60 second averaging time)
Lower detectable limit	0.01 ppm (60 second averaging time)
Zero drift (24 hour)	≈ 0.005 ppm
Span drift (24 hour)	± 1% full-scale
Response time (NO/NO_x mode)	15 sec (10 second averaging time) 85 sec (60 second averaging time) 305 sec (300 second averaging time)

MPU02869

Response time (NO mode)	15 sec (10 second averaging time) 65 sec (60 second averaging time) 305 sec (300 second averaging time)
Linearity	± 1% full-scale
Sample flow rate	≈ 25 cc/min. measured at atmospheric pressure
Operating temperature	15–35 °C (may be safely operated over the range of 0–45 °C)*
Power requirements	100 VAC @ 50/60 Hz 115 VAC @ 50/60 Hz 220–240 VAC @ 50/60 Hz 300 watts
Physical dimensions	16.75" (W) X 8.62" (H) X 23" (D)
Weight	Approximately 55 lbs.
Analog outputs	6 voltage outputs; 0–100 mV, 1 V, 5 V, 10 V (User selectable), 5% of full-scale over/under range, 12 bit resolution, user selectable for measurement input
Digital outputs	1 power fail relay Form C, 10 digital relays Form A, user selectable alarm output, relay logic, 100 mA @ 200 VDC
Digital inputs	16 digital inputs, user select programmable, TTL level, pulled high
Serial Ports	1 RS-232 or RS-485 with two connectors, baud rate 1200–115200, data bits, parity, and stop bits, protocols: C-Link, MODBUS, and streaming data (all user selectable)
Ethernet connection	RJ45 connector for 10Mbs Ethernet connection, static or dynamic TCP/IP addressing

*In non condensing environments. Performance specifications based on operation in 15–35 °C range.

MPU02870

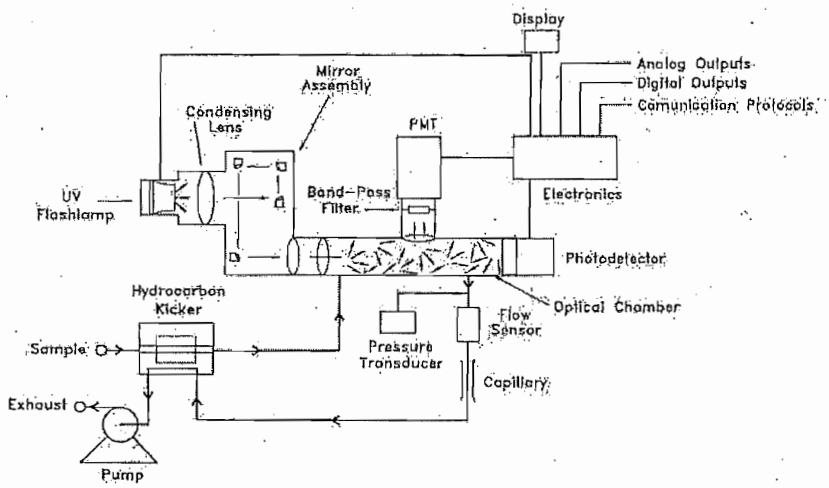

Figure 1-1. Model 43*i* Flow Schematic

Specifications

Table 1-1. Model 43*i* Specifications

Preset ranges	0-0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10 ppm 0-0.2, 0.5, 1, 2, 5, 10, 20, 25 mg/m^3
Extended ranges	0-0.5, 1, 2, 5, 10, 20, 50, 100 ppm 0-2, 5, 10, 20, 50, 100, 200, 250 mg/m^3
Custom ranges	0-0.05 to 10 ppm (0-0.5 to 100 ppm in extended range) 0-0.2 to 25 mg/m^3 (0-2 to 250 mg/m^3 in extended range)
Zero noise	1.0 ppb RMS (10 second averaging time) 0.5 ppb RMS (60 second averaging time) 0.25 ppb RMS (300 second averaging time)
Lower detectable limit	2.0 ppb (10 second averaging time) 1.0 ppb (60 second averaging time) 0.5 ppb (300 second averaging time)
Zero drift (24 hour)	< 1 ppb
Span drift	± 1% full-scale
Response time (in automatic mode)	80 sec (10 second averaging time) 110 sec (60 second averaging time) 320 sec (300 second averaging time)
Linearity	± 1% of full-scale

MPU02871

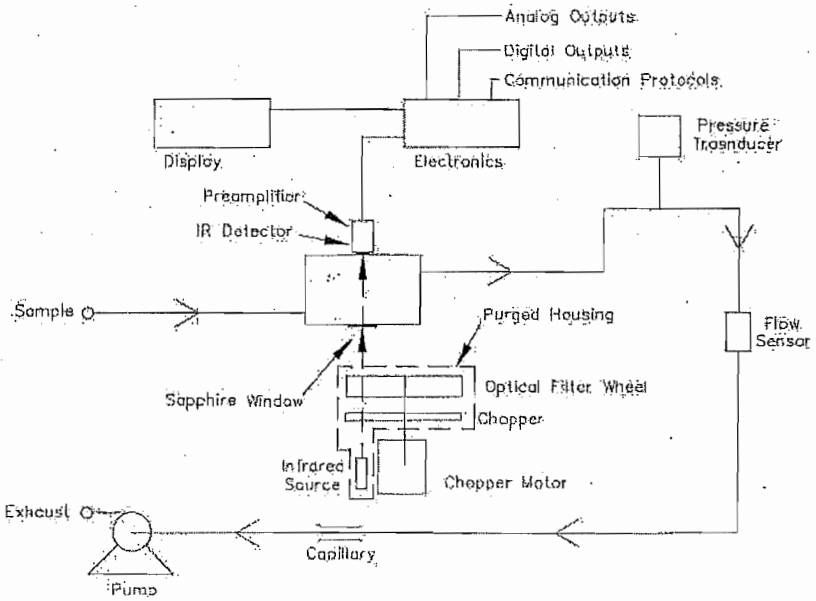

Figure 1-1. Model 410*i* Flow Schematic

Specifications

Table 1-1. Model 410*i* Specifications CO_2

Preset ranges	Standard: 0-200, 500, 1000, 2000, 5000, 10000 ppm High Level: 0-0.5, 1, 2, 5, 10, 20, 25%
Custom ranges	Standard: 0-200 to 10000 ppm High Level: 0-0.5 to 25%
Zero noise	Standard: 0.5 ppm RMS (60 second averaging time) High Level: 20 ppm RMS (60 second averaging time)
Minimum detectable limit	Standard: 1 ppm High Level: 40 ppm
Zero drift (24 hour)	± 1.0 ppm
Span drift (24 hour)	± 2% span concentration
Response time	90 seconds (30 second averaging time)
Linearity	± 1.5% of span (at concentrations of 10 to 100% of span)
Sample flow rate	1.0 LPM
Operating temperature	5–45 °C

Power requirements	100 VAC @ 50/60 Hz 115 VAC @ 50/60 Hz 220–240 VAC @ 50/60 Hz 275 watts
Physical dimensions	16.75" (W) X 8.62" (H) X 23" (D)
Weight	Approximately 39 lbs.
Analog outputs	6 voltage outputs; 0–100 mV, 1, 5, 10 V (User selectable), 5% of full-scale over/under range, 12 bit resolution, user selectable for measurement input
Digital outputs	1 power fail relay Form C, 10 digital relays Form A, user selectable alarm output, relay logic, 100 mA @ 200 VDC
Digital inputs	16 digital inputs, user select programmable, TTL level, pulled high
Serial Ports	1 RS-232 or RS-485 with two connectors, baud rate 1200–115200, Protocols: C-Link, MODBUS, and streaming data (all user selectable)
Ethernet connection	RJ45 connector for 10Mbs Ethernet connection, static or dynamic TCP/IP addressing

APPENDIX G

CEM INSTRUMENT INFORMATION SHEET

INTERPOLL LABORATORIES, INC.
(763) 786-6020

CEM Relative Accuracy Certification Instrument Information Sheet

Plant Name: MPU

Pollutant Gas Monitor Data:

Vendor: THERMO ENVIRONMENTAL

Model: 42 I NOx S/N 42I 0510511561

CEM Location: B9 SHELTER

Gas (es): ☐ SO2 ☒ NOx ☐ CO

Type of System: ☐ In-Situ ☐ Dry-Extractive ☒ Dilution

Installation Date: 8-15-2005

Start-Up Date: 1-1-2006

INITIAL CERT: 03-07-2006

Data Recording System:

☐ Strip Chart Recorder ☒ Data Logger System

☒ Computer

Relative Accuracy Certification Units:

☐ ppm, dry ☐ LB/106BTU by O2 F-Factor

☒ ppm, wet ☒ LB/106BTU by CO2 F-Factor

Span Value (ppm): (DUAL RANGE)

SO2

NOx LOW: 200 HIGH: 500

CO

Tom Rad

Signature of Person Responsible for Data

Plant Location: UNIT 9

Diluent Monitor Data: SEE SO2 FORM

Vendor:

Model: S/N

CEM Location:

Gas: ☐ O2 ☐ CO2

Type of System: ☐ In-Situ ☐ Dry-Extractive ☐ Dilution

Instillation Date:

Start-Up Date:

Data Recording System:

☐ Strip Chart Recorder ☐ Data Logger System

☐ Computer

Output Units:

☐ %O2, dry ☐ % CO2, dry

☐ %O2, wet ☐ % CO2, wet

Span Gas Values (% v/v):

	*********Oxygen********	***Carbon Dioxide***
Low		
High		

10-17-07

Date

MPU02875

INTERPOLL LABORATORIES, INC.
(763) 786-6020

CEM Relative Accuracy Certification Instrument Information Sheet

Plant Name: MANITOWOC PUBLIC UTILITIES-MPU

Plant Location: UNIT 9

Pollutant Gas Monitor Data:

Vendor: THERMO ENVIRONMENTAL

Model: 43I SO_2 S/N 43I0510511567

CEM Location: B9 SHELTER

Gas (es): ☒ SO2 ☐ NOx ☐ CO

Type of System: ☐ In-Situ ☐ Dry-Extractive ☒ Dilution

Installation Date: 8-15-2005

Start-Up Date: 1-1-2006

INITIAL CERT. 03-07-2006

Data Recording System:

☐ Strip Chart Recorder ☒ Data Logger System

☒ Computer

Relative Accuracy Certification Units:

☐ ppm, dry ☐ LB/106BTU by O2 F-Factor

☒ ppm, wet ☒ LB/106BTU by CO2 F-Factor

Span Value (ppm): (DUAL RANGE)

SO2 LOW: 400 HIGH: 4000

NOx

CO

Signature of Person Responsible for Data

Diluent Monitor Data:

Vendor: THERMO ENVIRONMENTAL

Model: 410I CO_2 S/N 410I0510511584

CEM Location: B9 SHELTER

Gas: ☐ O2 ☒ CO2

Type of System: ☐ In-Situ ☐ Dry-Extractive ☒ Dilution

Instillation Date: 8-15-2005

Start-Up Date: 1-1-2006

INITIAL CERT. 03-07-2006

Data Recording System:

☐ Strip Chart Recorder ☒ Data Logger System

☒ Computer

Output Units:

☐ %O2, dry ☐ % CO2, dry

☐ %O2, wet ☒ % CO2, wet

Span Gas Values (% v/v):

	********Oxygen********	***Carbon Dioxide***
Low		0
High		20.00

10-17-07

Date

2

MPU02876

INTERPOLL LABORATORIES, INC.
(763) 786-6020

Flow Monitor Relative Field Accuracy Instrument Information Sheet

Plant Name: MPU

Flow Monitor Data:

Vendor: UNITED SCIENCES, INC

Model: ULTRAFLOW 150 S/N 1500188

Location: B9 SHELTER & BREACHING

Type of System: ☐ Differential Pressure ☒ Ultrasonic

Installation Date: 8-15-2005

Start-Up Date: 1-1-2006

INITIAL CERT: 02-23-2006

Data Recording System:

☐ Strip Chart Recorder ☒ Data Logger System

☒ Computer

Plant Location: UNIT 9

Diluent Monitor Data:

Vendor:

Model: S/N

Location:

Gas: ☐ O2 ☐ CO2

Type of System: ☐ In-Situ ☐ Dry-Extractive

☐ Extractive - Dilution

Installation Date:

Start-Up Date:

Data Recording System:

☐ Strip Chart Recorder ☐ Data Logger System

☐ Computer

Output Units:

☐ %O2, dry ☐ % CO2, dry

☐ %O2, wet ☐ % CO2, wet

Span Gas Values (% v/v):

*********Oxygen********	***Carbon Dioxide***
Low	
High	

Tom Reed

Signature of Person Responsible for Data

10-17-07

Date

3

MPU02877

INTERPOLL LABORATORIES, INC.
(763) 786-6020

CEM Relative Accuracy Certification Instrument Information Sheet

Plant Name: MANITOWOC Public UTILITIES

Pollutant Gas Monitor Data:

Vendor: THERMO ENVIRONMENTAL

Model: 48i S/N 48165105 11587

Location: B9

Gas (es): ☐ SO2 ☐ NOx ☒ CO

Type of System: ☐ In-Situ ☐ Extractive ☒ Dilution

Probe Manufacturer: EPM

Installation Date: 4 AUG 05

Start-Up Date: 4 AUG 05

Data Recording System:

☐ Strip Chart Recorder ☒ Data Logger System

☐ Computer

Relative Accuracy Certification Units:

☐ ppm, dry ☐ LB/106BTU by O2 F-Factor

☒ ppm, wet ☐ LB/106BTU by CO2 F-Factor

Span Value (ppm):

SO2 _____

NOx _____

CO 100/5000

Roland E Derbali

Signature of Person Responsible for Data

Plant Location: _____

Diluent Monitor Data:

Vendor: _____

Model: _____ S/N _____

Location: _____

Gas: ☐ O2 ☐ CO2

Type of System: ☐ In-Situ ☐ Extractive ☐ Dilution

Installation Date: _____

Start-Up Date: _____

Data Recording System:

☐ Strip Chart Recorder ☐ Data Logger System

☐ Computer

Output Units:

☐ %O2, dry ☐ % CO2, dry

☐ %O2, wet ☐ % CO2, wet

Span Gas Values (% v/v):

	*********Oxygen********	***Carbon Dioxide***
Low		
High		

Date

MPU02878

APPENDIX H

CEM COMPUTER PRINTOUTS

B9 GAS RUN 1

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 07/30/2014 00:45 Through 07/30/2014 01:05
Time Online Criteria: 1 minute(s)

Source	B9								
Parameter)Unit(	B9CO#M (#/MMBTU)	B9CPCO2 (PERCENT)	B9CPNOX (PPM)	B9CPSO2 (PPM)	B9FFACT (MMBTU/CF)	B9NOX#M (#/MMBTU)	B9PCO (PPM)	B9SO2#M (#/MMBTU)	B9STEAM (KLBS/HR)
07/30/14 00:45	0.034	10.4	28.1	89.0	1,833.0	0.059	26.2	0.260	184
07/30/14 00:46	0.034	10.4	28.3	94.1	1,833.0	0.060	26.2	0.275	182
07/30/14 00:47	0.033	10.4	28.4	91.5	1,833.0	0.060	25.9	0.268	180
07/30/14 00:48	0.032	10.5	28.9	92.4	1,833.0	0.060	24.8	0.268	179
07/30/14 00:49	0.033	10.3	29.0	90.6	1,833.0	0.062	25.3	0.268	179
07/30/14 00:50	0.034	10.4	28.7	88.7	1,833.0	0.060	26.5	0.260	182
07/30/14 00:51	0.033	10.4	29.5	84.4	1,833.0	0.062	26.1	0.247	184
07/30/14 00:52	0.033	10.3	29.6	83.0	1,833.0	0.063	25.9	0.245	182
07/30/14 00:53	0.035	10.4	29.6	87.3	1,833.0	0.062	27.4	0.255	177
07/30/14 00:54	0.037	10.3	29.0	86.7	1,833.0	0.062	28.7	0.256	177
07/30/14 00:55	0.035	10.4	29.3	91.9	1,833.0	0.062	27.4	0.269	180
07/30/14 00:56	0.035	10.4	29.8	90.6	1,833.0	0.063	27.0	0.265	183
07/30/14 00:57	0.035	10.3	29.5	87.1	1,833.0	0.063	27.1	0.257	180
07/30/14 00:58	0.036	10.3	29.2	85.4	1,833.0	0.062	27.8	0.252	178
07/30/14 00:59	0.037	10.4	28.4	86.7	1,833.0	0.060	28.8	0.254	177
07/30/14 01:00	0.036	10.3	29.0	86.6	1,833.0	0.062	27.5	0.256	179
07/30/14 01:01	0.034	10.3	29.0	86.9	1,833.0	0.062	26.7	0.257	181
07/30/14 01:02	0.036	10.3	28.8	88.8	1,833.0	0.061	28.2	0.262	180
07/30/14 01:03	0.037	10.3	28.6	90.6	1,833.0	0.061	28.9	0.268	178
07/30/14 01:04	0.036	10.4	29.0	89.2	1,833.0	0.061	27.6	0.261	178
07/30/14 01:05	0.036	10.3	28.4	87.9	1,833.0	0.060	27.9	0.260	177
Average	0.035	10.4	29.0	88.5	1,833.0	0.061	27.0	0.260	180
Minimum	0.032	10.3	28.1	83.0	1,833.0	0.059	24.8	0.245	177
Maximum	0.037	10.5	29.8	94.1	1,833.0	0.063	28.9	0.275	184
Summation	0.731	217.5	608.1	1,859.4	38,493.0	1.287	567.9	5.463	3,777
Included Data Points	21	21	21	21	21	21	21	21	21
Total number of Data Points	21	21	21	21	21	21	21	21	21

F = Unit Offline E = Exceedance C = Calibration S = Substituted I = Invalid
M = Maintenance T = Out Of Control * = Suspect U = Startup D = Shutdown

MPU02880

B9 LOW FLOW RUN 1

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 07/30/2014 00:45 Through 07/30/2014 00:55
Time Online Criteria: 1 minute(s)

Source		B9					
Parameter)Unit(		B9CPFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
07/30/14	00:45	4,592,801.0	1,833.0	76.5	29.32	184	329.7
07/30/14	00:46	4,612,313.0	1,833.0	76.9	29.31	182	329.5
07/30/14	00:47	4,600,317.0	1,833.0	76.7	29.30	180	329.5
07/30/14	00:48	4,617,487.0	1,833.0	77.0	29.31	179	329.5
07/30/14	00:49	4,642,243.0	1,833.0	77.4	29.29	179	329.6
07/30/14	00:50	4,611,210.0	1,833.0	76.9	29.32	182	329.6
07/30/14	00:51	4,547,057.0	1,833.0	75.8	29.30	184	329.3
07/30/14	00:52	4,498,828.0	1,833.0	75.0	29.30	182	329.1
07/30/14	00:53	4,506,346.0	1,833.0	75.1	29.30	177	329.3
07/30/14	00:54	4,547,887.0	1,833.0	75.8	29.30	177	329.6
07/30/14	00:55	4,575,840.0	1,833.0	76.3	29.31	180	329.8
	Average	4,577,484.5	1,833.0	76.3	29.31	181	329.5
	Minimum	4,498,828.0	1,833.0	75.0	29.29	177	329.1
	Maximum	4,642,243.0	1,833.0	77.4	29.32	184	329.8
	Summation	50,352,329.0	20,163.0	839.4	322.36	1,986	3,624.5
	Included Data Points	11	11	11	11	11	11
	Total number of Data Points	11	11	11	11	11	11

F = Unit Offline **E = Exceedance** C = Calibration **S = Substituted** **U - Startup**
I = Invalid **M = Maintenance** **T = Out Of Control** * = Suspect **D - Shutdown**

B9 GAS RUN 2

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 07/30/2014 01:15 Through 07/30/2014 01:35
Time Online Criteria: 1 minute(s)

Source	B9								
Parameter)Unit(	B9CO#M (#/MMBTU)	B9CPCO2 (PERCENT)	B9CPNOX (PPM)	B9CPSO2 (PPM)	B9FFACT (MMBTU/CF)	B9NOX#M (#/MMBTU)	B9PCO (PPM)	B9SO2#M (#/MMBTU)	B9STEAM (KLBS/HR)
07/30/14 01:15	0.035	10.4	28.9	82.1	1,833.0	0.061	27.4	0.240	179
07/30/14 01:16	0.036	10.4	29.4	84.0	1,833.0	0.062	27.7	0.246	181
07/30/14 01:17	0.035	10.5	30.2	79.2	1,833.0	0.063	27.5	0.230	182
07/30/14 01:18	0.035	10.4	29.7	79.3	1,833.0	0.063	27.1	0.232	179
07/30/14 01:19	0.036	10.3	29.7	81.9	1,833.0	0.063	28.2	0.242	176
07/30/14 01:20	0.037	10.4	28.9	85.3	1,833.0	0.061	28.8	0.250	178
07/30/14 01:21	0.038	10.3	29.3	85.2	1,833.0	0.062	29.2	0.252	184
07/30/14 01:22	0.038	10.4	29.4	81.8	1,833.0	0.062	30.0	0.239	184
07/30/14 01:23	0.035	10.4	29.3	82.5	1,833.0	0.062	27.0	0.241	180
07/30/14 01:24	0.036	10.4	29.6	83.3	1,833.0	0.062	28.3	0.244	178
07/30/14 01:25	0.036	10.5	30.9	83.1	1,833.0	0.064	28.1	0.241	177
07/30/14 01:26	0.035	10.4	30.9	78.1	1,833.0	0.065	27.3	0.229	179
07/30/14 01:27	0.035	10.4	29.3	79.9	1,833.0	0.062	27.3	0.234	178
07/30/14 01:28	0.036	10.4	28.0	87.2	1,833.0	0.059	27.9	0.255	183
07/30/14 01:29	0.036	10.4	28.6	86.1	1,833.0	0.060	28.4	0.252	183
07/30/14 01:30	0.035	10.5	28.9	87.4	1,833.0	0.060	27.3	0.253	182
07/30/14 01:31	0.035	10.5	29.2	86.2	1,833.0	0.061	27.1	0.250	179
07/30/14 01:32	0.035	10.4	29.8	87.8	1,833.0	0.063	27.0	0.257	178
07/30/14 01:33	0.036	10.4	30.3	85.7	1,833.0	0.064	28.0	0.251	181
07/30/14 01:34	0.036	10.4	29.2	85.8	1,833.0	0.061	28.3	0.251	182
07/30/14 01:35	0.035	10.4	29.2	87.5	1,833.0	0.061	27.5	0.256	184
Average	0.036	10.4	29.5	83.8	1,833.0	0.062	27.9	0.245	180
Minimum	0.035	10.3	28.0	78.1	1,833.0	0.059	27.0	0.229	176
Maximum	0.038	10.5	30.9	87.8	1,833.0	0.065	30.0	0.257	184
Summation	0.751	218.6	618.7	1,759.4	38,493.0	1.301	585.4	5.145	3,787
Included Data Points	21	21	21	21	21	21	21	21	21
Total number of Data Points	21	21	21	21	21	21	21	21	21

3

F = Unit Offline **E = Exceedance** **C = Calibration** **S = Substituted** **I = Invalid**
M = Maintenance **T = Out Of Control** *** = Suspect** **U = Startup** **D = Shutdown**

MPU02882

B9 LOW FLOW RUN 2

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 07/30/2014 01:15 Through 07/30/2014 01:25
Time Online Criteria: 1 minute(s)

Source		B9					
Parameter	)Unit(	B9CPFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
07/30/14	01:15	4,567,599.0	1,833.0	76.1	29.28	179	329.8
07/30/14	01:16	4,569,559.0	1,833.0	76.2	29.29	181	329.7
07/30/14	01:17	4,547,028.0	1,833.0	75.8	29.30	182	329.5
07/30/14	01:18	4,541,027.0	1,833.0	75.7	29.30	179	329.3
07/30/14	01:19	4,571,465.0	1,833.0	76.2	29.31	176	329.3
07/30/14	01:20	4,598,155.0	1,833.0	76.6	29.30	178	329.4
07/30/14	01:21	4,597,098.0	1,833.0	76.6	29.28	184	329.8
07/30/14	01:22	4,595,004.0	1,833.0	76.6	29.30	184	330.1
07/30/14	01:23	4,561,432.0	1,833.0	76.0	29.30	180	330.1
07/30/14	01:24	4,566,174.0	1,833.0	76.1	29.30	178	329.9
07/30/14	01:25	4,602,335.0	1,833.0	76.7	29.31	177	329.8
	Average	4,574,261.5	1,833.0	76.2	29.30	180	329.7
	Minimum	4,541,027.0	1,833.0	75.7	29.28	176	329.3
	Maximum	4,602,335.0	1,833.0	76.7	29.31	184	330.1
	Summation	50,316,876.0	20,163.0	838.6	322.27	1,978	3,626.7
	Included Data Points	11	11	11	11	11	11
	Total number of Data Points	11	11	11	11	11	11

F = Unit Offline **E = Exceedance** **C = Calibration** **S = Substituted** **U - Startup**
I = Invalid **M = Maintenance** **T = Out Of Control** *** = Suspect** **D - Shutdown**

B9 GAS RUN 3

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 07/30/2014 01:45 Through 07/30/2014 02:05
Time Online Criteria: 1 minute(s)

Source	B9								
Parameter)Unit(	B9CO#M (#/MMBTU)	B9CPCO2 (PERCENT)	B9CPNOX (PPM)	B9CPSO2 (PPM)	B9FFACT (MMBTU/CF)	B9NOX#M (#/MMBTU)	B9PCO (PPM)	B9SO2#M (#/MMBTU)	B9STEAM (KLBS/HR)
07/30/14 01:45	0.039	10.5	26.3	102.5	1,833.0	0.055	31.0	0.297	180
07/30/14 01:46	0.040	10.5	26.6	99.8	1,833.0	0.055	31.6	0.289	182
07/30/14 01:47	0.040	10.5	27.1	98.6	1,833.0	0.056	31.8	0.286	180
07/30/14 01:48	0.038	10.4	26.7	97.0	1,833.0	0.056	29.7	0.284	182
07/30/14 01:49	0.039	10.5	27.1	94.4	1,833.0	0.056	30.6	0.274	182
07/30/14 01:50	0.039	10.6	27.1	95.7	1,833.0	0.056	30.6	0.275	182
07/30/14 01:51	0.036	10.6	27.1	95.0	1,833.0	0.056	28.7	0.273	182
07/30/14 01:52	0.036	10.6	27.3	91.9	1,833.0	0.056	28.4	0.264	180
07/30/14 01:53	0.038	10.4	27.0	90.1	1,833.0	0.057	29.4	0.264	179
07/30/14 01:54	0.035	10.5	27.2	87.3	1,833.0	0.057	27.8	0.253	181
07/30/14 01:55	0.037	10.5	28.3	83.0	1,833.0	0.059	29.0	0.241	181
07/30/14 01:56	0.037	10.5	28.0	82.8	1,833.0	0.058	29.1	0.240	183
07/30/14 01:57	0.035	10.6	28.3	85.3	1,833.0	0.058	28.1	0.245	184
07/30/14 01:58	0.036	10.4	27.9	84.2	1,833.0	0.059	28.4	0.246	183
07/30/14 01:59	0.036	10.4	28.1	85.3	1,833.0	0.059	27.8	0.250	179
07/30/14 02:00	0.035	10.5	28.0	88.4	1,833.0	0.058	27.9	0.256	177
07/30/14 02:01	0.037	10.5	29.2	87.1	1,833.0	0.061	29.0	0.252	180
07/30/14 02:02	0.036	10.5	28.6	85.1	1,833.0	0.060	28.4	0.247	180
07/30/14 02:03	0.036	10.6	28.7	85.7	1,833.0	0.059	28.5	0.246	182
07/30/14 02:04	0.037	10.5	28.9	82.9	1,833.0	0.060	29.0	0.240	181
07/30/14 02:05	0.035	10.5	28.5	85.2	1,833.0	0.059	27.5	0.247	176
Average	0.037	10.5	27.7	89.9	1,833.0	0.058	29.2	0.260	181
Minimum	0.035	10.4	26.3	82.8	1,833.0	0.055	27.5	0.240	176
Maximum	0.040	10.6	29.2	102.5	1,833.0	0.061	31.8	0.297	184
Summation	0.777	220.6	582.0	1,887.3	38,493.0	1.210	612.3	5.469	3,796
Included Data Points	21	21	21	21	21	21	21	21	21
Total number of Data Points	21	21	21	21	21	21	21	21	21

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MPU02884

F = Unit Offline **E = Exceedance** C = Calibration **S = Substituted** I = Invalid
M = Maintenance **T = Out Of Control** * = Suspect **U = Startup** **D = Shutdown**

B9 LOW FLOW RUN 3

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 07/30/2014 01:45 Through 07/30/2014 01:55
Time Online Criteria: 1 minute(s)

Source		B9					
Parameter)Unit(		B9CPFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
07/30/14	01:45	4,598,858.0	1,833.0	76.6	29.27	180	329.9
07/30/14	01:46	4,577,908.0	1,833.0	76.3	29.29	182	329.8
07/30/14	01:47	4,556,092.0	1,833.0	75.9	29.30	180	329.6
07/30/14	01:48	4,575,153.0	1,833.0	76.3	29.32	182	329.4
07/30/14	01:49	4,632,083.0	1,833.0	77.2	29.32	182	329.4
07/30/14	01:50	4,652,969.0	1,833.0	77.5	29.30	182	329.5
07/30/14	01:51	4,646,005.0	1,833.0	77.4	29.29	182	329.5
07/30/14	01:52	4,645,857.0	1,833.0	77.4	29.29	180	329.3
07/30/14	01:53	4,626,366.0	1,833.0	77.1	29.32	179	328.9
07/30/14	01:54	4,635,715.0	1,833.0	77.3	29.33	181	328.9
07/30/14	01:55	4,645,571.0	1,833.0	77.4	29.30	181	329.2
	Average	4,617,507.0	1,833.0	76.9	29.30	181	329.4
	Minimum	4,556,092.0	1,833.0	75.9	29.27	179	328.9
	Maximum	4,652,969.0	1,833.0	77.5	29.33	182	329.9
	Summation	50,792,577.0	20,163.0	846.4	322.33	1,991	3,623.4
	Included Data Points	11	11	11	11	11	11
	Total number of Data Points	11	11	11	11	11	11

F = Unit Offline **E = Exceedance** **C = Calibration** **S = Substituted** **U - Startup**
I = Invalid **M = Maintenance** **T = Out Of Control** *** = Suspect** **D - Shutdown**

B9 GAS RUN 4

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 07/30/2014 02:15 Through 07/30/2014 02:35
Time Online Criteria: 1 minute(s)

Source	B9								
Parameter)Unit(	B9CO#M (#/MMBTU)	B9CPCO2 (PERCENT)	B9CPNOX (PPM)	B9CPSO2 (PPM)	B9FFACT (MMBTU/CF)	B9NOX#M (#/MMBTU)	B9PCO (PPM)	B9SO2#M (#/MMBTU)	B9STEAM (KLBS/HR)
07/30/14 02:15	0.037	10.5	29.9	75.9	1,833.0	0.062	29.3	0.220	180
07/30/14 02:16	0.036	10.5	29.3	77.4	1,833.0	0.061	28.3	0.224	182
07/30/14 02:17	0.036	10.5	29.3	78.2	1,833.0	0.061	28.7	0.227	183
07/30/14 02:18	0.036	10.5	29.5	77.0	1,833.0	0.061	28.5	0.223	183
07/30/14 02:19	0.035	10.6	29.8	76.1	1,833.0	0.062	27.5	0.218	181
07/30/14 02:20	0.033	10.5	29.8	79.0	1,833.0	0.062	26.1	0.229	179
07/30/14 02:21	0.034	10.6	29.7	80.5	1,833.0	0.061	27.0	0.231	181
07/30/14 02:22	0.035	10.6	29.9	80.6	1,833.0	0.062	27.5	0.231	183
07/30/14 02:23	0.037	10.6	29.8	82.0	1,833.0	0.062	29.5	0.235	185
07/30/14 02:24	0.035	10.7	29.2	84.9	1,833.0	0.060	28.1	0.241	184
07/30/14 02:25	0.034	10.6	28.8	80.9	1,833.0	0.059	27.1	0.232	183
07/30/14 02:26	0.034	10.6	30.1	79.8	1,833.0	0.062	27.2	0.229	180
07/30/14 02:27	0.036	10.6	30.9	77.4	1,833.0	0.064	28.5	0.222	182
07/30/14 02:28	0.037	10.6	30.7	76.8	1,833.0	0.063	29.3	0.220	183
07/30/14 02:29	0.037	10.5	30.5	79.1	1,833.0	0.064	29.1	0.229	183
07/30/14 02:30	0.035	10.6	30.0	79.4	1,833.0	0.062	28.0	0.228	185
07/30/14 02:31	0.032	10.6	30.5	79.0	1,833.0	0.063	25.6	0.227	184
07/30/14 02:32	0.033	10.6	32.9	71.3	1,833.0	0.068	26.5	0.205	182
07/30/14 02:33	0.032	10.6	32.3	63.4	1,833.0	0.067	25.7	0.182	183
07/30/14 02:34	0.035	10.5	30.0	77.4	1,833.0	0.063	27.3	0.224	183
07/30/14 02:35	0.034	10.6	29.6	83.5	1,833.0	0.061	27.3	0.240	182
Average	0.035	10.6	30.1	78.1	1,833.0	0.062	27.7	0.225	182
Minimum	0.032	10.5	28.8	63.4	1,833.0	0.059	25.6	0.182	179
Maximum	0.037	10.7	32.9	84.9	1,833.0	0.068	29.5	0.241	185
Summation	0.733	222.0	632.5	1,639.6	38,493.0	1.310	582.1	4.717	3,831
Included Data Points	21	21	21	21	21	21	21	21	21
Total number of Data Points	21	21	21	21	21	21	21	21	21

F = Unit Offline **E = Exceedance** C = Calibration **S = Substituted** I = Invalid
M = Maintenance **T = Out Of Control** * = Suspect **U = Startup** **D = Shutdown**

MPU02886

B9 LOW FLOW RUN 4

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 07/30/2014 02:15 Through 07/30/2014 02:25
Time Online Criteria: 1 minute(s)

Source		B9					
Parameter)Unit(		B9CPFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
07/30/14	02:15	4,569,477.0	1,833.0	76.2	29.29	180	329.4
07/30/14	02:16	4,525,627.0	1,833.0	75.4	29.28	182	329.0
07/30/14	02:17	4,521,451.0	1,833.0	75.4	29.30	183	328.7
07/30/14	02:18	4,553,342.0	1,833.0	75.9	29.31	183	328.9
07/30/14	02:19	4,584,526.0	1,833.0	76.4	29.30	181	329.2
07/30/14	02:20	4,563,042.0	1,833.0	76.1	29.31	179	329.5
07/30/14	02:21	4,562,776.0	1,833.0	76.0	29.30	181	329.3
07/30/14	02:22	4,611,803.0	1,833.0	76.9	29.31	183	329.2
07/30/14	02:23	4,629,743.0	1,833.0	77.2	29.31	185	329.4
07/30/14	02:24	4,590,310.0	1,833.0	76.5	29.31	184	329.3
07/30/14	02:25	4,605,580.0	1,833.0	76.8	29.28	183	329.2
	Average	4,574,334.3	1,833.0	76.3	29.30	182	329.2
	Minimum	4,521,451.0	1,833.0	75.4	29.28	179	328.7
	Maximum	4,629,743.0	1,833.0	77.2	29.31	185	329.5
	Summation	50,317,677.0	20,163.0	838.8	322.30	2,004	3,621.1
	Included Data Points	11	11	11	11	11	11
	Total number of Data Points	11	11	11	11	11	11

F = Unit Offline **E = Exceedance** **C = Calibration** **S = Substituted** **U - Startup**
I = Invalid **M = Maintenance** **T = Out Of Control** *** = Suspect** **D - Shutdown**

B9 GAS RUN 5

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 07/30/2014 02:45 Through 07/30/2014 03:05
Time Online Criteria: 1 minute(s)

Source	B9								
Parameter)Unit(	B9CO#M (#/MMBTU)	B9CPCO2 (PERCENT)	B9CPNOX (PPM)	B9CPSO2 (PPM)	B9FFACT (MMBTU/CF)	B9NOX#M (#/MMBTU)	B9PCO (PPM)	B9SO2#M (#/MMBTU)	B9STEAM (KLBS/HR)
07/30/14 02:45	0.035	10.5	28.0	92.9	1,833.0	0.058	27.4	0.269	185
07/30/14 02:46	0.034	10.5	27.4	95.3	1,833.0	0.057	26.6	0.276	184
07/30/14 02:47	0.035	10.4	27.3	94.7	1,833.0	0.057	27.2	0.277	182
07/30/14 02:48	0.037	10.5	26.8	92.7	1,833.0	0.056	29.3	0.269	180
07/30/14 02:49	0.038	10.6	26.4	95.4	1,833.0	0.055	30.4	0.274	181
07/30/14 02:50	0.038	10.6	27.2	92.1	1,833.0	0.056	30.4	0.264	182
07/30/14 02:51	0.037	10.6	27.6	91.2	1,833.0	0.057	29.8	0.262	182
07/30/14 02:52	0.037	10.5	27.6	90.5	1,833.0	0.058	28.9	0.262	181
07/30/14 02:53	0.036	10.6	27.4	93.0	1,833.0	0.057	28.6	0.267	184
07/30/14 02:54	0.035	10.6	26.2	94.4	1,833.0	0.054	28.2	0.271	182
07/30/14 02:55	0.034	10.6	26.8	95.4	1,833.0	0.055	27.1	0.274	180
07/30/14 02:56	0.037	10.7	27.1	94.3	1,833.0	0.055	29.8	0.268	182
07/30/14 02:57	0.036	10.6	27.2	89.6	1,833.0	0.056	28.4	0.257	182
07/30/14 02:58	0.035	10.7	27.9	89.5	1,833.0	0.057	28.2	0.255	182
07/30/14 02:59	0.033	10.7	28.2	88.8	1,833.0	0.058	27.0	0.253	183
07/30/14 03:00	0.036	10.8	28.5	91.5	1,833.0	0.058	29.2	0.258	186
07/30/14 03:01	0.033	10.8	28.7	90.7	1,833.0	0.058	27.0	0.256	185
07/30/14 03:02	0.035	10.7	28.6	94.6	1,833.0	0.058	27.9	0.269	182
07/30/14 03:03	0.034	10.6	28.6	96.3	1,833.0	0.059	26.9	0.276	181
07/30/14 03:04	0.032	10.7	28.8	94.6	1,833.0	0.059	25.3	0.269	183
07/30/14 03:05	0.033	10.6	29.2	91.9	1,833.0	0.060	26.6	0.264	182
Average	0.035	10.6	27.7	92.8	1,833.0	0.057	28.1	0.266	182
Minimum	0.032	10.4	26.2	88.8	1,833.0	0.054	25.3	0.253	180
Maximum	0.038	10.8	29.2	96.3	1,833.0	0.060	30.4	0.277	186
Summation	0.740	222.9	581.5	1,949.4	38,493.0	1.198	590.2	5.590	3,831
Included Data Points	21	21	21	21	21	21	21	21	21
Total number of Data Points	21	21	21	21	21	21	21	21	21

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MPU02888

F = Unit Offline **E = Exceedance** C = Calibration **S = Substituted** I = Invalid
M = Maintenance **T = Out Of Control** * = Suspect **U = Startup** **D = Shutdown**

B9 LOW FLOW RUN 5

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 07/30/2014 02:45 Through 07/30/2014 02:55
Time Online Criteria: 1 minute(s)

Source		B9					
Parameter)Unit(		B9CPFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
07/30/14	02:45	4,610,266.0	1,833.0	76.8	29.31	185	329.8
07/30/14	02:46	4,602,038.0	1,833.0	76.7	29.30	184	329.8
07/30/14	02:47	4,595,916.0	1,833.0	76.6	29.31	182	329.8
07/30/14	02:48	4,585,081.0	1,833.0	76.4	29.29	180	329.8
07/30/14	02:49	4,572,541.0	1,833.0	76.2	29.30	181	329.6
07/30/14	02:50	4,604,016.0	1,833.0	76.7	29.31	182	329.6
07/30/14	02:51	4,625,997.0	1,833.0	77.1	29.28	182	329.7
07/30/14	02:52	4,642,201.0	1,833.0	77.4	29.31	181	329.8
07/30/14	02:53	4,601,264.0	1,833.0	76.7	29.30	184	329.4
07/30/14	02:54	4,530,252.0	1,833.0	75.5	29.27	182	328.7
07/30/14	02:55	4,553,577.0	1,833.0	75.9	29.32	180	328.7
	Average	4,593,013.5	1,833.0	76.5	29.30	182	329.5
	Minimum	4,530,252.0	1,833.0	75.5	29.27	180	328.7
	Maximum	4,642,201.0	1,833.0	77.4	29.32	185	329.8
	Summation	50,523,149.0	20,163.0	842.0	322.30	2,003	3,624.7
	Included Data Points	11	11	11	11	11	11
	Total number of Data Points	11	11	11	11	11	11

F = Unit Offline **E = Exceedance** **C = Calibration** **S = Substituted** **U - Startup**
I = Invalid **M = Maintenance** **T = Out Of Control** *** = Suspect** **D - Shutdown**

B9 GAS RUN 6

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 07/30/2014 03:15 Through 07/30/2014 03:35
Time Online Criteria: 1 minute(s)

Source	B9								
Parameter)Unit(	B9CO#M (#/MMBTU)	B9CPCO2 (PERCENT)	B9CPNOX (PPM)	B9CPSO2 (PPM)	B9FFACT (MMBTU/CF)	B9NOX#M (#/MMBTU)	B9PCO (PPM)	B9SO2#M (#/MMBTU)	B9STEAM (KLBS/HR)
07/30/14 03:15	0.033	10.6	29.6	86.5	1,833.0	0.061	26.6	0.248	181
07/30/14 03:16	0.033	10.7	29.9	87.8	1,833.0	0.061	26.1	0.250	182
07/30/14 03:17	0.034	10.7	29.6	89.2	1,833.0	0.061	27.6	0.254	184
07/30/14 03:18	0.034	10.7	29.5	87.2	1,833.0	0.060	27.6	0.248	182
07/30/14 03:19	0.034	10.6	29.5	86.8	1,833.0	0.061	26.8	0.249	182
07/30/14 03:20	0.033	10.7	30.1	83.6	1,833.0	0.062	26.3	0.238	182
07/30/14 03:21	0.032	10.7	31.0	80.5	1,833.0	0.063	25.8	0.229	182
07/30/14 03:22	0.034	10.7	30.7	81.6	1,833.0	0.063	26.9	0.232	183
07/30/14 03:23	0.034	10.7	30.1	82.0	1,833.0	0.062	27.1	0.233	185
07/30/14 03:24	0.035	10.6	29.7	81.1	1,833.0	0.061	27.8	0.233	184
07/30/14 03:25	0.034	10.7	30.3	83.0	1,833.0	0.062	27.4	0.236	184
07/30/14 03:26	0.036	10.7	30.3	83.0	1,833.0	0.062	29.1	0.236	182
07/30/14 03:27	0.034	10.6	31.2	83.3	1,833.0	0.064	27.2	0.239	179
07/30/14 03:28	0.036	10.6	30.9	84.0	1,833.0	0.064	28.5	0.241	182
07/30/14 03:29	0.037	10.6	30.5	80.9	1,833.0	0.063	29.3	0.232	185
07/30/14 03:30	0.034	10.5	30.0	84.1	1,833.0	0.063	27.2	0.244	185
07/30/14 03:31	0.033	10.6	30.5	84.6	1,833.0	0.063	26.0	0.243	182
07/30/14 03:32	0.036	10.6	30.0	83.3	1,833.0	0.062	28.9	0.239	182
07/30/14 03:33	0.035	10.7	30.3	82.7	1,833.0	0.062	27.7	0.235	181
07/30/14 03:34	0.035	10.7	30.5	82.2	1,833.0	0.062	28.0	0.234	182
07/30/14 03:35	0.034	10.5	30.4	85.2	1,833.0	0.063	26.6	0.247	183
Average	0.034	10.6	30.2	83.9	1,833.0	0.062	27.4	0.240	183
Minimum	0.032	10.5	29.5	80.5	1,833.0	0.060	25.8	0.229	179
Maximum	0.037	10.7	31.2	89.2	1,833.0	0.064	29.3	0.254	185
Summation	0.720	223.5	634.6	1,762.6	38,493.0	1.305	574.5	5.040	3,834
Included Data Points	21	21	21	21	21	21	21	21	21
Total number of Data Points	21	21	21	21	21	21	21	21	21

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MPU02890

F = Unit Offline E = Exceedance C = Calibration S = Substituted I = Invalid
M = Maintenance T = Out Of Control * = Suspect U = Startup D = Shutdown

B9 LOW FLOW RUN 6

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 07/30/2014 03:15 Through 07/30/2014 03:25
Time Online Criteria: 1 minute(s)

Source		B9					
Parameter)Unit(		B9CPFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
07/30/14	03:15	4,590,750.0	1,833.0	76.5	29.31	181	329.6
07/30/14	03:16	4,567,002.0	1,833.0	76.1	29.31	182	329.6
07/30/14	03:17	4,547,344.0	1,833.0	75.8	29.30	184	329.2
07/30/14	03:18	4,590,832.0	1,833.0	76.5	29.31	182	328.8
07/30/14	03:19	4,587,758.0	1,833.0	76.5	29.31	182	328.8
07/30/14	03:20	4,576,667.0	1,833.0	76.3	29.31	182	329.1
07/30/14	03:21	4,625,886.0	1,833.0	77.1	29.31	182	329.6
07/30/14	03:22	4,612,516.0	1,833.0	76.9	29.31	183	329.7
07/30/14	03:23	4,590,427.0	1,833.0	76.5	29.29	185	329.7
07/30/14	03:24	4,600,713.0	1,833.0	76.7	29.32	184	329.6
07/30/14	03:25	4,600,653.0	1,833.0	76.7	29.32	184	329.5
	Average	4,590,049.8	1,833.0	76.5	29.31	183	329.4
	Minimum	4,547,344.0	1,833.0	75.8	29.29	181	328.8
	Maximum	4,625,886.0	1,833.0	77.1	29.32	185	329.7
	Summation	50,490,548.0	20,163.0	841.6	322.40	2,011	3,623.2
	Included Data Points	11	11	11	11	11	11
	Total number of Data Points	11	11	11	11	11	11

F = Unit Offline **E = Exceedance** **C = Calibration** **S = Substituted** **U - Startup**
I = Invalid **M = Maintenance** **T = Out Of Control** *** = Suspect** **D - Shutdown**

B9 GAS RUN 7

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 07/30/2014 03:45 Through 07/30/2014 04:05
Time Online Criteria: 1 minute(s)

Source		B9								
Parameter	)Unit(	B9CO#M (#/MMBTU)	B9CPCO2 (PERCENT)	B9CPNOX (PPM)	B9CPSO2 (PPM)	B9FFACT (MMBTU/CF)	B9NOX#M (#/MMBTU)	B9PCO (PPM)	B9SO2#M (#/MMBTU)	B9STEAM (KLBS/HR)
07/30/14	03:45	0.035	10.7	28.9	90.8	1,833.0	0.059	27.9	0.258	183
07/30/14	03:46	0.037	10.6	29.4	87.2	1,833.0	0.061	29.7	0.250	185
07/30/14	03:47	0.037	10.7	30.6	73.6	1,833.0	0.063	29.6	0.209	187
07/30/14	03:48	0.037	10.6	28.8	80.2	1,833.0	0.059	29.2	0.230	188
07/30/14	03:49	0.037	10.6	28.2	87.8	1,833.0	0.058	29.2	0.252	187
07/30/14	03:50	0.038	10.6	27.8	90.3	1,833.0	0.057	30.2	0.259	187
07/30/14	03:51	0.036	10.5	26.6	92.0	1,833.0	0.055	28.8	0.267	187
07/30/14	03:52	0.036	10.5	27.1	95.8	1,833.0	0.056	28.6	0.278	184
07/30/14	03:53	0.037	10.5	27.4	94.5	1,833.0	0.057	29.0	0.274	181
07/30/14	03:54	0.037	10.5	26.6	98.8	1,833.0	0.055	29.3	0.286	183
07/30/14	03:55	0.037	10.6	26.7	98.5	1,833.0	0.055	29.9	0.283	184
07/30/14	03:56	0.038	10.6	25.6	96.1	1,833.0	0.053	29.9	0.276	186
07/30/14	03:57	0.036	10.7	25.4	98.4	1,833.0	0.052	28.8	0.280	188
07/30/14	03:58	0.037	10.7	24.9	97.2	1,833.0	0.051	29.4	0.276	188
07/30/14	03:59	0.036	10.7	25.1	96.8	1,833.0	0.051	28.5	0.275	185
07/30/14	04:00	0.037	10.7	25.4	96.1	1,833.0	0.052	29.3	0.273	181
07/30/14	04:01	0.038	10.8	25.1	94.4	1,833.0	0.051	30.6	0.266	182
07/30/14	04:02	0.037	10.7	25.2	95.7	1,833.0	0.052	29.3	0.272	186
07/30/14	04:03	0.036	10.8	25.2	96.0	1,833.0	0.051	29.1	0.270	188
07/30/14	04:04	0.036	10.7	25.4	95.2	1,833.0	0.052	29.1	0.271	187
07/30/14	04:05	0.035	10.7	25.6	95.1	1,833.0	0.052	28.3	0.270	185
Average		0.037	10.6	26.7	92.9	1,833.0	0.055	29.2	0.265	185
Minimum		0.035	10.5	24.9	73.6	1,833.0	0.051	27.9	0.209	181
Maximum		0.038	10.8	30.6	98.8	1,833.0	0.063	30.6	0.286	188
Summation		0.770	223.5	561.0	1,950.5	38,493.0	1.152	613.7	5.575	3,892
Included Data Points		21	21	21	21	21	21	21	21	21
Total number of Data Points		21	21	21	21	21	21	21	21	21

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F = Unit Offline **E = Exceedance** C = Calibration **S = Substituted** I = Invalid
M = Maintenance **T = Out Of Control** * = Suspect **U = Startup** **D = Shutdown**

MPU02892

B9 LOW FLOW RUN 7

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 07/30/2014 03:45 Through 07/30/2014 03:55
Time Online Criteria: 1 minute(s)

Source		B9					
Parameter)Unit(		B9CPFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
07/30/14	03:45	4,605,018.0	1,833.0	76.8	29.32	183	329.9
07/30/14	03:46	4,593,123.0	1,833.0	76.6	29.32	185	329.8
07/30/14	03:47	4,593,658.0	1,833.0	76.6	29.32	187	329.6
07/30/14	03:48	4,608,719.0	1,833.0	76.8	29.31	188	329.7
07/30/14	03:49	4,593,958.0	1,833.0	76.6	29.31	187	330.0
07/30/14	03:50	4,562,092.0	1,833.0	76.0	29.31	187	330.1
07/30/14	03:51	4,536,104.0	1,833.0	75.6	29.31	187	329.7
07/30/14	03:52	4,527,898.0	1,833.0	75.5	29.32	184	329.6
07/30/14	03:53	4,582,731.0	1,833.0	76.4	29.34	181	329.8
07/30/14	03:54	4,608,839.0	1,833.0	76.8	29.34	183	330.2
07/30/14	03:55	4,592,795.0	1,833.0	76.5	29.33	184	330.3
	Average	4,582,266.8	1,833.0	76.4	29.32	185	329.9
	Minimum	4,527,898.0	1,833.0	75.5	29.31	181	329.6
	Maximum	4,608,839.0	1,833.0	76.8	29.34	188	330.3
	Summation	50,404,935.0	20,163.0	840.2	322.53	2,036	3,628.7
	Included Data Points	11	11	11	11	11	11
	Total number of Data Points	11	11	11	11	11	11

F = Unit Offline **E = Exceedance** **C = Calibration** **S = Substituted** **U - Startup**
I = Invalid **M = Maintenance** **T = Out Of Control** *** = Suspect** **D - Shutdown**

B9 LOW FLOW RUN 8

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 07/30/2014 04:15 Through 07/30/2014 04:25
Time Online Criteria: 1 minute(s)

Source		B9					
Parameter)Unit(		B9CPFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
07/30/14	04:15	4,628,395.0	1,833.0	77.1	29.34	180	329.7
07/30/14	04:16	4,587,519.0	1,833.0	76.5	29.33	180	329.5
07/30/14	04:17	4,561,646.0	1,833.0	76.0	29.33	182	329.4
07/30/14	04:18	4,570,383.0	1,833.0	76.2	29.35	187	329.3
07/30/14	04:19	4,535,446.0	1,833.0	75.6	29.36	186	328.9
07/30/14	04:20	4,518,273.0	1,833.0	75.3	29.33	184	328.5
07/30/14	04:21	4,530,453.0	1,833.0	75.5	29.33	181	328.9
07/30/14	04:22	4,551,037.0	1,833.0	75.9	29.32	183	329.4
07/30/14	04:23	4,577,112.0	1,833.0	76.3	29.31	186	329.4
07/30/14	04:24	4,611,700.0	1,833.0	76.9	29.31	186	329.3
07/30/14	04:25	4,612,323.0	1,833.0	76.9	29.33	186	329.5
	Average	4,571,298.8	1,833.0	76.2	29.33	184	329.3
	Minimum	4,518,273.0	1,833.0	75.3	29.31	180	328.5
	Maximum	4,628,395.0	1,833.0	77.1	29.36	187	329.7
	Summation	50,284,287.0	20,163.0	838.2	322.64	2,021	3,621.8
	Included Data Points	11	11	11	11	11	11
	Total number of Data Points	11	11	11	11	11	11

F = Unit Offline **E = Exceedance** **C = Calibration** **S = Substituted** **U - Startup**
I = Invalid **M = Maintenance** **T = Out Of Control** *** = Suspect** **D - Shutdown**

B9 GAS RUN 8

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 07/30/2014 04:15 Through 07/30/2014 04:35
Time Online Criteria: 1 minute(s)

Source	B9								
Parameter)Unit(	B9CO#M (#/MMBTU)	B9CPCO2 (PERCENT)	B9CPNOX (PPM)	B9CPSO2 (PPM)	B9FFACT (MMBTU/CF)	B9NOX#M (#/MMBTU)	B9PCO (PPM)	B9SO2#M (#/MMBTU)	B9STEAM (KLBS/HR)
07/30/14 04:15	0.038	10.7	25.3	95.8	1,833.0	0.052	30.2	0.272	180
07/30/14 04:16	0.039	10.7	25.4	99.1	1,833.0	0.052	31.0	0.282	180
07/30/14 04:17	0.037	10.8	25.9	92.4	1,833.0	0.052	30.1	0.260	182
07/30/14 04:18	0.037	10.7	25.9	88.2	1,833.0	0.053	29.7	0.251	187
07/30/14 04:19	0.037	10.7	26.4	84.4	1,833.0	0.054	29.5	0.240	186
07/30/14 04:20	0.037	10.7	26.3	85.1	1,833.0	0.054	29.4	0.242	184
07/30/14 04:21	0.037	10.7	26.8	85.9	1,833.0	0.055	29.7	0.244	181
07/30/14 04:22	0.034	10.7	27.3	85.6	1,833.0	0.056	27.2	0.243	183
07/30/14 04:23	0.036	10.7	26.1	85.3	1,833.0	0.053	28.6	0.243	186
07/30/14 04:24	0.035	10.8	25.2	89.4	1,833.0	0.051	28.3	0.252	186
07/30/14 04:25	0.038	10.7	25.7	87.6	1,833.0	0.053	30.3	0.249	186
07/30/14 04:26	0.039	10.7	25.4	87.3	1,833.0	0.052	31.5	0.248	184
07/30/14 04:27	0.039	10.8	24.7	92.1	1,833.0	0.050	31.6	0.259	183
07/30/14 04:28	0.037	10.9	25.9	91.0	1,833.0	0.052	30.5	0.254	187
07/30/14 04:29	0.036	10.8	26.8	85.5	1,833.0	0.054	29.1	0.241	187
07/30/14 04:30	0.035	10.8	27.0	82.7	1,833.0	0.055	28.5	0.233	186
07/30/14 04:31	0.036	10.8	27.5	82.1	1,833.0	0.056	29.4	0.231	185
07/30/14 04:32	0.036	10.9	28.1	81.2	1,833.0	0.056	29.2	0.227	182
07/30/14 04:33	0.035	10.9	28.9	79.8	1,833.0	0.058	28.5	0.223	183
07/30/14 04:34	0.037	10.7	27.9	78.0	1,833.0	0.057	29.3	0.222	183
07/30/14 04:35	0.034	10.8	28.0	80.9	1,833.0	0.057	27.9	0.228	185
Average	0.037	10.8	26.5	86.6	1,833.0	0.054	29.5	0.245	184
Minimum	0.034	10.7	24.7	78.0	1,833.0	0.050	27.2	0.222	180
Maximum	0.039	10.9	28.9	99.1	1,833.0	0.058	31.6	0.282	187
Summation	0.769	226.0	556.5	1,819.4	38,493.0	1.132	619.5	5.144	3,866
Included Data Points	21	21	21	21	21	21	21	21	21
Total number of Data Points	21	21	21	21	21	21	21	21	21

F = Unit Offline **E = Exceedance** **C = Calibration** **S = Substituted** **I = Invalid**
M = Maintenance **T = Out Of Control** *** = Suspect** **U = Startup** **D = Shutdown**

MPU02895

B9 Gas Run 9

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 07/30/2014 04:45 Through 07/30/2014 05:05
Time Online Criteria: 1 minute(s)

Source	B9								
Parameter)Unit(	B9CO#M (#/MMBTU)	B9CPCO2 (PERCENT)	B9CPNOX (PPM)	B9CPSO2 (PPM)	B9FFACT (MMBTU/CF)	B9NOX#M (#/MMBTU)	B9PCO (PPM)	B9SO2#M (#/MMBTU)	B9STEAM (KLBS/HR)
07/30/14 04:45	0.033	10.7	30.1	75.6	1,833.0	0.062	26.8	0.215	184
07/30/14 04:46	0.031	10.7	29.9	76.3	1,833.0	0.061	24.6	0.217	183
07/30/14 04:47	0.033	10.7	29.8	78.5	1,833.0	0.061	26.2	0.223	182
07/30/14 04:48	0.032	10.7	30.0	81.2	1,833.0	0.061	25.5	0.231	180
07/30/14 04:49	0.031	10.8	30.8	79.2	1,833.0	0.062	25.0	0.223	181
07/30/14 04:50	0.033	10.6	30.5	75.5	1,833.0	0.063	25.9	0.217	184
07/30/14 04:51	0.035	10.6	30.1	76.4	1,833.0	0.062	27.6	0.219	185
07/30/14 04:52	0.037	10.7	30.1	76.3	1,833.0	0.062	29.6	0.217	181
07/30/14 04:53	0.036	10.7	30.7	74.8	1,833.0	0.063	29.1	0.213	179
07/30/14 04:54	0.036	10.7	31.3	74.5	1,833.0	0.064	28.8	0.212	182
07/30/14 04:55	0.035	10.7	30.6	72.5	1,833.0	0.063	28.3	0.206	186
07/30/14 04:56	0.036	10.6	31.0	73.8	1,833.0	0.064	28.7	0.212	185
07/30/14 04:57	0.035	10.7	30.7	74.7	1,833.0	0.063	27.8	0.212	185
07/30/14 04:58	0.035	10.7	30.4	77.6	1,833.0	0.062	28.1	0.221	183
07/30/14 04:59	0.034	10.7	31.2	76.2	1,833.0	0.064	27.2	0.217	181
07/30/14 05:00	0.035	10.8	30.8	77.1	1,833.0	0.062	28.1	0.217	180
07/30/14 05:01	0.034	10.6	30.4	79.9	1,833.0	0.063	27.4	0.229	181
07/30/14 05:02	0.034	10.7	31.2	78.0	1,833.0	0.064	27.3	0.222	185
07/30/14 05:03	0.035	10.7	31.1	76.1	1,833.0	0.064	28.2	0.216	186
07/30/14 05:04	0.035	10.7	31.5	75.0	1,833.0	0.064	28.1	0.213	184
07/30/14 05:05	0.036	10.7	31.2	75.6	1,833.0	0.064	28.7	0.215	183
Average	0.034	10.7	30.6	76.4	1,833.0	0.063	27.5	0.217	183
Minimum	0.031	10.6	29.8	72.5	1,833.0	0.061	24.6	0.206	179
Maximum	0.037	10.8	31.5	81.2	1,833.0	0.064	29.6	0.231	186
Summation	0.721	224.5	643.4	1,604.8	38,493.0	1.318	577.0	4.567	3,840
Included Data Points	21	21	21	21	21	21	21	21	21
Total number of Data Points	21	21	21	21	21	21	21	21	21

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F = Unit Offline **E = Exceedance** C = Calibration **S = Substituted** I = Invalid
M = Maintenance **T = Out Of Control** * = Suspect **U = Startup** **D = Shutdown**

MPU02896

B9 Low Flow Run 9

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 07/30/2014 04:45 Through 07/30/2014 04:55
Time Online Criteria: 1 minute(s)

Source		B9					
Parameter)Unit(		B9CPFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
07/30/14	04:45	4,609,056.0	1,833.0	76.8	29.34	184	329.7
07/30/14	04:46	4,617,366.0	1,833.0	77.0	29.34	183	329.7
07/30/14	04:47	4,552,754.0	1,833.0	75.9	29.34	182	329.7
07/30/14	04:48	4,563,382.0	1,833.0	76.1	29.32	180	329.7
07/30/14	04:49	4,645,548.0	1,833.0	77.4	29.33	181	329.7
07/30/14	04:50	4,668,114.0	1,833.0	77.8	29.33	184	329.8
07/30/14	04:51	4,627,083.0	1,833.0	77.1	29.34	185	329.7
07/30/14	04:52	4,573,381.0	1,833.0	76.2	29.31	181	329.4
07/30/14	04:53	4,537,162.0	1,833.0	75.6	29.32	179	329.1
07/30/14	04:54	4,538,934.0	1,833.0	75.6	29.33	182	329.5
07/30/14	04:55	4,593,681.0	1,833.0	76.6	29.34	186	329.9
	Average	4,593,314.6	1,833.0	76.6	29.33	182	329.6
	Minimum	4,537,162.0	1,833.0	75.6	29.31	179	329.1
	Maximum	4,668,114.0	1,833.0	77.8	29.34	186	329.9
	Summation	50,526,461.0	20,163.0	842.1	322.64	2,007	3,625.9
	Included Data Points	11	11	11	11	11	11
	Total number of Data Points	11	11	11	11	11	11

F = Unit Offline **E = Exceedance** **C = Calibration** **S = Substituted** **U - Startup**
I = Invalid **M = Maintenance** **T = Out Of Control** *** = Suspect** **D - Shutdown**

B9 GAS RUN 10

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 07/30/2014 05:15 Through 07/30/2014 05:35
Time Online Criteria: 1 minute(s)

Source	B9								
Parameter)Unit(	B9CO#M (#/MMBTU)	B9CPCO2 (PERCENT)	B9CPNOX (PPM)	B9CPSO2 (PPM)	B9FFACT (MMBTU/CF)	B9NOX#M (#/MMBTU)	B9PCO (PPM)	B9SO2#M (#/MMBTU)	B9STEAM (KLBS/HR)
07/30/14 05:15	0.034	10.6	33.6	71.5	1,833.0	0.069	26.7	0.205	181
07/30/14 05:16	0.033	10.7	33.4	71.7	1,833.0	0.068	26.2	0.204	183
07/30/14 05:17	0.033	10.6	33.0	71.5	1,833.0	0.068	26.0	0.205	184
07/30/14 05:18	0.035	10.6	33.2	71.3	1,833.0	0.069	27.5	0.205	184
07/30/14 05:19	0.034	10.7	33.4	71.6	1,833.0	0.068	27.0	0.204	181
07/30/14 05:20	0.034	10.6	33.5	71.8	1,833.0	0.069	26.9	0.206	180
07/30/14 05:21	0.033	10.7	33.3	75.2	1,833.0	0.068	26.7	0.214	181
07/30/14 05:22	0.034	10.6	32.9	73.3	1,833.0	0.068	27.0	0.210	183
07/30/14 05:23	0.034	10.7	33.7	73.7	1,833.0	0.069	26.9	0.210	185
07/30/14 05:24	0.035	10.7	33.7	74.8	1,833.0	0.069	27.7	0.213	184
07/30/14 05:25	0.035	10.7	33.9	74.2	1,833.0	0.069	28.1	0.211	185
07/30/14 05:26	0.034	10.6	34.8	73.1	1,833.0	0.072	26.8	0.210	183
07/30/14 05:27	0.036	10.7	35.0	70.3	1,833.0	0.072	28.4	0.200	181
07/30/14 05:28	0.035	10.6	35.4	72.5	1,833.0	0.073	28.0	0.208	184
07/30/14 05:29	0.033	10.6	35.7	71.2	1,833.0	0.074	26.3	0.204	184
07/30/14 05:30	0.034	10.6	34.3	72.6	1,833.0	0.071	26.5	0.208	184
07/30/14 05:31	0.035	10.6	32.6	76.6	1,833.0	0.067	27.9	0.220	182
07/30/14 05:32	0.034	10.7	32.0	80.3	1,833.0	0.065	27.3	0.228	178
07/30/14 05:33	0.034	10.6	31.9	82.3	1,833.0	0.066	27.0	0.236	181
07/30/14 05:34	0.032	10.7	32.9	78.6	1,833.0	0.067	25.9	0.224	188
07/30/14 05:35	0.033	10.7	33.4	76.9	1,833.0	0.068	26.3	0.219	187
Average	0.034	10.6	33.6	74.0	1,833.0	0.069	27.0	0.212	183
Minimum	0.032	10.6	31.9	70.3	1,833.0	0.065	25.9	0.200	178
Maximum	0.036	10.7	35.7	82.3	1,833.0	0.074	28.4	0.236	188
Summation	0.714	223.6	705.6	1,555.0	38,493.0	1.449	567.1	4.444	3,843
Included Data Points	21	21	21	21	21	21	21	21	21
Total number of Data Points	21	21	21	21	21	21	21	21	21

F = Unit Offline **E = Exceedance** **C = Calibration** **S = Substituted** **I = Invalid**
M = Maintenance **T = Out Of Control** *** = Suspect** **U = Startup** **D = Shutdown**

MPU02898

B9 LOW FLOW RUN 10

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 07/30/2014 05:15 Through 07/30/2014 05:25
Time Online Criteria: 1 minute(s)

Source		B9					
Parameter)Unit(		B9CPFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
07/30/14	05:15	4,590,160.0	1,833.0	76.5	29.33	181	330.5
07/30/14	05:16	4,588,430.0	1,833.0	76.5	29.35	183	330.6
07/30/14	05:17	4,576,456.0	1,833.0	76.3	29.34	184	330.3
07/30/14	05:18	4,573,770.0	1,833.0	76.2	29.33	184	329.9
07/30/14	05:19	4,584,028.0	1,833.0	76.4	29.34	181	329.9
07/30/14	05:20	4,595,107.0	1,833.0	76.6	29.35	180	330.5
07/30/14	05:21	4,600,374.0	1,833.0	76.7	29.34	181	330.7
07/30/14	05:22	4,604,135.0	1,833.0	76.7	29.34	183	330.6
07/30/14	05:23	4,588,149.0	1,833.0	76.5	29.32	185	330.4
07/30/14	05:24	4,585,825.0	1,833.0	76.4	29.33	184	330.3
07/30/14	05:25	4,619,032.0	1,833.0	77.0	29.33	185	330.4
	Average	4,591,406.0	1,833.0	76.5	29.34	183	330.4
	Minimum	4,573,770.0	1,833.0	76.2	29.32	180	329.9
	Maximum	4,619,032.0	1,833.0	77.0	29.35	185	330.7
	Summation	50,505,466.0	20,163.0	841.8	322.70	2,011	3,634.1
	Included Data Points	11	11	11	11	11	11
	Total number of Data Points	11	11	11	11	11	11

F = Unit Offline **E = Exceedance** **C = Calibration** **S = Substituted** **U - Startup**
I = Invalid **M = Maintenance** **T = Out Of Control** *** = Suspect** **D - Shutdown**

B9 MID FLOW RUN 1

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 07/30/2014 07:15 Through 07/30/2014 07:21
Time Online Criteria: 1 minute(s)

Source		B9					
Parameter)Unit(		B9CPFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
07/30/14	07:15	5,962,372.0	1,833.0	99.4	29.38	302	338.1
07/30/14	07:16	5,919,006.0	1,833.0	98.6	29.38	301	338.0
07/30/14	07:17	5,853,354.0	1,833.0	97.6	29.38	300	337.6
07/30/14	07:18	5,826,279.0	1,833.0	97.1	29.38	296	337.1
07/30/14	07:19	5,853,958.0	1,833.0	97.6	29.39	296	336.7
07/30/14	07:20	5,861,253.0	1,833.0	97.7	29.39	298	336.3
07/30/14	07:21	5,847,551.0	1,833.0	97.5	29.39	300	335.8
	Average	5,874,824.7	1,833.0	97.9	29.38	299	337.1
	Minimum	5,826,279.0	1,833.0	97.1	29.38	296	335.8
	Maximum	5,962,372.0	1,833.0	99.4	29.39	302	338.1
	Summation	41,123,773.0	12,831.0	685.5	205.69	2,093	2,359.6
	Included Data Points	7	7	7	7	7	7
	Total number of Data Points	7	7	7	7	7	7

F = Unit Offline **E = Exceedance** **C = Calibration** **S = Substituted** **U - Startup**
I = Invalid **M = Maintenance** **T = Out Of Control** *** = Suspect** **D - Shutdown**

B9 MED FLOW RUN 2

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 07/30/2014 07:22 Through 07/30/2014 07:28
Time Online Criteria: 1 minute(s)

Source		B9					
Parameter)Unit(		B9CPFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
07/30/14	07:22	5,850,014.0	1,833.0	97.5	29.37	300	335.4
07/30/14	07:23	5,888,729.0	1,833.0	98.1	29.41	300	335.2
07/30/14	07:24	5,894,731.0	1,833.0	98.2	29.40	302	335.1
07/30/14	07:25	5,884,279.0	1,833.0	98.1	29.39	300	334.7
07/30/14	07:26	5,878,011.0	1,833.0	98.0	29.39	300	334.3
07/30/14	07:27	5,867,047.0	1,833.0	97.8	29.41	297	334.0
07/30/14	07:28	5,906,694.0	1,833.0	98.4	29.39	300	333.5
	Average	5,881,357.9	1,833.0	98.0	29.39	300	334.6
	Minimum	5,850,014.0	1,833.0	97.5	29.37	297	333.5
	Maximum	5,906,694.0	1,833.0	98.4	29.41	302	335.4
	Summation	41,169,505.0	12,831.0	686.1	205.76	2,099	2,342.2
	Included Data Points	7	7	7	7	7	7
	Total number of Data Points	7	7	7	7	7	7

F = Unit Offline **E = Exceedance** C = Calibration **S = Substituted** **U - Startup**
I = Invalid **M = Maintenance** **T = Out Of Control** * = Suspect **D - Shutdown**

B9 MID FLOW RUN 3

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 07/30/2014 07:29 Through 07/30/2014 07:35
Time Online Criteria: 1 minute(s)

Source		B9					
Parameter)Unit(		B9CPFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
07/30/14	07:29	5,874,388.0	1,833.0	97.9	29.39	301	333.1
07/30/14	07:30	5,825,632.0	1,833.0	97.1	29.39	303	332.7
07/30/14	07:31	5,866,673.0	1,833.0	97.8	29.39	302	332.2
07/30/14	07:32	5,836,798.0	1,833.0	97.3	29.39	301	331.8
07/30/14	07:33	5,805,087.0	1,833.0	96.8	29.39	302	331.6
07/30/14	07:34	5,812,365.0	1,833.0	96.9	29.40	301	331.3
07/30/14	07:35	5,767,081.0	1,833.0	96.1	29.41	301	330.8
	Average	5,826,860.6	1,833.0	97.1	29.39	302	331.9
	Minimum	5,767,081.0	1,833.0	96.1	29.39	301	330.8
	Maximum	5,874,388.0	1,833.0	97.9	29.41	303	333.1
	Summation	40,788,024.0	12,831.0	679.9	205.76	2,111	2,323.5
	Included Data Points	7	7	7	7	7	7
	Total number of Data Points	7	7	7	7	7	7

F = Unit Offline **E = Exceedance** **C = Calibration** **S = Substituted** **U - Startup**
I = Invalid **M = Maintenance** **T = Out Of Control** *** = Suspect** **D - Shutdown**

B9 MID FLOW RUN 4

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 07/30/2014 07:45 Through 07/30/2014 07:51
Time Online Criteria: 1 minute(s)

Source		B9					
Parameter)Unit(		B9CPFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
07/30/14	07:45	5,800,016.0	1,833.0	96.7	29.40	303	329.4
07/30/14	07:46	5,779,077.0	1,833.0	96.3	29.40	303	329.2
07/30/14	07:47	5,752,130.0	1,833.0	95.9	29.41	303	329.0
07/30/14	07:48	5,768,715.0	1,833.0	96.1	29.38	303	329.0
07/30/14	07:49	5,837,294.0	1,833.0	97.3	29.39	304	329.2
07/30/14	07:50	5,855,714.0	1,833.0	97.6	29.41	302	329.3
07/30/14	07:51	5,779,036.0	1,833.0	96.3	29.39	303	329.2
	Average	5,795,997.4	1,833.0	96.6	29.40	303	329.2
	Minimum	5,752,130.0	1,833.0	95.9	29.38	302	329.0
	Maximum	5,855,714.0	1,833.0	97.6	29.41	304	329.4
	Summation	40,571,982.0	12,831.0	676.2	205.78	2,121	2,304.3
	Included Data Points	7	7	7	7	7	7
	Total number of Data Points	7	7	7	7	7	7

F = Unit Offline **E = Exceedance** **C = Calibration** **S = Substituted** **U - Startup**
I = Invalid **M = Maintenance** **T = Out Of Control** *** = Suspect** **D - Shutdown**

B9 MID FLOW RUN 5

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 07/30/2014 07:52 Through 07/30/2014 07:58
Time Online Criteria: 1 minute(s)

Source		B9					
Parameter)Unit(		B9CPFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
07/30/14	07:52	5,779,026.0	1,833.0	96.3	29.42	304	328.9
07/30/14	07:53	5,837,710.0	1,833.0	97.3	29.41	305	328.9
07/30/14	07:54	5,822,512.0	1,833.0	97.0	29.40	304	329.1
07/30/14	07:55	5,766,095.0	1,833.0	96.1	29.41	304	328.8
07/30/14	07:56	5,739,745.0	1,833.0	95.7	29.40	302	328.5
07/30/14	07:57	5,691,249.0	1,833.0	94.9	29.41	301	328.1
07/30/14	07:58	5,642,731.0	1,833.0	94.0	29.40	302	327.7
	Average	5,754,152.6	1,833.0	95.9	29.41	303	328.6
	Minimum	5,642,731.0	1,833.0	94.0	29.40	301	327.7
	Maximum	5,837,710.0	1,833.0	97.3	29.42	305	329.1
	Summation	40,279,068.0	12,831.0	671.3	205.85	2,122	2,300.0
	Included Data Points	7	7	7	7	7	7
	Total number of Data Points	7	7	7	7	7	7

F = Unit Offline **E = Exceedance** **C = Calibration** **S = Substituted** **U - Startup**
I = Invalid **M = Maintenance** **T = Out Of Control** *** = Suspect** **D - Shutdown**

B9 MID FLOW RUN 6

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 07/30/2014 07:59 Through 07/30/2014 08:05
Time Online Criteria: 1 minute(s)

Source		B9					
Parameter)Unit(		B9CPFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
07/30/14	07:59	5,656,914.0	1,833.0	94.3	29.39	300	327.5
07/30/14	08:00	5,655,889.0	1,833.0	94.3	29.39	298	327.4
07/30/14	08:01	5,652,990.0	1,833.0	94.2	29.38	300	327.3
07/30/14	08:02	5,699,144.0	1,833.0	95.0	29.39	300	327.1
07/30/14	08:03	5,751,657.0	1,833.0	95.9	29.39	298	327.2
07/30/14	08:04	5,777,557.0	1,833.0	96.3	29.39	299	327.1
07/30/14	08:05	5,803,569.0	1,833.0	96.7	29.40	300	327.0
	Average	5,713,960.0	1,833.0	95.2	29.39	299	327.2
	Minimum	5,652,990.0	1,833.0	94.2	29.38	298	327.0
	Maximum	5,803,569.0	1,833.0	96.7	29.40	300	327.5
	Summation	39,997,720.0	12,831.0	666.7	205.73	2,095	2,290.6
	Included Data Points	7	7	7	7	7	7
	Total number of Data Points	7	7	7	7	7	7

F = Unit Offline **E = Exceedance** **C = Calibration** **S = Substituted** **U - Startup**
I = Invalid **M = Maintenance** **T = Out Of Control** *** = Suspect** **D - Shutdown**

B9 MID FLOW RUN 7

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 07/30/2014 08:06 Through 07/30/2014 08:12
Time Online Criteria: 1 minute(s)

Source		B9					
Parameter)Unit(		B9CPFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
07/30/14	08:06	5,808,646.0	1,833.0	96.8	29.39	298	327.0
07/30/14	08:07	5,792,370.0	1,833.0	96.5	29.39	301	327.1
07/30/14	08:08	5,808,358.0	1,833.0	96.8	29.41	303	327.2
07/30/14	08:09	5,833,605.0	1,833.0	97.2	29.42	302	327.2
07/30/14	08:10	5,840,754.0	1,833.0	97.3	29.39	301	327.4
07/30/14	08:11	5,888,889.0	1,833.0	98.1	29.40	301	327.1
07/30/14	08:12	5,912,288.0	1,833.0	98.5	29.41	302	326.8
	Average	5,840,701.4	1,833.0	97.3	29.40	301	327.1
	Minimum	5,792,370.0	1,833.0	96.5	29.39	298	326.8
	Maximum	5,912,288.0	1,833.0	98.5	29.42	303	327.4
	Summation	40,884,910.0	12,831.0	681.2	205.81	2,108	2,289.8
	Included Data Points	7	7	7	7	7	7
	Total number of Data Points	7	7	7	7	7	7

F = Unit Offline **E = Exceedance** **C = Calibration** **S = Substituted** **U - Startup**
I = Invalid **M = Maintenance** **T = Out Of Control** *** = Suspect** **D - Shutdown**

B9 MID FLOW RUN 8

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 07/30/2014 08:13 Through 07/30/2014 08:19
Time Online Criteria: 1 minute(s)

Source		B9					
Parameter)Unit(		B9CPFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
07/30/14	08:13	5,859,212.0	1,833.0	97.7	29.41	303	326.7
07/30/14	08:14	5,817,689.0	1,833.0	97.0	29.41	302	326.4
07/30/14	08:15	5,789,361.0	1,833.0	96.5	29.41	302	326.2
07/30/14	08:16	5,766,003.0	1,833.0	96.1	29.41	302	326.1
07/30/14	08:17	5,774,220.0	1,833.0	96.2	29.43	300	326.1
07/30/14	08:18	5,808,251.0	1,833.0	96.8	29.41	301	326.4
07/30/14	08:19	5,813,148.0	1,833.0	96.9	29.41	302	326.5
	Average	5,803,983.4	1,833.0	96.7	29.41	302	326.3
	Minimum	5,766,003.0	1,833.0	96.1	29.41	300	326.1
	Maximum	5,859,212.0	1,833.0	97.7	29.43	303	326.7
	Summation	40,627,884.0	12,831.0	677.2	205.89	2,112	2,284.4
	Included Data Points	7	7	7	7	7	7
	Total number of Data Points	7	7	7	7	7	7

F = Unit Offline **E = Exceedance** **C = Calibration** **S = Substituted** **U - Startup**
I = Invalid **M = Maintenance** **T = Out Of Control** *** = Suspect** **D - Shutdown**

B9 MED FLOW RUN 9

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 07/30/2014 08:20 Through 07/30/2014 08:26
Time Online Criteria: 1 minute(s)

Source		B9					
Parameter)Unit(		B9CPFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
07/30/14	08:20	5,825,427.0	1,833.0	97.1	29.42	301	326.4
07/30/14	08:21	5,846,954.0	1,833.0	97.4	29.40	301	326.3
07/30/14	08:22	5,835,532.0	1,833.0	97.3	29.42	300	326.4
07/30/14	08:23	5,829,351.0	1,833.0	97.2	29.42	301	326.4
07/30/14	08:24	5,843,650.0	1,833.0	97.4	29.40	302	326.5
07/30/14	08:25	5,837,107.0	1,833.0	97.3	29.42	301	326.5
07/30/14	08:26	5,817,461.0	1,833.0	97.0	29.41	300	326.4
	Average	5,833,640.3	1,833.0	97.2	29.41	301	326.4
	Minimum	5,817,461.0	1,833.0	97.0	29.40	300	326.3
	Maximum	5,846,954.0	1,833.0	97.4	29.42	302	326.5
	Summation	40,835,482.0	12,831.0	680.7	205.89	2,106	2,284.9
	Included Data Points	7	7	7	7	7	7
	Total number of Data Points	7	7	7	7	7	7

F = Unit Offline **E = Exceedance** **C = Calibration** **S = Substituted** **U - Startup**
I = Invalid **M = Maintenance** **T = Out Of Control** *** = Suspect** **D - Shutdown**

B9 MID FLOW RUN10

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 07/30/2014 08:27 Through 07/30/2014 08:33
Time Online Criteria: 1 minute(s)

Source		B9					
Parameter)Unit(		B9CPFLOW (SCFH)	B9FFACT (MMBTU/CF)	B9PFLOW (KSCFM)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
07/30/14	08:27	5,778,936.0	1,833.0	96.3	29.40	300	326.0
07/30/14	08:28	5,728,555.0	1,833.0	95.5	29.42	301	325.8
07/30/14	08:29	5,711,851.0	1,833.0	95.2	29.41	300	326.0
07/30/14	08:30	5,752,003.0	1,833.0	95.9	29.40	300	326.1
07/30/14	08:31	5,791,386.0	1,833.0	96.5	29.40	301	326.4
07/30/14	08:32	5,784,763.0	1,833.0	96.4	29.40	302	326.5
07/30/14	08:33	5,804,216.0	1,833.0	96.7	29.43	302	326.5
	Average	5,764,530.0	1,833.0	96.1	29.41	301	326.2
	Minimum	5,711,851.0	1,833.0	95.2	29.40	300	325.8
	Maximum	5,804,216.0	1,833.0	96.7	29.43	302	326.5
	Summation	40,351,710.0	12,831.0	672.5	205.86	2,106	2,283.3
	Included Data Points	7	7	7	7	7	7
	Total number of Data Points	7	7	7	7	7	7

F = Unit Offline **E = Exceedance** **C = Calibration** **S = Substituted** **U - Startup**
I = Invalid **M = Maintenance** **T = Out Of Control** *** = Suspect** **D - Shutdown**

APPENDIX I

PROCEDURES

Please Note: In an effort to conserve paper, the procedure section of the appendix has been reserved for explanations of EPA methodology deviations. Please refer to the specific EPA Methods on the following EPA website: http://www.epa.gov/ttn/emc/

APPENDIX J

CALCULATION EQUATIONS

Summarize the results on a data sheet similar to that shown in Figure 2–2 (in Section 18.0).

12.1 All data from the RM and CEMS must be on a consistent dry basis and, as applicable, on a consistent diluent basis and in the units of the emission standard. Correct the RM and CEMS data for moisture and diluent as follows:

12.1.1 Moisture Correction (as applicable). Correct each wet RM run for moisture with the corresponding Method 4 data; correct each wet CEMS run using the corresponding CEMS moisture monitor date using Equation 2–1.

$$\text{Concentration}_{(\text{dry})} = \frac{Concentration_{wet}}{(1 - B_{ws})} \qquad \text{Eq. 2-1}$$

12.1.2 Correction to Units of Standard (as applicable). Correct each dry RM run to the units of the emission standard with the corresponding Method 3B data; correct each dry CEMS run using the corresponding CEMS diluent monitor data as follows:

12.1.2.1 Correct to Diluent Basis. The following is an example of concentration (ppm) correction to 7% oxygen.

$$\text{ppm}_{(\text{corr})} = \text{ppm}_{(\text{uncorr})} \left[\frac{20.9 - 7.0}{20.9 - \%O_{2(dry)}} \right] \qquad \text{Eq. 2-2}$$

The following is an example of mass/gross calorific value (lbs/million Btu) correction.

lbs/MMBtu=Conc(dry)(F-factor) (20.9/20.9-%O_2)

12.2 Arithmetic Mean. Calculate the arithmetic mean of the difference, d, of a data set as follows:

$$\bar{d} = \frac{1}{n} \sum_{i=1}^{n} d_i \qquad \text{Eq. 2-3}$$

Where:

n=Number of data points.

$$\sum_{i=1}^{n} d_i = \text{Algebraic summation of the individual differences } d_i.$$

12.3 Standard Deviation. Calculate the standard deviation, S_d, as follows:

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$$S_d = \left[\frac{\sum_{i=1}^{n} d_i^2 - \frac{\left[\sum_{i=1}^{n} d_i\right]^2}{n}}{n-1} \right]^{\frac{1}{2}} \qquad Eq.\ 2\text{-}4$$

12.4 Confidence Coefficient. Calculate the 2.5 percent error confidence coefficient (one-tailed), CC, as follows:

$$CC = t_{0.975} \frac{S_d}{\sqrt{n}} \qquad Eq.\ 2\text{-}5$$

Where:

$t_{0.975}$=t-value (see Table 2–1).

12.5 Relative Accuracy. Calculate the RA of a set of data as follows:

$$RA = \frac{\left[\left|\bar{d}\right| + \left|CC\right|\right]}{\overline{RM}} \times 100 \qquad Eq.\ 2\text{-}6$$

Where:

|d|=Absolute value of the mean differences (from Equation 2–3).

|CC|=Absolute value of the confidence coefficient (from Equation 2–3).

RM=Average RM value. In cases where the average emissions for the test are less than 50 percent of the applicable standard, substitute the emission standard value in the denominator of Eq. 2–6 in place ofRM. In all other cases, useRM.

13.0 Method Performance

13.1 Calibration Drift Performance Specification. The CEMS calibration must not drift or deviate from the reference value of the gas cylinder, gas cell, or optical filter by more than 2.5 percent of the span value. If the CEMS includes pollutant and diluent monitors, the CD must be determined separately for each in terms of concentrations (See Performance Specification 3 for the diluent specifications), and none of the CDs may exceed the specification.

13.2 Relative Accuracy Performance Specification. The RA of the CEMS must be no greater than 20 percent when RMis used in the denominator of Eq. 2–6 (average emissions during test are greater than 50 percent of the emission standard) or 10 percent when the applicable emission standard is used in the denominator of Eq. 2–6 (average emissions during test are less than 50 percent of the emission standard). For SO_2emission standards of 130 to and including 86 ng/J (0.30 and 0.20 lb/million Btu), inclusive, use 15 percent of the applicable standard; below 86 ng/J (0.20 lb/million Btu), use 20 percent of the emission standard.

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APPENDIX K

AETB REQUIREMENTS

Interpoll Laboratories, Inc.
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August 21, 2014

Manitowoc Public Utilities
Thomas E. Reed
1303 South 8th Street
P.O. Box 1090
Manitowoc, WI 54221-1090

Re: Part 75 Air Emission Testing Body Requirements

Mr. Reed

This letter addresses the requirements of 40 CFR Part 75. Specifically; effective March 27, 2012, 40 CFR Part 75 test programs must be conducted by an Air Emissions Testing Body (AETB) in accordance with the requirements set forth in ASTM D 7036-04, Standard Practice for Competent Air Emission Testing Body.

Consistent with Section 6.2.1(c), Appendix A, 40 CFR Part 75, the AETB shall provide to each customer a certification that the AETB operates in conformance with, and that data has been collected in accordance with, the requirements of ASTM D 7036-04.

This letter serves as certification that Interpoll Laboratories, Inc. does provide data and services which comply with the above requirements.

Regards,

Daniel Despen
President
Interpoll Laboratories, Inc.

SOURCE EVALUATION SOCIETY

Qualified Source Testing Individual

LET IT BE KNOWN THAT

AARON M. WILSON

HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

GASEOUS POLLUTANTS INSTRUMENTAL SAMPLING METHODS

ISSUED THIS 22ND DAY OF FEBRUARY 2012 AND EFFECTIVE UNTIL FEBRUARY 21ST, 2017

Peter R. Westlin, QSTI/QSTO Review Board

C. David Bagwell, QSTI/QSTO Review Board

Peter S. Pakalnis, QSTI/QSTO Review Board

Karen D. Kajiya-Mills , QSTI/QSTO Review Board

LeRoy Owens, QSTI/QSTO Review Board

Glenn C. England, QSTI/QSTO Review Board

APPLICATION NO. 2012-643

MPU02916

SOURCE EVALUATION SOCIETY

Qualified Source Testing Individual

LET IT BE KNOWN THAT

AARON M. WILSON

HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

MANUAL GAS VOLUME MEASUREMENTS AND ISOKINETIC PARTICULATE SAMPLING METHODS

ISSUED THIS 22ND DAY OF FEBRUARY 2012 AND EFFECTIVE UNTIL FEBRUARY 21ST, 2017

Peter R. Westlin, QSTI/QSTO Review Board

C. David Bagwell, QSTI/QSTO Review Board

Peter S. Pakalnis, QSTI/QSTO Review Board

Karen D. Kajiya-Mills, QSTI/QSTO Review Board

LeRoy Owens, QSTI/QSTO Review Board

Glenn C. England, QSTI/QSTO Review Board

APPLICATION NO. 2012-643

MPU02917

Stack Vision Entry Requirements

Required AETB Data Per Part 75

Field	Entry	Description
QI Last Name	Aaron	Required-Qualified Individual's last name
QI First Name	Wilson	Required-Qualified Individual's first name
QI Middle Initial	M.	Required-Qualified Individual's middle initial
AETB Name	Interpoll Laboratories, Inc.	Required-The AETB company whom the Qualified Individual represents.
AETB Phone Number	763-786-6020	Required-AETB company phone number.
AETB Email	stack@interpoll-labs.com	Required-AETB company email address or the email address of the qualified individual.
Exam Date	1/13/2012	Required-Date the Qualified Individual completed the AETB exam that certifies this person to conduct RATA tests.
Exam Provider Name	Source Evaluation Society	Required-Name of the agency who provided the exam
Exam Provider Email	qstiprogram@gmail.com	Required-Email address for the agency who provided the exam.
Comment		Optional field for additional comments.

Note-Interpoll Laboratories will be providing a letter of certification signed by a member of the senior management staff of the AETB for the clients records.

MPU02918