Interpoll Laboratories, Inc.
4500 Ball Road N.E.
Circle Pines, Minnesota 55014-1819

TEL: (763) 786-6020
FAX: (763) 786-7854

RESULTS OF THE SEPTEMBER 21-22, 2011 RELATIVE ACCURACY TEST AUDIT OF THE $SO_2/NO_x/CO_2$/FLOW CEM SYSTEM INSTALLED ON THE S20 STACK 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
Coordinator
Source Testing

Report Number 11-30312-S20
October 26, 2011
DVH

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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 September 21-22, 2011, Interpoll Laboratories personnel conducted a Title 40, Part 75, $SO_2/NO_x/CO_2$ and Flow Relative Accuracy Test Audit of the CEM System installed on the S20 Stack at the Manitowoc Public Utilities Facility in Manitowoc, Wisconsin. The following CEMs were tested:

Monitor Type	Manufacturer	Model	Serial No.	Location
NO_x	TECO	42i-d	0908635558	S20 Stack
SO_2	TECO	43i	0908635559	S20 Stack
CO_2	TECO	41i	0811429266	S20 Stack
Flow	United Sciences	100	9401760	S20 Stack

On-site testing was performed by Rory Eiynck and Andrew Strong. Jake Jensen of Mechanical Systems, Inc. provided coordination between testing activities and plant operation. A representative of the Wisconsin DNR did not witness testing.

Sulfur dioxide, oxides of nitrogen, and carbon dioxide evaluations were performed in accordance with EPA Methods 3A 6C, and 7E CFR Title 40, Part 60, Appendix A (revised August, 2010) and as per Part 75. For oxygen analysis, a slipstream of sample gas was withdrawn from the exhaust gas stream using test ports (provided by the plant) 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 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 SO_2, NO_x and CO_2 analyzers.

The test runs were performed by moving the sample probe through a three-point traverse (1/6, 3/6, 5/6 of the duct depth). The instruments were calibrated before and after the runs as per EPA Methods 3A, 6C, and 7E using EPA Protocol gases.

MPU00601

The reference method CO_2, SO_2, and NO_x concentrations were recorded using a computer datalogger. Copies of the computer printouts are included in this report.

Moisture determinations were performed in accordance with EPA Method 4. Volumetric flow rate determinations were determined with a Type S pitot tube using EPA Method 2 and applying the default wall adjustment factor of 0.9900 for a brick lined stack according to Method 2H, section 2.2.2. Flow measurements were conducted from four test ports oriented at ninety degrees on the stack using a 16-point traverse. The flow rate monitor was certified at low and mid load conditions.

The results of the CEM Relative Accuracy Test Audit are summarized in Section 2. Field data and all other supporting information are presented in the appendices.

MPU00602

2 SUMMARY AND DISCUSSION

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

S20 STACK RELATIVE ACCURACY RESULTS

Parameter	Units	Measured
NO_x	LB/10^6BTU	5.61
NO_x	ppm,w	2.62
SO_2	ppm,w	4.51
SO_2	LB/10^6BTU	7.24
CO_2	% v/v,w	3.19
Flow (LOW/NORMAL)	SCFH	1.74
Flow (MID)	SCFH	2.93

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.

MPU00603

Summary of the Results of the September 22, 2011, Relative Accuracy Test Audit of the NOx Analyzer Installed on the Boiler S20 Stack at the Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

Low "Normal" Load (80 Klbs/Hr)

				Nox Lbs/mmBTU		
Run		**Date**	**Time**	**RM**	**CEM**	**DIFF.**
1		09/22/11	19:40 - 20:00	0.146	0.151	-0.005
2		09/22/11	20:50 - 21:10	0.172	0.174	-0.002
3		09/22/11	21:25 - 21:45	0.162	0.158	0.004
4		09/22/11	22:00 - 22:20	0.182	0.177	0.005
5		09/22/11	22:35 - 22:55	0.173	0.165	0.008
6		09/22/11	23:10 - 23:30	0.175	0.167	0.008
7		09/22/11	12:00 - 12:20	0.177	0.166	0.011
8	*	09/22/11	12:35 - 12:55	0.188	0.175	0.013
9		09/22/11	1:10 - 1:30	0.188	0.178	0.010
10		09/22/11	1:45 - 2:05	0.191	0.181	0.010
Average Diff.				0.174	0.169	0.005444
Standard Deviation						0.006
Confidence Coefficient						0.004316
Relative Accuracy						5.61
Bias Test						Fail
Bias Adjustment Factor						1.032

* Run was not used in Relative Accuracy calculation

RM = Reference Method

CEM = Continuous Emission Monitor

Summary of the Results of the September 22, 2011, Relative Accuracy Test Audit of the NOx Analyzer Installed on the Boiler S20 Stack at the Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

Low "Normal" Load (80 Klbs/Hr)

					Nox ppm, wet		
Run		**Date**	**Time**		**RM**	**CEM**	**DIFF.**
1		09/22/11	19:40 -	20:00	40.6	42.6	-2.0
2		09/22/11	20:50 -	21:10	47.0	49.0	-2.0
3		09/22/11	21:25 -	21:45	46.1	45.9	0.2
4		09/22/11	22:00 -	22:20	51.2	51.4	-0.2
5		09/22/11	22:35 -	22:55	48.6	47.6	1.0
6		09/22/11	23:10 -	23:30	49.4	48.1	1.3
7		09/22/11	12:00 -	12:20	50.1	48.6	1.5
8	*	09/22/11	12:35 -	12:55	52.3	50.5	1.8
9		09/22/11	1:10 -	1:30	52.4	51.1	1.3
10		09/22/11	1:45 -	2:05	53.0	52.1	0.9
Average Diff.					48.711	48.489	0.222
Standard Deviation							1.373
Confidence Coefficient							1.055188
Relative Accuracy							2.62
Bias Test							Pass
Bias Adjustment Factor							1.005

* Run was not used in Relative Accuracy calculation

RM = Reference Method

CEM = Continuous Emission Monitor

Summary of the Results of the September 22, 2011, Relative Accuracy Test Audit of the SO2 Analyzer Installed on the Boiler S20 Stack at the Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

Low "Normal" Load (80 Klbs/Hr)

						SO_2 ppm, wet		
Run		**Date**	**Time**			**RM**	**CEM**	**DIFF.**
1	*	09/22/11	19:40	-	20:00	153.9	146.3	7.6
2		09/22/11	20:50	-	21:10	88.0	84.7	3.3
3		09/22/11	21:25	-	21:45	107.8	102.5	5.3
4		09/22/11	22:00	-	22:20	86.6	82.2	4.4
5		09/22/11	22:35	-	22:55	95.6	92.1	3.5
6		09/22/11	23:10	-	23:30	95.0	90.9	4.1
7		09/22/11	12:00	-	12:20	97.4	94.6	2.8
8		09/22/11	12:35	-	12:55	92.7	89.5	3.2
9		09/22/11	1:10	-	1:30	93.8	91.1	2.7
10		09/22/11	1:45	-	2:05	91.2	88.2	3.0
Average Diff.						94.233	90.644	3.588889
Standard Deviation								0.855
Confidence Coefficient								0.657249
Relative Accuracy								4.51
Bias Test								Fail
Bias Adjustment Factor								1.040

* Run was not used in Relative Accuracy calculation

RM = Reference Method

CEM = Continuous Emission Monitor

Summary of the Results of the September 22, 2011, Relative Accuracy Test Audit of the SO2 Analyzer Installed on the Boiler S20 Stack at the Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

Low "Normal" Load (80 Klbs/Hr)

				SO_2 Lbs/mmBTU		
Run		**Date**	**Time**	**RM**	**CEM**	**DIFF.**
1	*	09/22/11	19:40 - 20:00	0.769	0.717	0.052
2		09/22/11	20:50 - 21:10	0.447	0.419	0.028
3		09/22/11	21:25 - 21:45	0.528	0.490	0.038
4		09/22/11	22:00 - 22:20	0.429	0.395	0.034
5		09/22/11	22:35 - 22:55	0.474	0.444	0.030
6		09/22/11	23:10 - 23:30	0.470	0.437	0.033
7		09/22/11	12:00 - 12:20	0.479	0.449	0.030
8		09/22/11	12:35 - 12:55	0.463	0.432	0.031
9		09/22/11	1:10 - 1:30	0.467	0.440	0.027
10		09/22/11	1:45 - 2:05	0.456	0.425	0.031
Average Diff.				0.468	0.437	0.031333
Standard Deviation						0.003
Confidence Coefficient						0.002549
Relative Accuracy						7.24
Bias Test						Fail
Bias Adjustment Factor						1.072

* Run was not used in Relative Accuracy calculation

RM = Reference Method

CEM = Continuous Emission Monitor

Summary of the Results of the September 22, 2011, Relative Accuracy Test Audit on the CO2 Analyzer Installed on the Boiler S20 Stack at the Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

Low "Normal" Load (80 Klbs/Hr)

						CO_2, wet Summary		
Run		**Date**	**Time**			**RM**	**CEM**	**DIFF.**
1		09/22/11	12:20	-	12:40	6.1	6.2	-0.1
2		09/22/11	12:50	-	13:10	6.0	6.2	-0.2
3		09/22/11	13:20	-	13:40	6.2	6.4	-0.2
4		09/22/11	13:50	-	14:10	6.2	6.3	-0.1
5		09/22/11	14:30	-	14:50	6.2	6.3	-0.1
6		09/22/11	15:00	-	15:20	6.2	6.3	-0.1
7		09/22/11	15:30	-	15:50	6.2	6.4	-0.2
8		09/22/11	14:00	-	14:20	6.1	6.3	-0.2
9		09/22/11	16:30	-	16:50	6.1	6.3	-0.2
10	*	09/22/11	17:00	-	17:20	6.1	6.3	-0.2
Average Difference						6.144	6.300	-0.15556
Standard Deviation								0.053
Confidence Coefficient								0.040512
Relative Accuracy								3.19
Bias Test								Pass
Bias Adjustment Factor								0.975

* Run was not used in Relative Accuracy calculation

RM = Reference Method

CEM = Continuous Emission Monitor

Summary of the Results of the September 22, 2011, Relative Accuracy Test Audit on the Flow Analyzer Installed on the Boiler S20 Stack at the Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

Low "Normal" Load (80 Klbs/Hr)

Run		Date	Time			Flow (SCFH) Summary RM	CEM	DIFF.
1		09/22/11	12:27	-	12:35	3,453,000	3,383,249	69,751
2		09/22/11	12:50	-	13:00	3,440,000	3,426,237	13,763
3	*	09/22/11	13:20	-	13:30	3,378,000	3,509,803	-131,803
4		09/22/11	13:50	-	14:00	3,389,000	3,517,113	-128,113
5		09/22/11	14:30	-	14:40	3,538,000	3,479,522	58,478
6		09/22/11	15:00	-	15:10	3,482,000	3,522,829	-40,829
7		09/22/11	15:30	-	15:40	3,385,000	3,436,557	-51,557
8		09/22/11	14:00	-	14:10	3,429,000	3,500,158	-71,158
9		09/22/11	16:30	-	16:40	3,490,000	3,465,973	24,027
10		09/22/11	17:00	-	17:10	3,530,000	3,460,722	69,278
Average Difference						3459555.556	3465817.900	-6262.34444
Standard Deviation								70088.956
Confidence Coefficient								53875.044557
Relative Accuracy								1.74
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 September 21, 2011 Relative Accuracy Test Audit of the Flow Analyzer Installed on the Boiler S20 Stack at the Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

				140 Klbs/Hr		
				Flow (SCFH)		
Run	Date	Time		RM	CEM	DIFF.
1	09/21/11	20:35 - 20:44		4,053,000	4,003,975	49,025
2	09/21/11	8:45 - 20:52		3,982,000	4,111,413	-129,413
3	09/21/11	20:53 - 21:00		4,088,000	4,068,362	19,638
4	09/21/11	21:12 - 21:18		3,995,000	4,124,785	-129,785
5	* 09/21/11	21:19 - 21:26		3,879,000	4,106,081	-227,081
6	09/21/11	21:27 - 21:33		3,978,000	4,061,709	-83,709
7	09/21/11	21:42 - 21:48		3,985,000	3,985,047	-47
8	09/21/11	21:49 - 21:55		4,006,000	4,084,217	-78,217
9	09/21/11	21:56 - 22:02		3,929,000	4,073,784	-144,784
10	09/21/11	22:03 - 22:08		3,931,000	4,000,160	-69,160
Average Diff.				3994111.111	4057050.278	-62939.167
Confidence Coefficient						54080.198076
Standard Deviation						70355.852
Relative Accuracy						2.93
Bias Test						Pass
Bias Adjustment Factor						0.984486471

* Run was not used in Relative Accuracy calculation

RM = Reference Method

CEM = Continuous Emission Monitor

APPENDIX A

SAMPLING TRAIN CALIBRATION DATA

INTERPOLL LABORATORIES, INC.
(763) 786-6020

Stack Sampling Department - QA
Field Barometer Calibration Sheet

Date:	4/14/2011
Technician:	Rory Eiynck
Mercury Column Barometer Number:	Weighing Room Barometer
Aneroid Barometer Number:	Ultimeter #3 (Rory's)

Reference Mercury Barometer Reading	Ambient Temperature	Temperature Correction Factor	Adjusted Mercury Barometer Reading	Initial Field Barometer Reading	Difference (P_{ba} - P_{bm})
29.36	76	0.132	29.23	29.24	0.012

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.

MPU00612

INTERPOLL LABORATORIES, INC.
(763) 786-6020

Temperature Measurement Device Calibration Sheet

Unit under Test:

Vendor	CEN-TECH	Serial Number	5183648
Model	92242	Thermocouple Type	Type K
Range	0-2100 °F	Technician	Rory Eiynck
Date of Calibration	4/14/2011	PDT Number	109

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 oF) +/- 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	1	1	0.217
100	98	2	0.357
200	203	3	0.455
300	299	1	0.132
400	398	2	0.233
500	497	3	0.313
600	599	1	0.094
700	695	5	0.431
800	798	2	0.159
900	896	4	0.294
1000	999	1	0.068
1100	1098	2	0.128
1200	1198	2	0.120
1300	1299	1	0.057
1400	1398	2	0.108
1500	1498	2	0.102
1600	1598	2	0.097
1700	1695	5	0.231
1800	1794	6	0.265
1900	1894	6	0.254
2000	1996	4	0.163
2100			
	Average:	**3**	**0.204**

OF = off scale response by unit under test (oF)

% 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	Omega	Serial Number	201108
Model	hh-81	Thermocouple Type	Type K
Range	0-2100 °F	Technician	Rory Eiynck
Date of Calibration	4/14/2011	PDT Number	85

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 oF) +/- 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	101	1	0.179
200	205	5	0.758
300	302	2	0.263
400	402	2	0.233
500	500	0	0.000
600	603	3	0.283
700	699	1	0.086
800	803	3	0.238
900	901	1	0.074
1000	1004	4	0.274
1100	1103	3	0.192
1200	1204	4	0.241
1300	1304	4	0.227
1400	1404	4	0.215
1500	1504	4	0.204
1600	1605	5	0.243
1700	1702	2	0.093
1800	1800	0	0.000
1900	1901	1	0.042
2000			
2100	OF		
	Average:	**3**	**0.214**

OF = off scale response by unit under test (oF)

% 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:	**10-May-11**
Standard Pitot ID:	**001**	Personnel:	**WB**
Cp(std):	**0.99**	Cp(actual):	**0.816**
Part Number:		P(bar):	**29.50**
Test Velocity (fps):	**30 - 60 - 90**	T(°F):	**63**

Calibration Results

Velocity (fps)	Nominal ΔPs [inches H_2O]	$Cp_{(s)}$ A-Side	$Cp_{(s)}$ B-Side	$Cp_{(s)}$ Average
30	0.304	0.810	0.809	0.810
60	1.148	0.821	0.817	0.819
90	2.649	0.820	0.819	0.819
		Overall Average		0.816

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.

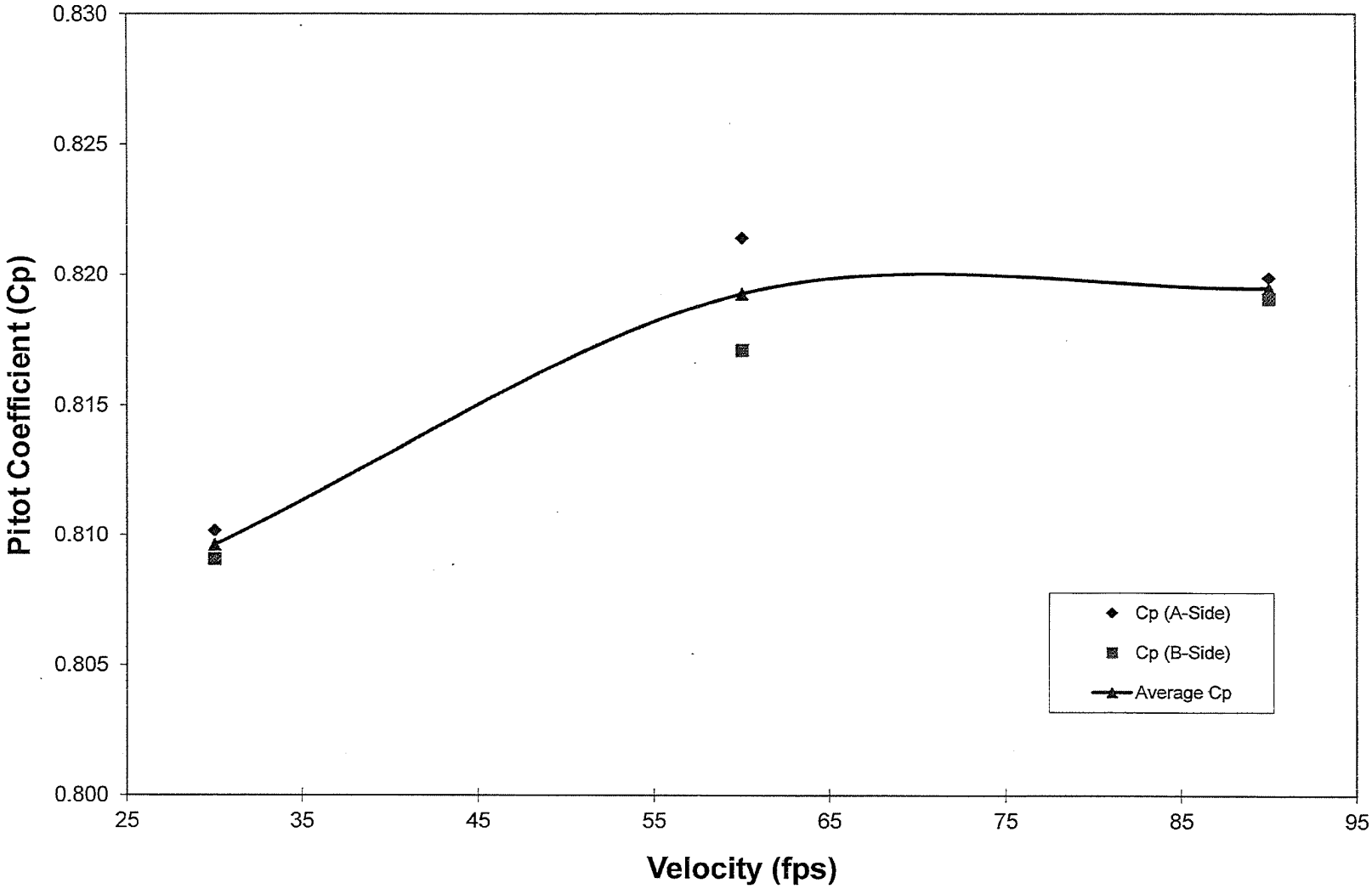
William Burkett
Signature

5/10/2011
Date

2142 E. Geer Street, Durham, North Carolina 27704 www.environsupply.com 919-956-9688 FAX: 919-682-0333

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

Environmental Supply Company Wind Tunnel - 5/11/2011



MPU00616

Environmental Supply Company, Inc.

Quality Source Sampling Systems & Accessories

Wind Tunnel Pitot Calibration

S-type Pitot ID:	**04-5+P1**	Date:	**10-May-11**
Standard Pitot ID:	**001**	Personnel:	**WB**
Cp(std):	**0.99**	Cp(actual):	**0.810**
Part Number:		P(bar):	**29.50**
Test Velocity (fps):	**30**	T(°F):	**63**

A-SIDE

ΔP_{std} (in. H_2O)	ΔP_s (in. H_2O)	Cp(s)	Deviation*
0.203	**0.305**	**0.807**	-0.003
0.203	**0.300**	**0.814**	0.004
0.204	**0.301**	**0.815**	0.005
0.201	**0.304**	**0.805**	-0.005
	AVERAGE	**0.810**	0.004
		Std deviation	0.005

B-SIDE

ΔP_{std} (in. H_2O)	ΔP_s (in. H_2O)	Cp(s)	Deviation*
0.203	**0.306**	**0.806**	-0.003
0.204	**0.304**	**0.810**	0.001
0.205	**0.306**	**0.811**	0.002
0.203	**0.305**	**0.809**	0.000
	AVERAGE	**0.809**	0.001
		Std deviation	0.002

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

Cp(A) - Cp(B) = 0.001 {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.

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Environmental Supply Company, Inc.

Quality Source Sampling Systems & Accessories

Wind Tunnel Pitot Calibration

S-type Pitot ID:	**04-5+P1**	Date:	**10-May-11**
Standard Pitot ID:	**001**	Personnel:	**WB**
Cp(std):	**0.99**	Cp(actual):	**0.819**
Part Number:		P(bar):	**29.50**
Test Velocity (fps):	**60**	T(°F):	**63**

A-SIDE

ΔP_{std} (in. H_2O)	ΔP_s (in. H_2O)	Cp(s)	Deviation*
0.782	**1.152**	**0.816**	-0.006
0.787	**1.142**	**0.822**	0.001
0.786	**1.143**	**0.821**	0.000
0.789	**1.130**	**0.827**	0.006
	AVERAGE	**0.821**	0.003
		Std deviation	0.005

B-SIDE

ΔP_{std} (in. H_2O)	ΔP_s (in. H_2O)	Cp(s)	Deviation*
0.789	**1.150**	**0.820**	0.003
0.785	**1.150**	**0.818**	0.001
0.785	**1.164**	**0.813**	-0.004
0.786	**1.151**	**0.818**	0.001
	AVERAGE	**0.817**	0.002
		Std deviation	0.003

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

Cp(A) - Cp(B) = 0.004 {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.

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Environmental Supply Company, Inc.

Quality Source Sampling Systems & Accessories

Wind Tunnel Pitot Calibration

S-type Pitot ID:	**04-5+P1**	Date:	**10-May-11**
Standard Pitot ID:	**001**	Personnel:	**WB**
Cp(std):	**0.99**	Cp(actual):	**0.819**
Part Number:		P(bar):	**29.50**
Test Velocity (fps):	**90**	T(°F):	**63**

A-SIDE

ΔP_{std} (in. H_2O)	ΔP_s (in. H_2O)	Cp(s)	Deviation*
1.824	**2.644**	**0.822**	0.002
1.811	**2.639**	**0.820**	0.000
1.815	**2.645**	**0.820**	0.000
1.802	**2.646**	**0.817**	-0.003
	AVERAGE	**0.820**	0.001
		Std deviation	0.002

B-SIDE

ΔP_{std} (in. H_2O)	ΔP_s (in. H_2O)	Cp(s)	Deviation*
1.821	**2.659**	**0.819**	0.000
1.809	**2.655**	**0.817**	-0.002
1.817	**2.655**	**0.819**	0.000
1.821	**2.649**	**0.821**	0.002
	AVERAGE	**0.819**	0.001
		Std deviation	0.001

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

Cp(A) - Cp(B) = 0.001 {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.

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APPENDIX B

REFERENCE METHOD COMPUTER PRINTOUTS

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
9/21/2011
Run 1-3

Time	$\%O_2$, d	$\%\ CO_2$, w
8:35:22	10.569	9.085
8:36:22	10.595	9.151
8:37:22	10.447	9.167
8:38:22	10.728	8.915
8:39:22	10.684	9.074
8:40:22	10.568	9.087
8:41:22	10.651	9.039
8:42:22	10.737	8.989
8:43:22	10.62	9.062
8:44:22	10.787	8.923
8:45:22	10.693	9.033
8:46:22	10.571	9.101
8:47:22	10.723	8.951
8:48:22	10.71	9.057
8:49:22	10.632	9.041
8:50:22	10.601	9.149
8:51:22	10.56	9.103
8:52:22	10.557	9.184
8:53:22	10.565	9.138
8:54:22	10.501	9.216
8:55:22	10.376	9.318
8:56:22	10.595	9.006
8:57:22	10.747	8.977
8:58:22	10.535	9.176
8:59:22	10.546	9.15
9:00:22	10.574	9.022
Average	**10.610**	**9.081**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

9/21/2011
Test 3M **Run 1**
140 Klbs/Hr

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.025	0.158	210	8:35 PM
2	A-2	0.030	0.173	210	
3	A-3	0.035	0.187	210	
4	A-4	0.025	0.158	210	
5	B-1	0.028	0.167	212	
6	B-2	0.032	0.179	212	
7	B-3	0.031	0.176	212	
8	B-4	0.025	0.158	212	
9	C-1	0.025	0.158	215	
10	C-2	0.032	0.179	215	
11	C-3	0.031	0.176	215	
12	C-4	0.020	0.141	215	
13	D-1	0.015	0.122	213	
14	D-2	0.018	0.134	213	
15	D-3	0.015	0.122	213	
16	D-4	0.012	0.110	213	8:44 PM
Average		0.0249	0.156	213	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	213		
Wet Bulb (°F)	108.0	Static Pressure	-0.38
TRA	1.18	Pitot Coefficient	0.815
Vapor Pressure of Water	2.45		
ZT	104.50	Duct Width (in.)	0.0
PM	133.78	Duct Length (in.)	0.0
Barometric Pressure	29.27	Duct Area (ft^2)	0.0
		Stack Diameter (in.)	168.0
		Stack Area (ft^2)	153.938
Moisture Content	4.57		
		Molecular Weight (dry)	29.95
O_2 %	10.615	Molecular Weight (wet)	29.403
CO_2 %	9.531	Stack Pressure	29.242
		Feet per Second	9.532
Standard CFH	4,053,428	Actual CFM	88040.65
K Standard CFH	67.557	DSCFM	64466.54

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	10.61	0.02	11.00	11.00	**10.61**	dry
CO_2 (wet)	9.08	0.05	8.51	8.52	**9.10**	wet

Moisture	4.57	**Standard CFH**	**4,053,428**
Fuel Factor C	1839	K Standard CFM	67.557
DSCFM	64467		

Results

Start Time	**8:35 PM**
Stop Time	**8:44 PM**
Standard CFH	**4,053,000**
CO_2 %, wet	**9.10**
WAF applied	**0.9900**

MSI / Manitowoc PU	**9/21/2011**
Manitowoc, WI	**Test 3M** **Run 2**
S20 Boiler Stack	**140 Klbs/Hr**

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.020	0.141	213	8:45 AM
2	A-2	0.015	0.122	213	
3	A-3	0.014	0.118	213	
4	A-4	0.010	0.100	213	
5	B-1	0.032	0.179	214	
6	B-2	0.030	0.173	214	
7	B-3	0.032	0.179	214	
8	B-4	0.025	0.158	214	
9	C-1	0.028	0.167	213	
10	C-2	0.031	0.176	213	
11	C-3	0.032	0.179	213	
12	C-4	0.022	0.148	213	
13	D-1	0.028	0.167	212	
14	D-2	0.028	0.167	212	
15	D-3	0.025	0.158	212	
16	D-4	0.015	0.122	212	8:52 PM
Average		0.0242	0.154	213	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	213		
Wet Bulb (°F)	108.0	Static Pressure	-0.40
TRA	1.18	Pitot Coefficient	0.82
Vapor Pressure of Wate	2.45		
ZT	105.00	Duct Width (in.)	0.00
PM	133.25	Duct Length (in.)	0.00
Barometric Pressure	29.27	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	168.00
		Stack Area (ft^2)	153.94
Moisture Content	4.56		
		Molecular Weight (dry)	29.952
O_2 %	10.6	Molecular Weight (wet)	29.408
CO_2 %	9.551	Stack Pressure	29.241
		Feet per Second	9.371
Standard CFH	3,981,989	Actual CFM	86557.64
K Standard CFH	66.366	DSCFM	63342.15

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	10.61	0.03	11.01	11.00	**10.60**	dry
CO_2 (wet)	9.08	0.04	8.49	8.52	**9.12**	wet

Moisture	4.56	**Standard CFH**	**3,981,989**
Fuel Factor C	1839	K Standard CFM	66.366
DSCFM	63342		

Results

Start Time	**8:45 AM**
Stop Time	**8:52 PM**
Standard CFH	**3,982,000**
CO_2 %, wet	**9.12**
WAF applied	**0.9900**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

9/21/2011
Test 3M **Run 3**
140 Klbs/Hr

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.022	0.148	214	8:53 PM
2	A-2	0.025	0.158	214	
3	A-3	0.030	0.173	214	
4	A-4	0.020	0.141	214	
5	B-1	0.030	0.173	212	
6	B-2	0.031	0.176	212	
7	B-3	0.035	0.187	212	
8	B-4	0.028	0.167	212	
9	C-1	0.028	0.167	210	
10	C-2	0.045	0.212	210	
11	C-3	0.037	0.192	210	
12	C-4	0.028	0.167	210	
13	D-1	0.014	0.118	210	
14	D-2	0.013	0.114	210	
15	D-3	0.013	0.114	210	
16	D-4	0.012	0.110	210	9:00 PM
Average		0.0257	0.157	212	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	212		
Wet Bulb (°F)	108.0	Static Pressure	-0.40
TRA	1.18	Pitot Coefficient	0.815
Vapor Pressure of Water	2.45		
ZT	103.50	Duct Width (in.)	0.00
PM	134.85	Duct Length (in.)	0.00
Barometric Pressure	29.27	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	168.00
		Stack Area (ft^2)	153.94
Moisture Content	4.61		
		Molecular Weight (dry)	29.953
O_2 %	10.6	Molecular Weight (wet)	29.402
CO_2 %	9.557	Stack Pressure	29.241
		Feet per Second	9.601
Standard CFH	4,088,455	Actual CFM	88673.41
K Standard CFH	68.141	DSCFM	64998.55

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	10.61	0.03	11.01	11.00	**10.60**	dry
CO_2 (wet)	9.08	0.04	8.49	8.52	**9.12**	wet

Moisture	4.61	**Standard CFH**	**4,088,455**
Fuel Factor C	1839	K Standard CFM	68.141
DSCFM	64999		

Results

Start Time	**8:53 PM**
Stop Time	**9:00 PM**
Standard CFH	**4,088,000**
CO_2 %, wet	**9.12**
WAF applied	**0.9900**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
9/21/2011
Run 4-6

Time	$\%O_2$, d	$\%\ CO_2$, w
9:12:52	10.518	9.125
9:13:52	10.652	9.093
9:14:52	10.701	9.091
9:15:52	10.548	9.228
9:16:52	10.487	9.206
9:17:52	10.604	9.059
9:18:52	10.808	8.94
9:19:52	10.836	8.973
9:20:52	10.651	9.144
9:21:52	10.543	9.136
9:22:52	10.695	9.04
9:23:52	10.747	8.955
9:24:52	10.835	8.849
9:25:52	10.841	8.935
9:26:52	10.906	8.787
9:27:52	10.909	8.849
9:28:52	10.929	8.715
9:29:52	11.096	8.748
9:30:52	10.676	9.061
9:31:52	10.794	8.792
9:32:52	11.026	8.74
9:33:52	10.958	8.819
Average	**10.762**	**8.968**

MSI / Manitowoc PU	**9/21/2011**
Manitowoc, WI	**Test 3M** **Run 4**
S20 Boiler Stack	**140 Klbs/Hr**

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.019	0.138	210	9:12 PM
2	A-2	0.012	0.110	210	
3	A-3	0.012	0.110	210	
4	A-4	0.012	0.110	210	
5	B-1	0.030	0.173	211	
6	B-2	0.029	0.170	211	
7	B-3	0.036	0.190	211	
8	B-4	0.028	0.167	211	
9	C-1	0.029	0.170	212	
10	C-2	0.036	0.190	212	
11	C-3	0.033	0.182	212	
12	C-4	0.023	0.152	212	
13	D-1	0.022	0.148	213	
14	D-2	0.020	0.141	213	
15	D-3	0.031	0.176	213	
16	D-4	0.019	0.138	213	9:18 PM
Average		0.0244	0.154	212	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	212		
Wet Bulb (°F)	106.0	Static Pressure	-0.41
TRA	1.19	Pitot Coefficient	0.815
Vapor Pressure of Wate	2.31		
ZT	105.50	Duct Width (in.)	0
PM	118.79	Duct Length (in.)	0
Barometric Pressure	29.27	Duct Area (ft^2)	0
		Stack Diameter (in.)	168
		Stack Area (ft^2)	153.93804
Moisture Content	4.06		
		Molecular Weight (dry)	29.929
O_2 %	10.751	Molecular Weight (wet)	29.445
CO_2 %	9.371	Stack Pressure	29.24
		Feet per Second	9.381
Standard CFH	3,995,005	Actual CFM	86649.21
K Standard CFH	66.583	DSCFM	63878.36

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	10.76	0.03	11.01	11.00	**10.75**	dry
CO_2 (wet)	8.97	0.04	8.50	8.52	**8.99**	wet

Moisture	4.06	**Standard CFH**	**3,995,005**
Fuel Factor C	1839	K Standard CFM	66.583
DSCFM	63878		

Results

Start Time	**9:12 PM**
Stop Time	**9:18 PM**
Standard CFH	**3,995,000**
CO_2 %, wet	**8.99**
WAF applied	**0.9900**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

9/21/2011
Test 3M **Run 5**
140 Klbs/Hr

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.023	0.152	211	9:19 PM
2	A-2	0.028	0.167	211	
3	A-3	0.031	0.176	211	
4	A-4	0.014	0.118	211	
5	B-1	0.030	0.173	212	
6	B-2	0.033	0.182	212	
7	B-3	0.039	0.197	212	
8	B-4	0.019	0.138	212	
9	C-1	0.021	0.145	212	
10	C-2	0.039	0.197	212	
11	C-3	0.031	0.176	212	
12	C-4	0.018	0.134	212	
13	D-1	0.012	0.110	213	
14	D-2	0.012	0.110	213	
15	D-3	0.014	0.118	213	
16	D-4	0.010	0.100	213	9:26 PM
Average		0.0234	0.150	212	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	212		
Wet Bulb (°F)	106.0	Static Pressure	-0.41
TRA	1.19	Pitot Coefficient	0.815
Vapor Pressure of Water	2.31		
ZT	106.00	Duct Width (in.)	0
PM	118.26	Duct Length (in.)	0
Barometric Pressure	29.27	Duct Area (ft^2)	0
		Stack Diameter (in.)	168
		Stack Area (ft^2)	153.93804
Moisture Content	4.04		
		Molecular Weight (dry)	29.927
O_2 %	10.752	Molecular Weight (wet)	29.445
CO_2 %	9.358	Stack Pressure	29.24
		Feet per Second	9.117
Standard CFH	3,879,355	Actual CFM	84203.48
K Standard CFH	64.656	DSCFM	62040.93

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	10.76	0.02	11.01	11.00	**10.75**	dry
CO_2 (wet)	8.97	0.03	8.51	8.52	**8.98**	wet

Moisture	4.04	**Standard CFH**	**3,879,355**
Fuel Factor C	1839	K Standard CFM	64.656
DSCFM	62041		

Results

Start Time	**9:19 PM**
Stop Time	**9:26 PM**
Standard CFH	**3,879,000**
CO_2 %, wet	**8.98**
WAF applied	**0.9900**

MSI / Manitowoc PU		**9/21/2011**	
Manitowoc, WI		**Test 3M**	**Run 6**
S20 Boiler Stack		**140 Klbs/Hr**	

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.019	0.138	214	9:27 PM
2	A-2	0.016	0.126	214	
3	A-3	0.013	0.114	214	
4	A-4	0.011	0.105	214	
5	B-1	0.021	0.145	213	
6	B-2	0.032	0.179	213	
7	B-3	0.038	0.195	213	
8	B-4	0.028	0.167	213	
9	C-1	0.026	0.161	213	
10	C-2	0.032	0.179	213	
11	C-3	0.031	0.176	213	
12	C-4	0.024	0.155	213	
13	D-1	0.025	0.158	214	
14	D-2	0.028	0.167	214	
15	D-3	0.026	0.161	214	
16	D-4	0.017	0.130	214	9:33 PM
Average		0.0242	0.154	214	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	214		
Wet Bulb (°F)	106.0	Static Pressure	-0.45
TRA	1.19	Pitot Coefficient	0.815
Vapor Pressure of Water	2.31		
ZT	107.50	Duct Width (in.)	0.00
PM	116.67	Duct Length (in.)	0.00
Barometric Pressure	29.27	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	168.00
		Stack Area (ft^2)	153.94
Moisture Content	3.99		
		Molecular Weight (dry)	29.927
O_2 %	10.752	Molecular Weight (wet)	29.451
CO_2 %	9.353	Stack Pressure	29.237
		Feet per Second	9.37
Standard CFH	3,977,871	Actual CFM	86543.26
K Standard CFH	66.298	DSCFM	63652.15

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	10.76	0.02	11.01	11.00	**10.75**	dry
CO_2 (wet)	8.97	0.03	8.51	8.52	**8.98**	wet

Moisture	3.99	**Standard CFH**	**3,977,871**
Fuel Factor C	1839	K Standard CFM	66.298
DSCFM	63652		

Results

Start Time	**9:27 PM**
Stop Time	**9:33 PM**
Standard CFH	**3,978,000**
CO_2 %, wet	**8.98**
WAF applied	**0.9900**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
9/21/2011
Run 7-9

Time	$\%O_2$, d	$\%\ CO_2$, w
9:42:52	10.729	9.049
9:43:52	10.854	8.903
9:44:52	10.639	9.155
9:45:52	10.775	8.893
9:46:52	10.986	8.796
9:47:52	10.864	8.945
9:48:52	10.86	8.906
9:49:52	10.874	8.868
9:50:52	11.014	8.783
9:51:52	10.929	8.819
9:52:52	10.844	9.06
9:53:52	10.614	8.994
9:54:52	11.094	8.622
9:55:52	11.148	8.745
9:56:52	11.084	8.681
9:57:52	11.11	8.785
9:58:52	10.779	8.999
9:59:52	11.033	8.703
10:00:52	11.041	8.793
10:01:52	11.102	8.665
10:02:52	11.082	8.796
10:03:52	11.009	8.731
10:04:52	11.354	8.507
10:05:52	10.96	8.812
10:06:52	10.863	8.913
10:07:52	10.868	8.82
10:08:52	11.056	8.711
Average	**10.947**	**8.832**

MSI / Manitowoc PU		**9/21/2011**	
Manitowoc, WI		**Test 3M**	**Run 7**
S20 Boiler Stack		**140 Klbs/Hr**	

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.020	0.141	214	9:42 PM
2	A-2	0.030	0.173	214	
3	A-3	0.031	0.176	214	
4	A-4	0.020	0.141	214	
5	B-1	0.030	0.173	215	
6	B-2	0.039	0.197	215	
7	B-3	0.034	0.184	215	
8	B-4	0.022	0.148	215	
9	C-1	0.021	0.145	213	
10	C-2	0.031	0.176	213	
11	C-3	0.030	0.173	213	
12	C-4	0.028	0.167	213	
13	D-1	0.018	0.134	214	
14	D-2	0.014	0.118	214	
15	D-3	0.013	0.114	214	
16	D-4	0.010	0.100	214	9:48 PM
Average		0.0244	0.154	214	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	214		
Wet Bulb (°F)	105.0	Static Pressure	-0.40
TRA	1.19	Pitot Coefficient	0.815
Vapor Pressure of Water	2.24		
ZT	109.00	Duct Width (in.)	0.00
PM	108.36	Duct Length (in.)	0.00
Barometric Pressure	29.27	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	168.00
		Stack Area (ft^2)	153.94
Moisture Content	3.71		
		Molecular Weight (dry)	29.906
O_2 %	10.937	Molecular Weight (wet)	29.465
CO_2 %	9.178	Stack Pressure	29.241
		Feet per Second	9.394
Standard CFH	3,985,478	Actual CFM	86762.22
K Standard CFH	66.425	DSCFM	63963.1

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	10.95	0.03	11.01	11.0	**10.94**	dry
CO_2 (wet)	8.83	0.04	8.52	8.5	**8.84**	wet

Moisture	3.71	**Standard CFH**	**3,985,478**
Fuel Factor C	1839	K Standard CFM	66.425
DSCFM	63963		

Results

Start Time	**9:42 PM**
Stop Time	**9:48 PM**
Standard CFH	**3,985,000**
CO_2 %, wet	**8.84**
WAF applied	**0.9900**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

9/21/2011
Test 3M **Run 8**
140 Klbs/Hr

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.019	0.138	215	9:49 PM
2	A-2	0.013	0.114	215	
3	A-3	0.012	0.110	215	
4	A-4	0.011	0.105	215	
5	B-1	0.029	0.170	214	
6	B-2	0.038	0.195	214	
7	B-3	0.039	0.197	214	
8	B-4	0.024	0.155	214	
9	C-1	0.033	0.182	212	
10	C-2	0.041	0.202	212	
11	C-3	0.030	0.173	212	
12	C-4	0.019	0.138	212	
13	D-1	0.020	0.141	213	
14	D-2	0.029	0.170	213	
15	D-3	0.029	0.170	213	
16	D-4	0.013	0.114	213	9:55 PM
Average		0.025	0.155	214	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	214		
Wet Bulb (°F)	105.0	Static Pressure	-0.42
TRA	1.19	Pitot Coefficient	0.815
Vapor Pressure of Water	2.24		
ZT	108.50	Duct Width (in.)	0.00
PM	108.90	Duct Length (in.)	0.00
Barometric Pressure	29.27	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	168.00
		Stack Area (ft^2)	153.94
Moisture Content	3.72		
		Molecular Weight (dry)	29.905
O_2 %	10.937	Molecular Weight (wet)	29.462
CO_2 %	9.175	Stack Pressure	29.239
		Feet per Second	9.435
Standard CFH	4,005,801	Actual CFM	87144.32
K Standard CFH	66.763	DSCFM	64276.84

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	10.95	0.03	11.01	11.0	**10.94**	dry
CO_2 (wet)	8.83	0.04	8.52	8.5	**8.83**	wet

Moisture	3.72	**Standard CFH**	**4,005,801**
Fuel Factor C	1839	K Standard CFM	66.763
DSCFM	64277		

Results

Start Time	**9:49 PM**
Stop Time	**9:55 PM**
Standard CFH	**4,006,000**
CO_2 %, wet	**8.83**
WAF applied	**0.9900**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

9/21/2011
Test 3M **Run 9**
140 Klbs/Hr

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.020	0.141	215	9:56 PM
2	A-2	0.021	0.145	215	
3	A-3	0.025	0.158	215	
4	A-4	0.019	0.138	215	
5	B-1	0.028	0.167	216	
6	B-2	0.031	0.176	216	
7	B-3	0.038	0.195	216	
8	B-4	0.027	0.164	216	
9	C-1	0.021	0.145	212	
10	C-2	0.037	0.192	212	
11	C-3	0.038	0.195	212	
12	C-4	0.021	0.145	212	
13	D-1	0.012	0.108	213	
14	D-2	0.015	0.122	213	
15	D-3	0.013	0.114	213	
16	D-4	0.015	0.122	213	10:02 PM
Average		0.0238	0.152	214	

Moisture Content Data		Flow Rate Data	
Dry Bulb (^{0}F)	214		
Wet Bulb (^{0}F)	105.0	Static Pressure	-0.39
TRA	1.19	Pitot Coefficient	0.815
Vapor Pressure of Water	2.24		
ZT	109.00	Duct Width (in.)	0.00
PM	108.36	Duct Length (in.)	0.00
Barometric Pressure	29.27	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	168.00
		Stack Area (ft^2)	153.94
Moisture Content	3.71		
		Molecular Weight (dry)	29.905
O_2 %	10.937	Molecular Weight (wet)	29.464
CO_2 %	9.173	Stack Pressure	29.241
		Feet per Second	9.261
Standard CFH	3,929,260	Actual CFM	85536.22
K Standard CFH	65.488	DSCFM	63060.98

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	10.95	0.03	11.01	11.0	**10.94**	dry
CO_2 (wet)	8.83	0.04	8.52	8.5	**8.83**	wet

Moisture	3.71	**Standard CFH**	**3,929,260**
Fuel Factor C	1839	K Standard CFM	65.488
DSCFM	63061		

Results

Start Time	**9:56 PM**
Stop Time	**10:02 PM**
Standard CFH	**3,929,000**
CO_2 %, wet	**8.83**
WAF applied	**0.9900**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
9/21/2011
Run 10

Time	$\%O_2$, d	$\%\ CO_2$, w
9:42:52	10.729	9.049
9:43:52	10.854	8.903
9:44:52	10.639	9.155
9:45:52	10.775	8.893
9:46:52	10.986	8.796
9:47:52	10.864	8.945
9:48:52	10.86	8.906
9:49:52	10.874	8.868
9:50:52	11.014	8.783
9:51:52	10.929	8.819
9:52:52	10.844	9.06
9:53:52	10.614	8.994
9:54:52	11.094	8.622
9:55:52	11.148	8.745
9:56:52	11.084	8.681
9:57:52	11.11	8.785
9:58:52	10.779	8.999
9:59:52	11.033	8.703
10:00:52	11.041	8.793
10:01:52	11.102	8.665
10:02:52	11.082	8.796
10:03:52	11.009	8.731
10:04:52	11.354	8.507
10:05:52	10.96	8.812
10:06:52	10.863	8.913
10:07:52	10.868	8.82
10:08:52	11.056	8.711
Average	**10.947**	**8.832**

MSI / Manitowoc PU	**9/21/2011**	
Manitowoc, WI	**Test 3M**	**Run 10**
S20 Boiler Stack	**140 Klbs/Hr**	

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.013	0.114	215	10:03 PM
2	A-2	0.016	0.126	215	
3	A-3	0.013	0.114	215	
4	A-4	0.014	0.118	215	
5	B-1	0.026	0.161	215	
6	B-2	0.038	0.195	215	
7	B-3	0.039	0.197	215	
8	B-4	0.019	0.138	215	
9	C-1	0.026	0.161	214	
10	C-2	0.034	0.184	214	
11	C-3	0.035	0.187	214	
12	C-4	0.021	0.145	214	
13	D-1	0.022	0.148	216	
14	D-2	0.024	0.155	216	
15	D-3	0.027	0.164	216	
16	D-4	0.015	0.122	216	10:08 PM
Average		0.024	0.152	215	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	215		
Wet Bulb (°F)	105.0	Static Pressure	-0.41
TRA	1.19	Pitot Coefficient	0.815
Vapor Pressure of Water	2.24		
ZT	110.00	Duct Width (in.)	0.00
PM	107.30	Duct Length (in.)	0.00
Barometric Pressure	29.27	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	168.00
		Stack Area (ft^2)	153.94
Moisture Content	3.67		
		Molecular Weight (dry)	29.905
O_2 %	10.937	Molecular Weight (wet)	29.468
CO_2 %	9.17	Stack Pressure	29.24
		Feet per Second	9.28
Standard CFH	3,931,320	Actual CFM	85712.34
K Standard CFH	65.522	DSCFM	63117.63

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	10.95	0.03	11.01	11.0	**10.94**	dry
CO_2 (wet)	8.83	0.04	8.52	8.5	**8.83**	wet

Moisture	3.67	**Standard CFH**	**3,931,320**
Fuel Factor C	1839	K Standard CFM	65.522
DSCFM	63118		

Results

Start Time	**10:03 PM**
Stop Time	**10:08 PM**
Standard CFH	**3,931,000**
CO_2 %, wet	**8.83**
WAF applied	**0.9900**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
9/22/2011
Run 1

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	% CO_2, w
12:20:42	113.317	45.171	14.285	5.957
12:21:42	107.605	45.614	14.422	5.845
12:22:42	110.092	45.639	14.266	5.885
12:23:42	114.202	45.258	14.207	5.954
12:24:42	119.019	44.286	14.239	5.86
12:25:42	125.605	43.437	14.236	5.856
12:26:42	132.462	42.084	14.23	5.847
12:27:42	135.997	42.928	14.135	5.988
12:28:42	146.932	40.827	14.135	5.928
12:29:42	154.917	39.19	14.095	5.994
12:30:42	160.116	40.12	14.043	6.067
12:31:42	170.573	38.361	14.142	6.145
12:32:42	175.008	39.434	13.887	6.288
12:33:42	178.09	37.811	13.638	6.471
12:34:42	180.15	36.006	13.64	6.443
12:35:42	181.971	36.433	13.68	6.363
12:36:42	177.261	37.445	13.865	6.26
12:37:42	187.256	38.488	13.841	6.339
12:38:42	197.932	38.803	13.709	6.424
12:39:42	188.075	39.5	13.728	6.437
12:40:42	177.338	39.627	13.732	6.49
Average	**153.996**	**40.784**	**14.007**	**6.135**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

9/22/2011
Test 3L Run 1
Low "Normal" Load (80 Klbs/Hr)

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.010	0.100	184	12:27 PM
2	A-2	0.012	0.110	184	
3	A-3	0.011	0.105	184	
4	A-4	0.011	0.105	184	
5	B-1	0.025	0.158	182	
6	B-2	0.026	0.161	182	
7	B-3	0.023	0.152	182	
8	B-4	0.012	0.110	182	
9	C-1	0.024	0.155	185	
10	C-2	0.027	0.164	185	
11	C-3	0.025	0.158	185	
12	C-4	0.023	0.152	185	
13	D-1	0.016	0.126	186	
14	D-2	0.012	0.110	186	
15	D-3	0.011	0.105	186	
16	D-4	0.010	0.100	186	12:35 PM
Average		0.0174	0.129	184	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	184		
Wet Bulb (°F)	101.0	Static Pressure	-0.36
TRA	1.20	Pitot Coefficient	0.815
Vapor Pressure of Water	1.99		
ZT	83.25	Duct Width (in.)	0.0
PM	110.11	Duct Length (in.)	0.0
Barometric Pressure	29.43	Duct Area (ft^2)	0.0
		Stack Diameter (in.)	168.0
		Stack Area (ft^2)	153.938
Moisture Content	3.74		
		Molecular Weight (dry)	29.574
O_2 %	13.952	Molecular Weight (wet)	29.141
CO_2 %	6.351	Stack Pressure	29.404
		Feet per Second	7.737
Standard CFH	3,453,482	Actual CFM	71464.21
K Standard CFH	57.558	DSCFM	55402.54

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration
O_2 (dry)	14.01	0.03	11.05	11.00	**13.95**
CO_2 (wet)	6.14	0.04	8.54	8.52	**6.11**
NOx (wet)	40.78	0.09	113.65	113.20	**40.57**
SO_2 (wet)	154.00	0.17	114.54	114.40	**153.86**

Moisture	3.74	**Standard CFH**	3,453,482
Fuel Factor	1839	K Standard CFM	57.558
DSCFM	55403		

Results

Flow Start	**12:27 PM**	**Gases Start**	**12:20 PM**
Flow Stop	**12:35 PM**	**Gases Stop**	**12:40 PM**

CO_2 %, wet	**6.1**
NOX ppm, wet	**40.6**
NOx LB/mmBTU	**0.146**
SO_2 ppm, wet	**153.9**
SO_2 LB/mmBTU	**0.769**
SCFH	**3,453,000**
WAF applied	**0.9900**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
9/22/2011
Run 2

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	% CO_2, w
12:50:12	86.06	46.921	14.111	6.119
12:51:12	82.57	47.796	14.181	6.04
12:52:12	83.867	48.406	14.083	6.119
12:53:12	85.017	46.977	14.151	6.025
12:54:12	85.968	47.902	14.123	6.129
12:55:12	83.603	47.373	14.004	6.162
12:56:12	81.06	47.206	14.08	6.064
12:57:12	79.697	47.256	14.145	5.958
12:58:12	80.841	47.358	14.192	5.949
12:59:12	82.581	46.687	14.229	5.903
13:00:12	86.116	47.953	14.21	5.95
13:01:12	87.718	47.628	14.226	5.895
13:02:12	89.147	47.633	14.228	5.961
13:03:12	90.632	46.687	14.141	5.973
13:04:12	91.273	47.307	14.261	5.954
13:05:12	95.495	47.038	14.113	6.073
13:06:12	95.083	46.946	14.061	6.047
13:07:12	95.179	47.663	14.193	5.999
13:08:12	96.858	46.509	14.122	5.997
13:09:12	95.84	47.109	14.184	5.996
13:10:12	99.986	47.785	14.086	6.128
Average	**88.314**	**47.340**	**14.149**	**6.021**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

9/22/2011
Test 3L **Run 2**
Low "Normal" Load (80 Klbs/Hr)

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.015	0.122	186	12:50 PM
2	A-2	0.015	0.122	186	
3	A-3	0.010	0.100	186	
4	A-4	0.011	0.105	186	
5	B-1	0.024	0.155	185	
6	B-2	0.022	0.148	185	
7	B-3	0.022	0.148	185	
8	B-4	0.011	0.105	185	
9	C-1	0.028	0.167	186	
10	C-2	0.028	0.167	186	
11	C-3	0.028	0.167	186	
12	C-4	0.014	0.118	186	
13	D-1	0.017	0.130	188	
14	D-2	0.011	0.105	188	
15	D-3	0.011	0.105	188	
16	D-4	0.010	0.100	188	1:00 PM
Average		0.0173	0.129	186	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	186		
Wet Bulb (°F)	99.0	Static Pressure	-0.41
TRA	1.20	Pitot Coefficient	0.815
Vapor Pressure of Water	1.88		
ZT	87.25	Duct Width (in.)	0.00
PM	94.20	Duct Length (in.)	0.00
Barometric Pressure	29.43	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	168.00
		Stack Area (ft^2)	153.94
Moisture Content	3.20		
		Molecular Weight (dry)	29.556
O_2 %	14.082	Molecular Weight (wet)	29.186
CO_2 %	6.208	Stack Pressure	29.4
		Feet per Second	7.732
Standard CFH	3,440,160	Actual CFM	71418.47
K Standard CFH	57.336	DSCFM	55498.86

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration
O_2 (dry)	14.15	0.04	11.06	11.00	**14.08**
CO_2 (wet)	6.02	0.03	8.53	8.52	**6.01**
NOx (wet)	47.34	0.09	113.79	113.20	**47.05**
SO_2 (wet)	88.31	0.18	114.76	114.40	**88.00**

Moisture	3.20	**Standard CFH**	3,440,160
Fuel Factor	1839	K Standard CFM	57.336
DSCFM	55499		

Results

Flow Start	**12:50 PM**	**Gases Start**	**12:50 PM**
Flow Stop	**1:00 PM**	**Gases Stop**	**1:10 PM**

CO_2 %, wet	**6.0**
NOX ppm, wet	**47.0**
NOx LB/mmBTU	**0.172**
SO_2 ppm, wet	**88.0**
SO_2 LB/mmBTU	**0.447**
SCFH	**3,440,000**
WAF applied	**0.9900**

MPU00638

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
9/22/2011
Run 3

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	% CO_2, w
1:20:12	98.338	48.258	14.086	6.099
1:21:12	99.609	47.521	14.066	6.037
1:22:12	99.925	47.897	14.205	5.973
1:23:12	103.017	47.246	14.151	5.984
1:24:12	108.765	45.125	14.225	5.957
1:25:12	113.017	45.914	14.137	6.028
1:26:12	117.91	43.889	14.02	6.147
1:27:12	119.517	43.035	13.953	6.186
1:28:12	120.351	44.907	13.912	6.224
1:29:12	117.467	45.125	13.93	6.26
1:30:12	115.748	44.652	13.863	6.355
1:31:12	112.686	45.497	13.765	6.415
1:32:12	112.574	46.066	13.87	6.363
1:33:12	108.47	46.402	13.872	6.359
1:34:12	104.528	47.043	13.8	6.407
1:35:12	102.626	46.56	13.842	6.365
1:36:12	102.066	45.497	13.991	6.276
1:37:12	98.251	47.058	13.887	6.356
1:38:12	100.484	47.043	13.818	6.405
1:39:12	99.808	47.353	13.822	6.413
1:40:12	104.35	46.509	13.879	6.317
Average	**107.596**	**46.124**	**13.957**	**6.235**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

9/22/2011
Test 3L Run 3
Low "Normal" Load (80 Klbs/Hr)

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.017	0.130	187	1:20 PM
2	A-2	0.011	0.105	187	
3	A-3	0.010	0.100	187	
4	A-4	0.010	0.100	187	
5	B-1	0.024	0.155	188	
6	B-2	0.021	0.145	188	
7	B-3	0.020	0.141	188	
8	B-4	0.012	0.110	188	
9	C-1	0.027	0.164	190	
10	C-2	0.028	0.167	190	
11	C-3	0.026	0.161	190	
12	C-4	0.016	0.126	190	
13	D-1	0.015	0.122	192	
14	D-2	0.011	0.105	192	
15	D-3	0.011	0.105	192	
16	D-4	0.010	0.100	192	1:30 PM
Average		0.0168	0.127	189	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	189		
Wet Bulb (°F)	96.0	Static Pressure	-0.40
TRA	1.21	Pitot Coefficient	0.815
Vapor Pressure of Water	1.71		
ZT	93.25	Duct Width (in.)	0.00
PM	71.42	Duct Length (in.)	0.00
Barometric Pressure	29.43	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	168.00
		Stack Area (ft^2)	153.94
Moisture Content	2.43		
		Molecular Weight (dry)	29.579
O_2 %	13.884	Molecular Weight (wet)	29.298
CO_2 %	6.398	Stack Pressure	29.401
		Feet per Second	7.627
Standard CFH	3,377,543	Actual CFM	70442.25
K Standard CFH	56.292	DSCFM	54924.92

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration
O_2 (dry)	13.96	0.04	11.07	11.0	**13.88**
CO_2 (wet)	6.23	0.03	8.50	8.5	**6.24**
NOx (wet)	46.12	-0.04	113.31	113.2	**46.10**
SO_2 (wet)	107.60	0.25	114.13	114.4	**107.84**

Moisture	2.43	**Standard CFH**	**3,377,543**
Fuel Factor	1839	K Standard CFM	56.292
DSCFM	54925		

Results

Flow Start	**1:20 PM**	**Gases Start**	**1:20 PM**
Flow Stop	**1:30 PM**	**Gases Stop**	**1:40 PM**

CO_2 %, wet	**6.2**
NOX ppm, wet	**46.1**
NOx LB/mmBTU	**0.162**
SO_2 ppm, wet	**107.8**
SO_2 LB/mmBTU	**0.528**
SCFH	**3,378,000**
WAF applied	**0.9900**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
9/22/2011
Run 4

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	% CO_2, w
1:50:02	84.534	49.494	13.947	6.27
1:51:02	81.599	51.295	13.903	6.289
1:52:02	80.139	51.865	13.935	6.236
1:53:02	80.953	51.834	13.922	6.267
1:54:02	78.7	53.111	13.987	6.168
1:55:02	84.269	50.72	14.015	6.175
1:56:02	84.564	51.61	13.948	6.215
1:57:02	79.519	50.43	13.964	6.152
1:58:02	77.362	51.656	13.967	6.187
1:59:02	79.315	51.219	13.982	6.125
2:00:02	79.076	52.877	14.046	6.071
2:01:02	82.052	51.275	14.095	6.073
2:02:02	84.173	51.839	14.004	6.147
2:03:02	84.951	50.929	13.903	6.154
2:04:02	85.49	51.249	14.128	5.899
2:05:02	90.103	51.381	14.192	5.967
2:06:02	94.676	50.71	14.005	6.053
2:07:02	99.945	50.908	14.001	6.109
2:08:02	100.932	49.062	13.948	6.116
2:09:02	102.717	49.586	13.893	6.194
2:10:02	104.604	50.629	13.91	6.219
Average	**86.651**	**51.128**	**13.985**	**6.147**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

9/22/2011
Test 3L Run 4
Low "Normal" Load (80 Klbs/Hr)

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.014	0.118	193	1:50 PM
2	A-2	0.013	0.114	193	
3	A-3	0.012	0.110	193	
4	A-4	0.011	0.105	193	
5	B-1	0.022	0.148	195	
6	B-2	0.026	0.161	195	
7	B-3	0.013	0.114	195	
8	B-4	0.010	0.100	195	
9	C-1	0.023	0.151	193	
10	C-2	0.028	0.167	193	
11	C-3	0.026	0.161	193	
12	C-4	0.018	0.134	193	
13	D-1	0.019	0.138	193	
14	D-2	0.013	0.114	193	
15	D-3	0.012	0.110	193	
16	D-4	0.011	0.105	193	2:00 PM
Average		0.0169	0.128	194	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	194		
Wet Bulb (°F)	97.0	Static Pressure	-0.40
TRA	1.21	Pitot Coefficient	0.815
Vapor Pressure of Wate	1.77		
ZT	96.50	Duct Width (in.)	0
PM	73.25	Duct Length (in.)	0
Barometric Pressure	29.43	Duct Area (ft^2)	0
		Stack Diameter (in.)	168
		Stack Area (ft^2)	153.93804
Moisture Content	2.49		
		Molecular Weight (dry)	29.568
O_2 %	13.908	Molecular Weight (wet)	29.28
CO_2 %	6.323	Stack Pressure	29.401
		Feet per Second	7.703
Standard CFH	3,389,091	Actual CFM	71145.8
K Standard CFH	56.485	DSCFM	55077.55

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration
O_2 (dry)	13.99	0.04	11.07	11.0	**13.91**
CO_2 (wet)	6.15	0.03	8.49	8.5	**6.17**
NOx (wet)	51.13	-0.19	113.17	113.2	**51.24**
SO_2 (wet)	86.65	0.26	114.45	114.4	**86.55**

Moisture	2.49	**Standard CFH**	3,389,091
Fuel Factor	1839	K Standard CFM	56.485
DSCFM	55078		

Results

Flow Start	**1:50 PM**	**Gases Start**	**1:50 PM**
Flow Stop	**2:00 PM**	**Gases Stop**	**2:10 PM**

CO_2 %, wet	**6.2**
NOX ppm, wet	**51.2**
NOx LB/mmBTU	**0.182**
SO_2 ppm, wet	**86.6**
SO_2 LB/mmBTU	**0.429**
SCFH	**3,389,000**
WAF applied	**0.9900**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
9/22/2011
Run 5

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	% CO_2, w
2:30:02	95.22	47.567	13.873	6.261
2:31:02	98.653	46.193	13.952	6.15
2:32:02	96.746	47.262	14.009	6.087
2:33:02	96.558	48.091	14.067	6.044
2:34:02	92.885	48.086	14.16	5.964
2:35:02	95.454	47.394	14.093	6.035
2:36:02	98.557	49.484	13.943	6.149
2:37:02	101.639	48.67	14.05	6.072
2:38:02	98.984	47.872	14.041	6.095
2:39:02	99.701	48.721	13.92	6.267
2:40:02	97.117	48.162	13.933	6.143
2:41:02	99.243	48.045	14.034	6.089
2:42:02	93.48	48.686	14.037	6.054
2:43:02	93.699	49.164	14.094	6.078
2:44:02	96.354	48.604	13.952	6.22
2:45:02	96.909	49.805	13.927	6.237
2:46:02	94.36	50.298	14.02	6.208
2:47:02	90.647	50.054	14.074	6.101
2:48:02	92.504	49.616	14.02	6.12
2:49:02	96.303	51.107	14.042	6.151
2:50:02	94.177	49.779	13.997	6.182
Average	**96.152**	**48.698**	**14.011**	**6.129**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

9/22/2011
Test 3L Run 5
Low "Normal" Load (80 Klbs/Hr)

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.016	0.126	187	2:30 PM
2	A-2	0.013	0.114	187	
3	A-3	0.012	0.110	187	
4	A-4	0.015	0.122	187	
5	B-1	0.028	0.167	190	
6	B-2	0.030	0.173	190	
7	B-3	0.023	0.152	190	
8	B-4	0.015	0.122	190	
9	C-1	0.024	0.155	193	
10	C-2	0.028	0.167	193	
11	C-3	0.029	0.170	193	
12	C-4	0.017	0.130	193	
13	D-1	0.017	0.130	191	
14	D-2	0.011	0.105	191	
15	D-3	0.010	0.100	191	
16	D-4	0.008	0.089	191	2:40 PM
Average		0.0185	0.133	190	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	190		
Wet Bulb (°F)	97.0	Static Pressure	-0.39
TRA	1.21	Pitot Coefficient	0.815
Vapor Pressure of Water	1.77		
ZT	93.25	Duct Width (in.)	0
PM	76.73	Duct Length (in.)	0
Barometric Pressure	29.43	Duct Area (ft^2)	0
		Stack Diameter (in.)	168
		Stack Area (ft^2)	153.93804
Moisture Content	2.61		
		Molecular Weight (dry)	29.569
O_2 %	13.951	Molecular Weight (wet)	29.267
CO_2 %	6.321	Stack Pressure	29.401
		Feet per Second	8.
Standard CFH	3,537,723	Actual CFM	73894.76
K Standard CFH	58.962	DSCFM	57423.34

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration
O_2 (dry)	14.01	0.04	11.06	11.0	**13.95**
CO_2 (wet)	6.13	0.02	8.48	8.5	**6.16**
NOx (wet)	48.70	-0.20	113.65	113.2	**48.62**
SO_2 (wet)	96.15	0.31	115.05	114.4	**95.56**

Moisture	2.61	**Standard CFH**	3,537,723
Fuel Factor	1839	K Standard CFM	58.962
DSCFM	57423		

Results

Flow Start	**2:30 PM**	**Gases Start**	**2:30 PM**
Flow Stop	**2:40 PM**	**Gases Stop**	**2:50 PM**

CO_2 %, wet	**6.2**
NOX ppm, wet	**48.6**
NOx LB/mmBTU	**0.173**
SO_2 ppm, wet	**95.6**
SO_2 LB/mmBTU	**0.474**
SCFH	**3,538,000**
WAF applied	**0.9900**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
9/22/2011
Run 6

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	% CO_2, w
3:00:22	95.84	49.464	14.032	6.119
3:01:22	96.466	49.83	14.084	6.009
3:02:22	103.175	48.935	14.046	6.129
3:03:22	103.139	48.777	13.898	6.251
3:04:22	100.464	48.615	13.945	6.152
3:05:22	99.63	48.904	13.995	6.129
3:06:22	100.321	49.123	13.977	6.188
3:07:22	101.186	49.957	13.883	6.297
3:08:22	94.421	49.764	13.813	6.33
3:09:22	90.714	48.436	13.939	6.172
3:10:22	85.276	49.494	14.221	5.938
3:11:22	90.454	48.406	14.266	5.991
3:12:22	98.246	50.613	13.905	6.324
3:13:22	94.498	49.235	13.725	6.408
3:14:22	90.714	49.769	13.878	6.187
3:15:22	90.317	50.471	14.084	6.069
3:16:22	92.631	50.247	13.939	6.211
3:17:22	95.276	49.957	14.047	6.12
3:18:22	93.969	50.903	13.994	6.136
3:19:22	94.081	50.975	14.027	6.121
3:20:22	97.544	50.034	14.027	6.141
Average	**95.636**	**49.615**	**13.987**	**6.163**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

9/22/2011
Test 3L Run 6
Low "Normal" Load (80 Klbs/Hr)

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.013	0.114	185	3:00 PM
2	A-2	0.013	0.114	185	
3	A-3	0.012	0.110	185	
4	A-4	0.012	0.110	185	
5	B-1	0.028	0.167	186	
6	B-2	0.029	0.170	186	
7	B-3	0.026	0.161	186	
8	B-4	0.010	0.100	186	
9	C-1	0.021	0.145	183	
10	C-2	0.029	0.170	183	
11	C-3	0.019	0.138	183	
12	C-4	0.016	0.126	183	
13	D-1	0.023	0.152	185	
14	D-2	0.012	0.110	185	
15	D-3	0.011	0.105	185	
16	D-4	0.010	0.100	185	3:10 PM
Average		0.0178	0.131	185	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	185		
Wet Bulb (°F)	97.0	Static Pressure	-0.41
TRA	1.21	Pitot Coefficient	0.815
Vapor Pressure of Water	1.77		
ZT	87.75	Duct Width (in.)	0.00
PM	82.62	Duct Length (in.)	0.00
Barometric Pressure	29.43	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	168.00
		Stack Area (ft^2)	153.94
Moisture Content	2.81		
		Molecular Weight (dry)	29.574
O_2 %	13.932	Molecular Weight (wet)	29.249
CO_2 %	6.356	Stack Pressure	29.4
		Feet per Second	7.808
Standard CFH	3,481,868	Actual CFM	72116.54
K Standard CFH	58.031	DSCFM	56400.34

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration
O_2 (dry)	13.99	0.03	11.05	11.0	**13.93**
CO_2 (wet)	6.16	0.03	8.49	8.5	**6.18**
NOx (wet)	49.61	-0.18	113.98	113.2	**49.38**
SO_2 (wet)	95.64	0.44	115.09	114.4	**94.99**

Moisture	2.81	**Standard CFH**	3,481,868
Fuel Factor	1839	K Standard CFM	58.031
DSCFM	56400		

Results

Flow Start	**3:00 PM**	**Gases Start**	**3:00 PM**
Flow Stop	**3:10 PM**	**Gases Stop**	**3:20 PM**

CO_2 %, wet	**6.2**
NOX ppm, wet	**49.4**
NOx LB/mmBTU	**0.175**
SO_2 ppm, wet	**95.0**
SO_2 LB/mmBTU	**0.470**
SCFH	**3,482,000**
WAF applied	**0.9900**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
9/22/2011
Run 7

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	% CO_2, w
3:30:52	98.577	49.749	13.992	6.092
3:31:52	103.246	49.545	14.018	6.148
3:32:52	106.527	49.138	13.91	6.225
3:33:52	106.232	48.564	13.854	6.238
3:34:52	102.381	49.683	13.892	6.229
3:35:52	102.254	51.051	13.879	6.279
3:36:52	104.304	49.215	13.842	6.237
3:37:52	101.598	50.466	13.927	6.21
3:38:52	99.447	50.832	13.91	6.24
3:39:52	101.267	49.347	13.939	6.176
3:40:52	100.55	49.494	13.941	6.21
3:41:52	97.046	49.403	13.88	6.233
3:42:52	100.418	48.869	13.87	6.247
3:43:52	99.93	50.471	13.8	6.333
3:44:52	92.911	51.356	13.791	6.29
3:45:52	95.342	50.054	13.869	6.211
3:46:52	93.18	49.932	13.969	6.123
3:47:52	91.37	50.308	14.022	6.025
3:48:52	89.635	50.507	14.022	6.106
3:49:52	86.95	53.172	13.981	6.146
3:50:52	86.441	53.085	13.933	6.167
Average	**98.076**	**50.202**	**13.916**	**6.198**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

9/22/2011
Test 3L Run 7
Low "Normal" Load (80 Klbs/Hr)

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.015	0.122	186	3:30 PM
2	A-2	0.012	0.110	186	
3	A-3	0.011	0.105	186	
4	A-4	0.010	0.100	186	
5	B-1	0.026	0.161	191	
6	B-2	0.030	0.173	191	
7	B-3	0.023	0.152	191	
8	B-4	0.012	0.110	191	
9	C-1	0.022	0.148	191	
10	C-2	0.028	0.167	191	
11	C-3	0.027	0.164	191	
12	C-4	0.012	0.110	191	
13	D-1	0.011	0.105	190	
14	D-2	0.012	0.110	190	
15	D-3	0.011	0.105	190	
16	D-4	0.010	0.100	190	3:40 PM
Average		0.0170	0.128	190	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	190		
Wet Bulb (°F)	97.0	Static Pressure	-0.42
TRA	1.21	Pitot Coefficient	0.815
Vapor Pressure of Water	1.77		
ZT	92.50	Duct Width (in.)	0.00
PM	77.54	Duct Length (in.)	0.00
Barometric Pressure	29.43	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	168.00
		Stack Area (ft^2)	153.94
Moisture Content	2.64		
		Molecular Weight (dry)	29.575
O_2 %	13.869	Molecular Weight (wet)	29.27
CO_2 %	6.378	Stack Pressure	29.399
		Feet per Second	7.646
Standard CFH	3,384,531	Actual CFM	70618.71
K Standard CFH	56.409	DSCFM	54921.13

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration
O_2 (dry)	13.92	0.04	11.05	11.0	**13.87**
CO_2 (wet)	6.20	0.03	8.50	8.5	**6.21**
NOx (wet)	50.20	-0.20	113.67	113.2	**50.10**
SO_2 (wet)	98.08	0.47	115.06	114.4	**97.44**

Moisture	2.64	**Standard CFH**	3,384,531
Fuel Factor	1839	K Standard CFM	56.409
DSCFM	54921		

Results

Flow Start	**3:30 PM**	**Gases Start**	**3:30 PM**
Flow Stop	**3:40 PM**	**Gases Stop**	**3:50 PM**

CO_2 %, wet	**6.2**
NOX ppm, wet	**50.1**
NOx LB/mmBTU	**0.177**
SO_2 ppm, wet	**97.4**
SO_2 LB/mmBTU	**0.479**
SCFH	**3,385,000**
WAF applied	**0.9900**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
9/22/2011
Run 8

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	% CO_2, w
4:00:32	94.538	51.509	13.907	6.175
4:01:32	92.489	51.539	13.935	6.172
4:02:32	91.543	51.682	13.95	6.106
4:03:32	88.862	52.053	14.058	6.054
4:04:32	88.12	50.964	14.097	6.028
4:05:32	95.21	52.007	14.043	6.126
4:06:32	94.203	52.053	13.954	6.179
4:07:32	93.328	50.817	14.022	6.105
4:08:32	94.66	52.251	13.949	6.184
4:09:32	91.914	51.453	14.06	6.008
4:10:32	88.781	52.343	14.16	5.99
4:11:32	91.695	52.195	14.16	5.986
4:12:32	92.382	51.86	14.128	6.027
4:13:32	94.945	51.788	14.094	6.039
4:14:32	100.047	52.775	14.074	6.138
4:15:32	102.346	50.908	14.055	6.153
4:16:32	99.05	51.753	14.103	6.233
4:17:32	95.54	51.671	14.022	6.164
4:18:32	91.136	51.951	14.027	6.071
4:19:32	87.799	60.562	14.144	5.979
4:20:32	92.656	52.912	14.108	6.008
Average	**93.393**	**52.240**	**14.050**	**6.092**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

9/22/2011
Test 3L Run 8
Low "Normal" Load (80 Klbs/Hr)

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.015	0.122	186	2:00 PM
2	A-2	0.018	0.134	186	
3	A-3	0.011	0.105	186	
4	A-4	0.010	0.100	186	
5	B-1	0.033	0.182	190	
6	B-2	0.036	0.190	190	
7	B-3	0.025	0.158	190	
8	B-4	0.016	0.126	190	
9	C-1	0.015	0.122	191	
10	C-2	0.018	0.134	191	
11	C-3	0.020	0.141	191	
12	C-4	0.016	0.126	191	
13	D-1	0.013	0.114	188	
14	D-2	0.011	0.105	188	
15	D-3	0.011	0.105	188	
16	D-4	0.010	0.100	188	2:10 PM
Average		0.017	0.129	189	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	189		
Wet Bulb (°F)	98.0	Static Pressure	-0.42
TRA	1.20	Pitot Coefficient	0.815
Vapor Pressure of Water	1.82		
ZT	90.75	Duct Width (in.)	0.00
PM	84.86	Duct Length (in.)	0.00
Barometric Pressure	29.43	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	168.00
		Stack Area (ft^2)	153.94
Moisture Content	2.89		
		Molecular Weight (dry)	29.567
O_2 %	13.983	Molecular Weight (wet)	29.233
CO_2 %	6.298	Stack Pressure	29.399
		Feet per Second	7.738
Standard CFH	3,429,247	Actual CFM	71469.09
K Standard CFH	57.154	DSCFM	55504.33

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration
O_2 (dry)	14.05	0.04	11.06	11.0	**13.98**
CO_2 (wet)	6.09	0.02	8.48	8.5	**6.12**
NOx (wet)	52.24	-0.23	113.42	113.2	**52.26**
SO_2 (wet)	93.39	0.42	115.21	114.4	**92.66**

Moisture	2.89	**Standard CFH**	**3,429,247**
Fuel Factor	1839	K Standard CFM	57.154
DSCFM	55504		

Results

Flow Start	**2:00 PM**	**Gases Start**	**2:00 PM**
Flow Stop	**2:10 PM**	**Gases Stop**	**2:20 PM**

CO_2 %, wet	**6.1**
NOX ppm, wet	**52.3**
NOx LB/mmBTU	**0.188**
SO_2 ppm, wet	**92.7**
SO_2 LB/mmBTU	**0.463**
SCFH	**3,429,000**
WAF applied	**0.9900**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
9/22/2011
Run 9

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	% CO_2, w
4:30:02	90.13	52.673	14	6.177
4:31:03	90.019	52.729	14.018	6.147
4:32:04	87.231	53.894	14.02	6.126
4:33:05	85.395	52.546	14.117	6.041
4:34:06	85.354	54.413	14.07	6.067
4:35:07	82.242	54.326	14.088	6.05
4:36:08	83.829	52.709	14.06	6.127
4:37:09	86.275	51.87	14.038	6.108
4:38:10	89.378	52.739	14.022	6.113
4:39:11	90.766	53.599	14.095	6.049
4:40:12	93.202	53.253	14.119	5.986
4:41:13	95.756	52.979	14.172	6.001
4:42:14	99.53	52.46	14.081	6.055
4:43:15	104.174	51.666	14.127	6.016
4:44:16	105.252	51.951	14.069	6.08
4:45:17	107.424	52.643	13.99	6.186
4:46:18	104.331	50.323	14.011	6.131
4:47:19	105.766	50.842	13.995	6.183
4:48:20	104.926	52.816	13.887	6.301
4:49:21	100.277	52.582	13.945	6.206
4:50:22	96.402	51.951	13.994	6.15
Average	**94.650**	**52.617**	**14.044**	**6.110**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

9/22/2011
Test 3L Run 9
Low "Normal" Load (80 Klbs/Hr)

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.018	0.134	192	4:30 PM
2	A-2	0.014	0.118	192	
3	A-3	0.013	0.114	192	
4	A-4	0.010	0.100	192	
5	B-1	0.025	0.158	188	
6	B-2	0.022	0.148	188	
7	B-3	0.026	0.161	188	
8	B-4	0.021	0.145	188	
9	C-1	0.021	0.145	190	
10	C-2	0.022	0.148	190	
11	C-3	0.020	0.141	190	
12	C-4	0.013	0.114	190	
13	D-1	0.018	0.134	191	
14	D-2	0.018	0.134	191	
15	D-3	0.012	0.110	191	
16	D-4	0.010	0.100	191	4:40 PM
Average		0.018	0.132	190	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	190		
Wet Bulb (°F)	97.0	Static Pressure	-0.40
TRA	1.21	Pitot Coefficient	0.815
Vapor Pressure of Water	1.77		
ZT	93.25	Duct Width (in.)	0.00
PM	76.73	Duct Length (in.)	0.00
Barometric Pressure	29.43	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	168.00
		Stack Area (ft^2)	153.94
Moisture Content	2.61		
		Molecular Weight (dry)	29.565
O_2 %	13.95	Molecular Weight (wet)	29.263
CO_2 %	6.295	Stack Pressure	29.401
		Feet per Second	7.892
Standard CFH	3,489,561	Actual CFM	72890.6
K Standard CFH	58.159	DSCFM	56641.51

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration
O_2 (dry)	14.04	0.03	11.08	11.0	**13.95**
CO_2 (wet)	6.11	0.02	8.49	8.5	**6.13**
NOx (wet)	52.62	-0.22	113.84	113.2	**52.44**
SO_2 (wet)	94.65	0.25	115.42	114.4	**93.77**

Moisture	2.61	**Standard CFH**	3,489,561
Fuel Factor	1839	K Standard CFM	58.159
DSCFM	56642		

Results

Flow Start	**4:30 PM**	**Gases Start**	**4:30 PM**
Flow Stop	**4:40 PM**	**Gases Stop**	**4:50 PM**

CO_2 %, wet	**6.1**
NOX ppm, wet	**52.4**
NOx LB/mmBTU	**0.188**
SO_2 ppm, wet	**93.8**
SO_2 LB/mmBTU	**0.467**
SCFH	**3,490,000**
WAF applied	**0.9900**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
9/22/2011
Run 10

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	% CO_2, w
5:00:23	95.725	52.378	14.011	6.186
5:01:22	95.201	51.946	13.949	6.147
5:02:21	92.841	52.546	14.074	6.105
5:03:20	92.801	53.223	14.039	6.167
5:04:19	87.821	54.245	13.969	6.166
5:05:18	87.969	53.131	14.011	6.144
5:06:17	85.426	52.948	14.1	6.083
5:07:16	86.005	53.421	14.052	6.093
5:08:15	86.478	53.935	14.062	6.104
5:09:14	86.234	54.586	14.119	6.005
5:10:13	87.618	54.474	14.517	6.068
5:11:12	88.06	53.736	14.064	6.101
5:12:11	88.549	53.899	14.069	6.057
5:13:10	90.095	53.569	14.07	6.134
5:14:09	87.592	54.245	14.062	6.115
5:15:08	90.664	53.507	14.062	6.126
5:16:07	95.369	53.472	14.039	6.146
5:17:06	99.759	52.383	14.062	6.094
5:18:05	101.213	53.528	14.066	6.139
5:19:04	101.615	52.633	14.02	6.172
5:20:03	104.204	52.673	14.088	6.077
Average	**91.964**	**53.356**	**14.072**	**6.116**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

9/22/2011
Test 3L Run 10
Low "Normal" Load (80 Klbs/Hr)

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.013	0.114	187	5:00 PM
2	A-2	0.011	0.105	187	
3	A-3	0.010	0.100	187	
4	A-4	0.010	0.100	187	
5	B-1	0.023	0.152	187	
6	B-2	0.027	0.164	187	
7	B-3	0.028	0.167	187	
8	B-4	0.018	0.134	187	
9	C-1	0.027	0.164	189	
10	C-2	0.031	0.176	189	
11	C-3	0.028	0.167	189	
12	C-4	0.021	0.145	189	
13	D-1	0.014	0.118	190	
14	D-2	0.013	0.114	190	
15	D-3	0.011	0.105	190	
16	D-4	0.010	0.100	190	5:10 PM
Average		0.018	0.133	188	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	188		
Wet Bulb (°F)	97.0	Static Pressure	-0.42
TRA	1.21	Pitot Coefficient	0.815
Vapor Pressure of Water	1.77		
ZT	91.25	Duct Width (in.)	0.00
PM	78.88	Duct Length (in.)	0.00
Barometric Pressure	29.43	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	168.00
		Stack Area (ft^2)	153.94
Moisture Content	2.68		
		Molecular Weight (dry)	29.563
O_2 %	13.986	Molecular Weight (wet)	29.253
CO_2 %	6.273	Stack Pressure	29.399
		Feet per Second	7.958
Standard CFH	3,529,622	Actual CFM	73504.32
K Standard CFH	58.827	DSCFM	57248.76

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration
O_2 (dry)	14.07	0.04	11.08	11.0	**13.99**
CO_2 (wet)	6.12	0.03	8.53	8.5	**6.10**
NOx (wet)	53.36	-0.22	114.23	113.2	**52.99**
SO_2 (wet)	91.96	0.16	115.37	114.4	**91.16**

Moisture	2.68	**Standard CFH**	3,529,622
Fuel Factor	1839	K Standard CFM	58.827
DSCFM	57249		

Results

Flow Start	**5:00 PM**	**Gases Start**	**5:00 PM**
Flow Stop	**5:10 PM**	**Gases Stop**	**5:20 PM**

CO_2 %, wet	**6.1**
NOX ppm, wet	**53.0**
NOx LB/mmBTU	**0.191**
SO_2 ppm, wet	**91.2**
SO_2 LB/mmBTU	**0.456**
SCFH	**3,530,000**
WAF applied	**0.9900**

APPENDIX C

FIELD DATA SHEETS

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

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	3M	Run 1	Date	9/21/2011	
Stack Diameter (in.)	168				
Dry Bulb (°F)	210	Wet Bulb (°F)	108		
Moisture Content (%)	4.57				
Monometer	Expanded				
Barometric Pressure	29.27				
Static Pressure +/-	-0.38				
Operators	Rory Eiynck / Andrew Strong				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150		

Cross-section View	Elevation View

140 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.):	14.00	Start Time:	8:35 PM
A-1	0.032	5.38	19.38	0.025	210
A-2	0.105	17.64	31.64	0.030	210
A-3	0.194	32.59	46.59	0.035	210
A-4	0.323	54.26	68.26	0.025	210
B-1				0.028	212
B-2				0.032	212
B-3				0.031	212
B-4				0.025	212
C-1				0.025	215
C-2				0.032	215
C-3				0.031	215
C-4				0.020	215
D-1				0.015	213
D-2				0.018	213
D-3				0.015	213
D-4				0.012	213
Digital Numbers Used:		85 / 138		End Time:	8:44 PM

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

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	3M	Run 2	Date	9/21/2011	
Stack Diameter (in.)	168				
Dry Bulb (°F)	213		Wet Bulb (°F)	108	
Moisture Content (%)	4.56				
Monometer	Expanded				
Barometric Pressure	29.27				
Static Pressure +/-	-0.40				
Operators	Rory Eiynck / Andrew Strong				
Pitot No.	04-5+-P1		Pitot Coeff.	0.8150	

Cross-section View	Elevation View

140 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.):	14.00	Start Time:	8:45 AM
A-1	0.032	5.38	19.38	0.020	213
A-2	0.105	17.64	31.64	0.015	213
A-3	0.194	32.59	46.59	0.014	213
A-4	0.323	54.26	68.26	0.010	213
B-1				0.032	214
B-2				0.030	214
B-3				0.032	214
B-4				0.025	214
C-1				0.028	213
C-2				0.031	213
C-3				0.032	213
C-4				0.022	213
D-1				0.028	212
D-2				0.028	212
D-3				0.025	212
D-4				0.015	212
Digital Numbers Used:		85 / 138		End Time:	8:52 PM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	3M	Run 3	Date	9/21/2011	
Stack Diameter (in.)	168				
Dry Bulb (°F)	214	Wet Bulb (°F)	108		
Moisture Content (%)	4.61				
Monometer	Expanded				
Barometric Pressure	29.27				
Static Pressure +/-	-0.40				
Operators	Rory Eiynck / Andrew Strong				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150		

Cross-section	Elevation
View	View

140 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.):	14.00	Start Time:	8:53 PM
A-1	0.032	5.38	19.38	0.022	214
A-2	0.105	17.64	31.64	0.025	214
A-3	0.194	32.59	46.59	0.030	214
A-4	0.323	54.26	68.26	0.020	214
B-1				0.030	212
B-2				0.031	212
B-3				0.035	212
B-4				0.028	212
C-1				0.028	210
C-2				0.045	210
C-3				0.037	210
C-4				0.028	210
D-1				0.014	210
D-2				0.013	210
D-3				0.013	210
D-4				0.012	210
Digital Numbers Used:		85 / 138		End Time:	9:00 PM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	3M	Run 4	Date	9/21/2011	Cross-section View / Elevation View
Stack Diameter (in.)	168				
Dry Bulb (°F)	210	Wet Bulb (°F)	106		
Moisture Content (%)	4.06				
Monometer	Expanded				
Barometric Pressure	29.27				
Static Pressure +/-	-0.41				
Operators	Rory Eiynck / Andrew Strong				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150		

140 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.):	14.00	Start Time:	9:12 PM
A-1	0.032	5.38	19.38	0.019	210
A-2	0.105	17.64	31.64	0.012	210
A-3	0.194	32.59	46.59	0.012	210
A-4	0.323	54.26	68.26	0.012	210
B-1				0.030	211
B-2				0.029	211
B-3				0.036	211
B-4				0.028	211
C-1				0.029	212
C-2				0.036	212
C-3				0.033	212
C-4				0.023	212
D-1				0.022	213
D-2				0.020	213
D-3				0.031	213
D-4				0.019	213
Digital Numbers Used:		85 / 138		End Time:	9:18 PM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	3M	Run 5	Date	9/21/2011	
Stack Diameter (in.)	168				
Dry Bulb (°F)	211	Wet Bulb (°F)	106		
Moisture Content (%)	4.04				
Monometer	Expanded				
Barometric Pressure	29.27				
Static Pressure +/-	-0.41				
Operators	Rory Eiynck / Andrew Strong				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150		

Cross-section View	Elevation View

140 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.):	14.00	Start Time:	9:19 PM
A-1	0.032	5.38	19.38	0.023	211
A-2	0.105	17.64	31.64	0.028	211
A-3	0.194	32.59	46.59	0.031	211
A-4	0.323	54.26	68.26	0.014	211
B-1				0.030	212
B-2				0.033	212
B-3				0.039	212
B-4				0.019	212
C-1				0.021	212
C-2				0.039	212
C-3				0.031	212
C-4				0.018	212
D-1				0.012	213
D-2				0.012	213
D-3				0.014	213
D-4				0.010	213
Digital Numbers Used:		85 / 138		End Time:	9:26 PM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	3M	Run 6	Date	9/21/2011	Cross-section View / Elevation View
Stack Diameter (in.)	168				
Dry Bulb (°F)	214	Wet Bulb (°F)	106		
Moisture Content (%)	3.99				
Monometer	Expanded				
Barometric Pressure	29.27				
Static Pressure +/-	-0.45				
Operators	Rory Eiynck / Andrew Strong				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150		

140 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.):	14.00	Start Time:	9:27 PM
A-1	0.032	5.38	19.38	0.019	214
A-2	0.105	17.64	31.64	0.016	214
A-3	0.194	32.59	46.59	0.013	214
A-4	0.323	54.26	68.26	0.011	214
B-1				0.021	213
B-2				0.032	213
B-3				0.038	213
B-4				0.028	213
C-1				0.026	213
C-2				0.032	213
C-3				0.031	213
C-4				0.024	213
D-1				0.025	214
D-2				0.028	214
D-3				0.026	214
D-4				0.017	214
Digital Numbers Used:		85 / 138		End Time:	9:33 PM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	3M	Run 7	Date	9/21/2011	
Stack Diameter (in.)	168				
Dry Bulb (°F)	214	Wet Bulb (°F)	105		
Moisture Content (%)	3.71				
Monometer	Expanded				
Barometric Pressure	29.27				
Static Pressure +/-	-0.40				
Operators	Rory Eiynck / Andrew Strong				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150		

Cross-section View	Elevation View

140 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.):	14.00	Start Time:	9:42 PM
A-1	0.032	5.38	19.38	0.020	214
A-2	0.105	17.64	31.64	0.030	214
A-3	0.194	32.59	46.59	0.031	214
A-4	0.323	54.26	68.26	0.020	214
B-1				0.030	215
B-2				0.039	215
B-3				0.034	215
B-4				0.022	215
C-1				0.021	213
C-2				0.031	213
C-3				0.030	213
C-4				0.028	213
D-1				0.018	214
D-2				0.014	214
D-3				0.013	214
D-4				0.010	214
Digital Numbers Used:		85 / 138		End Time:	9:48 PM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	3M	Run 8	Date	9/21/2011	
Stack Diameter (in.)	168				
Dry Bulb (°F)	215	Wet Bulb (°F)	105		
Moisture Content (%)	3.72				
Monometer	Expanded				
Barometric Pressure	29.27				
Static Pressure +/-	-0.42				
Operators	Rory Eiynck / Andrew Strong				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150		

Cross-section View	Elevation View

140 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.):	14.00	Start Time:	9:49 PM
A-1	0.032	5.38	19.38	0.019	215
A-2	0.105	17.64	31.64	0.013	215
A-3	0.194	32.59	46.59	0.012	215
A-4	0.323	54.26	68.26	0.011	215
B-1				0.029	214
B-2				0.038	214
B-3				0.039	214
B-4				0.024	214
C-1				0.033	212
C-2				0.041	212
C-3				0.030	212
C-4				0.019	212
D-1				0.020	213
D-2				0.029	213
D-3				0.029	213
D-4				0.013	213
Digital Numbers Used:		85 / 138		End Time:	9:55 PM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	3M	Run 9	Date	9/21/2011	Cross-section View / Elevation View
Stack Diameter (in.)	168				
Dry Bulb (°F)	215	Wet Bulb (°F)	105		
Moisture Content (%)	3.71				
Monometer	Expanded				
Barometric Pressure	29.27				
Static Pressure +/-	-0.39				
Operators	Rory Eiynck / Andrew Strong				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150		

140 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.):	14.00	Start Time:	9:56 PM
A-1	0.032	5.38	19.38	0.020	215
A-2	0.105	17.64	31.64	0.021	215
A-3	0.194	32.59	46.59	0.025	215
A-4	0.323	54.26	68.26	0.019	215
B-1				0.028	216
B-2				0.031	216
B-3				0.038	216
B-4				0.027	216
C-1				0.021	212
C-2				0.037	212
C-3				0.038	212
C-4				0.021	212
D-1				0.012	213
D-2				0.015	213
D-3				0.013	213
D-4				0.015	213
Digital Numbers Used:		85 / 138		End Time:	10:02 PM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	3M	Run 10	Date	9/21/2011	
Stack Diameter (in.)	168				
Dry Bulb (°F)	215	Wet Bulb (°F)	105		
Moisture Content (%)	3.67				
Monometer	Expanded				
Barometric Pressure	29.27				
Static Pressure +/-	-0.41				
Operators	Rory Eiynck / Andrew Strong				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150		

Cross-section View	Elevation View

140 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.):	14.00	Start Time:	10:03 PM
A-1	0.032	5.38	19.38	0.013	215
A-2	0.105	17.64	31.64	0.016	215
A-3	0.194	32.59	46.59	0.013	215
A-4	0.323	54.26	68.26	0.014	215
B-1				0.026	215
B-2				0.038	215
B-3				0.039	215
B-4				0.019	215
C-1				0.026	214
C-2				0.034	214
C-3				0.035	214
C-4				0.021	214
D-1				0.022	216
D-2				0.024	216
D-3				0.027	216
D-4				0.015	216
Digital Numbers Used:		85 / 138		End Time:	10:08 PM

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

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	3L	Run 1	Date	9/22/2011	
Stack Diameter (in.)	168				
Dry Bulb (°F)	184		Wet Bulb (°F)	101	
Moisture Content (%)	3.74				
Monometer	Normal				
Barometric Pressure	29.43				
Static Pressure +/-	-0.36				
Operators	Rory Eiynck / Andrew Strong				
Pitot No.	04-5+-P1		Pitot Coeff.	0.8150	

Cross-section View	Elevation View

Low "Normal" Load (80 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.):	14.00	Start Time:	12:27 PM
A-1	0.032	5.38	19.38	0.010	184
A-2	0.105	17.64	31.64	0.012	184
A-3	0.194	32.59	46.59	0.011	184
A-4	0.323	54.26	68.26	0.011	184
B-1				0.025	182
B-2				0.026	182
B-3				0.023	182
B-4				0.012	182
C-1				0.024	185
C-2				0.027	185
C-3				0.025	185
C-4				0.023	185
D-1				0.016	186
D-2				0.012	186
D-3				0.011	186
D-4				0.010	186
Digital Numbers Used:		85 / 138		End Time:	12:35 PM

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

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	3L	Run 2	Date	9/22/2011	
Stack Diameter (in.)	168				
Dry Bulb (°F)	186	Wet Bulb (°F)	99		
Moisture Content (%)	3.20				
Monometer	Normal				
Barometric Pressure	29.43				
Static Pressure +/-	-0.41				
Operators	Rory Eiynck / Andrew Strong				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150		

Cross-section View	Elevation View

Low "Normal" Load (80 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.):	14.00	Start Time:	12:50 PM
A-1	0.032	5.38	19.38	0.015	186
A-2	0.105	17.64	31.64	0.015	186
A-3	0.194	32.59	46.59	0.010	186
A-4	0.323	54.26	68.26	0.011	186
B-1				0.024	185
B-2				0.022	185
B-3				0.022	185
B-4				0.011	185
C-1				0.028	186
C-2				0.028	186
C-3				0.028	186
C-4				0.014	186
D-1				0.017	188
D-2				0.011	188
D-3				0.011	188
D-4				0.010	188
Digital Numbers Used:		85 / 138		End Time:	1:00 PM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU			
Source	S20 Boiler Stack			
Test	3L	Run 3	Date	9/22/2011
Stack Diameter (in.)	168			
Dry Bulb (°F)	187	Wet Bulb (°F)	96	
Moisture Content (%)	2.43			
Monometer	Normal			
Barometric Pressure	29.43			
Static Pressure +/-	-0.40			
Operators	Rory Eiynck / Andrew Strong			
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150	

Cross-section View	Elevation View

Low "Normal" Load (80 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.):	14.00	Start Time:	1:20 PM
A-1	0.032	5.38	19.38	0.017	187
A-2	0.105	17.64	31.64	0.011	187
A-3	0.194	32.59	46.59	0.010	187
A-4	0.323	54.26	68.26	0.010	187
B-1				0.024	188
B-2				0.021	188
B-3				0.020	188
B-4				0.012	188
C-1				0.027	190
C-2				0.028	190
C-3				0.026	190
C-4				0.016	190
D-1				0.015	192
D-2				0.011	192
D-3				0.011	192
D-4				0.010	192
Digital Numbers Used:		85 / 138		End Time:	1:30 PM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	3L	Run 4	Date	9/22/2011	
Stack Diameter (in.)	168				
Dry Bulb (°F)	193		Wet Bulb (°F)	97	
Moisture Content (%)	2.49				
Monometer	Normal				
Barometric Pressure	29.43				
Static Pressure +/-	-0.40				
Operators	Rory Elynck / Andrew Strong				
Pitot No.	04-5+-P1		Pitot Coeff.	0.8150	

Cross-section View	Elevation View

Low "Normal" Load (80 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.):	14.00	Start Time:	1:50 PM
A-1	0.032	5.38	19.38	0.014	193
A-2	0.105	17.64	31.64	0.013	193
A-3	0.194	32.59	46.59	0.012	193
A-4	0.323	54.26	68.26	0.011	193
B-1				0.022	195
B-2				0.026	195
B-3				0.013	195
B-4				0.010	195
C-1				0.023	193
C-2				0.028	193
C-3				0.026	193
C-4				0.018	193
D-1				0.019	193
D-2				0.013	193
D-3				0.012	193
D-4				0.011	193
Digital Numbers Used:		85 / 138		End Time:	2:00 PM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	3L	Run 5	Date	9/22/2011	
Stack Diameter (in.)	168				
Dry Bulb (°F)	187	Wet Bulb (°F)	97		
Moisture Content (%)	2.61				
Monometer	Normal				
Barometric Pressure	29.43				
Static Pressure +/-	-0.39				
Operators	Rory Eiynck / Andrew Strong				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150		

Cross-section View	Elevation View

Low "Normal" Load (80 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.):	14.00	Start Time:	2:30 PM
A-1	0.032	5.38	19.38	0.016	187
A-2	0.105	17.64	31.64	0.013	187
A-3	0.194	32.59	46.59	0.012	187
A-4	0.323	54.26	68.26	0.015	187
B-1				0.028	190
B-2				0.030	190
B-3				0.023	190
B-4				0.015	190
C-1				0.024	193
C-2				0.028	193
C-3				0.029	193
C-4				0.017	193
D-1				0.017	191
D-2				0.011	191
D-3				0.010	191
D-4				0.008	191
Digital Numbers Used:		85 / 138		End Time:	2:40 PM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU			
Source	S20 Boiler Stack			
Test	3L	Run 6	Date	9/22/2011
Stack Diameter (in.)	168			
Dry Bulb (°F)	185	Wet Bulb (°F)	97	
Moisture Content (%)	2.81			
Monometer	Normal			
Barometric Pressure	29.43			
Static Pressure +/-	-0.41			
Operators	Rory Eiynck / Andrew Strong			
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150	

Cross-section View	Elevation View

Low "Normal" Load (80 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.):	14.00	Start Time:	3:00 PM
A-1	0.032	5.38	19.38	0.013	185
A-2	0.105	17.64	31.64	0.013	185
A-3	0.194	32.59	46.59	0.012	185
A-4	0.323	54.26	68.26	0.012	185
B-1				0.028	186
B-2				0.029	186
B-3				0.026	186
B-4				0.010	186
C-1				0.021	183
C-2				0.029	183
C-3				0.019	183
C-4				0.016	183
D-1				0.023	185
D-2				0.012	185
D-3				0.011	185
D-4				0.010	185
Digital Numbers Used:		85 / 138		End Time:	3:10 PM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	3L	Run 7	Date	9/22/2011	
Stack Diameter (in.)	168				
Dry Bulb (°F)	186		Wet Bulb (°F)	97	
Moisture Content (%)	2.64				
Monometer	Normal				
Barometric Pressure	29.43				
Static Pressure +/-	-0.42				
Operators	Rory Elynck / Andrew Strong				
Pitot No.	04-5+-P1		Pitot Coeff.	0.8150	

Cross-section View	Elevation View

Low "Normal" Load (80 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.):	14.00	Start Time:	3:30 PM
A-1	0.032	5.38	19.38	0.015	186
A-2	0.105	17.64	31.64	0.012	186
A-3	0.194	32.59	46.59	0.011	186
A-4	0.323	54.26	68.26	0.010	186
B-1				0.026	191
B-2				0.030	191
B-3				0.023	191
B-4				0.012	191
C-1				0.022	191
C-2				0.028	191
C-3				0.027	191
C-4				0.012	191
D-1				0.011	190
D-2				0.012	190
D-3				0.011	190
D-4				0.010	190
Digital Numbers Used:		85 / 138		End Time:	3:40 PM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	3L	Run 8	Date	9/22/2011	
Stack Diameter (in.)	168				
Dry Bulb (°F)	186	Wet Bulb (°F)	98		
Moisture Content (%)	2.89				
Monometer	Normal				
Barometric Pressure	29.43				
Static Pressure +/-	-0.42				
Operators	Rory Eiynck / Andrew Strong				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150		

Cross-section View	Elevation View

Low "Normal" Load (80 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.):	14.00	Start Time:	2:00 PM
A-1	0.032	5.38	19.38	0.015	186
A-2	0.105	17.64	31.64	0.018	186
A-3	0.194	32.59	46.59	0.011	186
A-4	0.323	54.26	68.26	0.010	186
B-1				0.033	190
B-2				0.036	190
B-3				0.025	190
B-4				0.016	190
C-1				0.015	191
C-2				0.018	191
C-3				0.020	191
C-4				0.016	191
D-1				0.013	188
D-2				0.011	188
D-3				0.011	188
D-4				0.010	188
Digital Numbers Used:		85 / 138		End Time:	2:10 PM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU			
Source	S20 Boiler Stack			
Test	3L	Run 9	Date	9/22/2011
Stack Diameter (in.)	168			
Dry Bulb (°F)	192	Wet Bulb (°F)	97	
Moisture Content (%)	2.61			
Monometer	Normal			
Barometric Pressure	29.43			
Static Pressure +/-	-0.40			
Operators	Rory Eiynck / Andrew Strong			
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150	

Cross-section View	Elevation View

Low "Normal" Load (80 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.):	14.00	Start Time:	4:30 PM
A-1	0.032	5.38	19.38	0.018	192
A-2	0.105	17.64	31.64	0.014	192
A-3	0.194	32.59	46.59	0.013	192
A-4	0.323	54.26	68.26	0.010	192
B-1				0.025	188
B-2				0.022	188
B-3				0.026	188
B-4				0.021	188
C-1				0.021	190
C-2				0.022	190
C-3				0.020	190
C-4				0.013	190
D-1				0.018	191
D-2				0.018	191
D-3				0.012	191
D-4				0.010	191
Digital Numbers Used:		85 / 138		End Time:	4:40 PM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU			
Source	S20 Boiler Stack			
Test	3L	Run 10	Date	9/22/2011
Stack Diameter (in.)	168			
Dry Bulb (°F)	187	Wet Bulb (°F)	97	
Moisture Content (%)	2.68			
Monometer	Normal			
Barometric Pressure	29.43			
Static Pressure +/-	-0.42			
Operators	Rory Eiynck / Andrew Strong			
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150	

Cross-section View	Elevation View

Low "Normal" Load (80 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.):	14.00	Start Time:	5:00 PM
A-1	0.032	5.38	19.38	0.013	187
A-2	0.105	17.64	31.64	0.011	187
A-3	0.194	32.59	46.59	0.010	187
A-4	0.323	54.26	68.26	0.010	187
B-1				0.023	187
B-2				0.027	187
B-3				0.028	187
B-4				0.018	187
C-1				0.027	189
C-2				0.031	189
C-3				0.028	189
C-4				0.021	189
D-1				0.014	190
D-2				0.013	190
D-3				0.011	190
D-4				0.010	190
Digital Numbers Used:		85 / 138		End Time:	5:10 PM

APPENDIX D

MEASUREMENT SYSTEM PERFORMANCE SPECIFICATIONS

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
9/21/2011
Test 3M

CO_2 (TEI Model 410i)

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	% of Span
Zero	0.00	0.05	0.05	17.36	0.29
Mid Level	8.52	8.53	0.01	17.36	0.06
High Level	17.36	17.51	0.15	17.36	0.86

O_2 (Servomex Series 1400)

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	% of Span
Zero	0.00	0.01	0.01	20.99	0.05
Mid Level	11.00	10.98	0.02	20.99	0.10
High Level	20.99	20.98	0.01	20.99	0.05

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

Calibration Drift

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
9/21/2011
Test 3M

O_2

		Initial	Pre-Cal Bias	Final	Post-cal Bias	Avg.	% Drift of Span
1	Zero	0.01	0.00%	0.03	0.10%	**0.02**	**0.10%**
	Upscale	10.98	0.00%	11.01	0.14%	**11.00**	**0.14%**
2	Zero	0.03	0.10%	0.03	0.10%	**0.03**	**0.00%**
	Upscale	11.01	0.14%	11.01	0.14%	**11.01**	**0.00%**
3	Zero	0.03	0.10%	0.03	0.10%	**0.03**	**0.00%**
	Upscale	11.01	0.14%	11.01	0.14%	**11.01**	**0.00%**
4	Zero	0.03	0.10%	0.02	0.05%	**0.03**	**-0.05%**
	Upscale	11.01	0.14%	11.01	0.14%	**11.01**	**0.00%**
5	Zero	0.02	0.05%	0.02	0.05%	**0.02**	**0.00%**
	Upscale	11.01	0.14%	11.01	0.14%	**11.01**	**0.00%**
6	Zero	0.02	0.05%	0.02	0.05%	**0.02**	**0.00%**
	Upscale	11.01	0.14%	11.01	0.14%	**11.01**	**0.00%**
7	Zero	0.02	0.05%	0.03	0.10%	**0.03**	**0.05%**
	Upscale	11.01	0.14%	11.01	0.14%	**11.01**	**0.00%**
8	Zero	0.03	0.10%	0.03	0.10%	**0.03**	**0.00%**
	Upscale	11.01	0.14%	11.01	0.14%	**11.01**	**0.00%**
9	Zero	0.03	0.10%	0.03	0.10%	**0.03**	**0.00%**
	Upscale	11.01	0.14%	11.01	0.14%	**11.01**	**0.00%**
10	Zero	0.03	0.10%	0.03	0.10%	**0.03**	**0.00%**
	Upscale	11.01	0.14%	11.01	0.14%	**11.01**	**0.00%**

	Cylinder Value	Analyzer Value
Zero	0.00 %	0.01 %
Upscale	11.00 %	10.98 %
Span	20.99 %	20.99 %

** 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
S20 Boiler Stack
9/21/2011
Test 3M

CO_2

		Initial	Pre-Cal Bias	Final	Post-Cal Bias	Avg.	% Drift of Span
1	Zero	0.05	0.00%	0.04	-0.06%	**0.05**	**-0.06%**
	Upscale	8.53	0.00%	8.49	-0.23%	**8.51**	**-0.23%**
2	Zero	0.04	-0.06%	0.04	-0.06%	**0.04**	**0.00%**
	Upscale	8.49	-0.23%	8.49	-0.23%	**8.49**	**0.00%**
3	Zero	0.04	-0.06%	0.04	-0.06%	**0.04**	**0.00%**
	Upscale	8.49	-0.23%	8.49	-0.23%	**8.49**	**0.00%**
4	Zero	0.04	-0.06%	0.03	-0.12%	**0.04**	**-0.06%**
	Upscale	8.49	-0.23%	8.51	-0.12%	**8.50**	**0.12%**
5	Zero	0.03	-0.12%	0.03	-0.12%	**0.03**	**0.00%**
	Upscale	8.51	-0.12%	8.51	-0.12%	**8.51**	**0.00%**
6	Zero	0.03	-0.12%	0.03	-0.12%	**0.03**	**0.00%**
	Upscale	8.51	-0.12%	8.51	-0.12%	**8.51**	**0.00%**
7	Zero	0.03	-0.12%	0.04	-0.06%	**0.04**	**0.06%**
	Upscale	8.51	-0.12%	8.52	-0.06%	**8.52**	**0.06%**
8	Zero	0.04	-0.06%	0.04	-0.06%	**0.04**	**0.00%**
	Upscale	8.52	-0.06%	8.52	-0.06%	**8.52**	**0.00%**
9	Zero	0.04	-0.06%	0.04	-0.06%	**0.04**	**0.00%**
	Upscale	8.52	-0.06%	8.52	-0.06%	**8.52**	**0.00%**
10	Zero	0.04	-0.06%	0.04	-0.06%	**0.04**	**0.00%**
	Upscale	8.52	-0.06%	8.52	-0.06%	**8.52**	**0.00%**

	Cylinder Value	Analyzer Response
Zero	0.00 ppm	0.05 ppm
Upscale	8.52 ppm	8.53 ppm
Span	17.36 ppm	17.36 ppm

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

Calibration Error

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
9/22/2011
Test 3L

$S0_2$(TEI Model 43i)

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	% of Span
Zero	0.00	0.21	0.21	249.00	0.08
Mid Level	114.40	114.25	0.15	249.00	0.06
High Level	249.00	249.71	0.71	249.00	0.29

NOx (TEI Model 42i)

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	% of Span
Zero	0.00	0.09	0.09	113.20	0.08
Mid Level	49.50	49.77	0.27	113.20	0.24
High Level	113.20	113.32	0.12	113.20	0.11

CO_2 (TEI Model 410i)

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (%)	% of Span
Zero	0.00	0.04	0.04	17.36	0.23
Mid Level	8.52	8.53	0.01	17.36	0.06
High Level	17.36	17.56	0.20	17.36	1.15

O_2 (Servomex Series 1400)

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (%)	% of Span
Zero	0.00	0.02	0.02	20.99	0.10
Mid Level	11.00	11.03	0.03	20.99	0.14
High Level	20.99	21.07	0.08	20.99	0.38

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

Calibration Drift

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
9/22/2011
Test 3L

O_2

		Initial	Pre-Cal Bias	Final	Post-cal Bias	Avg.	% Drift of Span
1	Zero	0.02	0.00%	0.04	0.10%	**0.03**	**0.10%**
	Upscale	11.03	0.00%	11.07	0.19%	**11.05**	**0.19%**
2	Zero	0.04	0.10%	0.03	0.05%	**0.04**	**-0.05%**
	Upscale	11.07	0.19%	11.05	0.10%	**11.06**	**-0.10%**
3	Zero	0.03	0.05%	0.04	0.10%	**0.04**	**0.05%**
	Upscale	11.05	0.10%	11.08	0.24%	**11.07**	**0.14%**
4	Zero	0.04	0.10%	0.04	0.10%	**0.04**	**0.00%**
	Upscale	11.08	0.24%	11.06	0.14%	**11.07**	**-0.10%**
5	Zero	0.04	0.10%	0.03	0.05%	**0.04**	**-0.05%**
	Upscale	11.06	0.14%	11.05	0.10%	**11.06**	**-0.05%**
6	Zero	0.03	0.05%	0.03	0.05%	**0.03**	**0.00%**
	Upscale	11.05	0.10%	11.05	0.10%	**11.05**	**0.00%**
7	Zero	0.03	0.05%	0.04	0.10%	**0.04**	**0.05%**
	Upscale	11.05	0.10%	11.04	0.05%	**11.05**	**-0.05%**
8	Zero	0.04	0.10%	0.03	0.05%	**0.04**	**-0.05%**
	Upscale	11.04	0.05%	11.08	0.24%	**11.06**	**0.19%**
9	Zero	0.03	0.05%	0.03	0.05%	**0.03**	**0.00%**
	Upscale	11.08	0.24%	11.08	0.24%	**11.08**	**0.00%**
10	Zero	0.03	0.05%	0.04	0.10%	**0.04**	**0.05%**
	Upscale	11.08	0.24%	11.07	0.19%	**11.08**	**-0.05%**

	Cylinder Value	Analyzer Value
Zero	0.00 %	0.02 %
Upscale	11.00 %	11.03 %
Span	20.99 %	20.99 %

** 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
S20 Boiler Stack
9/22/2011
Test 3L

CO_2

		Initial	Pre-Cal Bias	Final	Post-Cal Bias	Avg.	% Drift of Span
1	Zero	0.04	0.00%	0.04	0.00%	**0.04**	**0.00%**
	Upscale	8.53	0.00%	8.54	0.06%	**8.54**	**0.06%**
2	Zero	0.04	0.00%	0.02	-0.12%	**0.03**	**-0.12%**
	Upscale	8.54	0.06%	8.51	-0.12%	**8.53**	**-0.17%**
3	Zero	0.02	-0.12%	0.03	-0.06%	**0.03**	**0.06%**
	Upscale	8.51	-0.12%	8.49	-0.23%	**8.50**	**-0.12%**
4	Zero	0.03	-0.06%	0.02	-0.12%	**0.03**	**-0.06%**
	Upscale	8.49	-0.23%	8.48	-0.29%	**8.49**	**-0.06%**
5	Zero	0.02	-0.12%	0.02	-0.12%	**0.02**	**0.00%**
	Upscale	8.48	-0.29%	8.47	-0.35%	**8.48**	**-0.06%**
6	Zero	0.02	-0.12%	0.03	-0.06%	**0.03**	**0.06%**
	Upscale	8.47	-0.35%	8.51	-0.12%	**8.49**	**0.23%**
7	Zero	0.03	-0.06%	0.02	-0.12%	**0.03**	**-0.06%**
	Upscale	8.51	-0.12%	8.48	-0.29%	**8.50**	**-0.17%**
8	Zero	0.02	-0.12%	0.01	-0.17%	**0.02**	**-0.06%**
	Upscale	8.48	-0.29%	8.48	-0.29%	**8.48**	**0.00%**
9	Zero	0.01	-0.17%	0.02	-0.12%	**0.02**	**0.06%**
	Upscale	8.48	-0.29%	8.49	-0.23%	**8.49**	**0.06%**
10	Zero	0.02	-0.12%	0.03	-0.06%	**0.03**	**0.06%**
	Upscale	8.49	-0.23%	8.56	0.17%	**8.53**	**0.40%**

	Cylinder Value	Analyzer Response
Zero	0.00 ppm	0.04 ppm
Upscale	8.52 ppm	8.53 ppm
Span	17.36 ppm	17.36 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
S20 Boiler Stack
9/22/2011
Test 3L

Nox

		Initial	Pre-Cal Bias	Final	Post-Cal Bias	Avg.	% Drift of Span
1	Zero	0.09	0.00%	0.08	-0.01%	**0.09**	**-0.01%**
	Upscale	113.32	0.00%	113.97	0.57%	**113.65**	**0.57%**
2	Zero	0.08	-0.01%	0.09	0.00%	**0.09**	**0.01%**
	Upscale	113.97	0.57%	113.60	0.25%	**113.79**	**-0.33%**
3	Zero	0.09	0.00%	-0.16	-0.22%	**-0.04**	**-0.22%**
	Upscale	113.60	0.25%	113.02	-0.27%	**113.31**	**-0.51%**
4	Zero	-0.16	-0.22%	-0.21	-0.27%	**-0.19**	**-0.04%**
	Upscale	113.02	-0.27%	113.31	-0.01%	**113.17**	**0.26%**
5	Zero	-0.21	-0.27%	-0.18	-0.24%	**-0.20**	**0.03%**
	Upscale	113.31	-0.01%	113.98	0.58%	**113.65**	**0.59%**
6	Zero	-0.18	-0.24%	-0.18	-0.24%	**-0.18**	**0.00%**
	Upscale	113.98	0.58%	113.97	0.57%	**113.98**	**-0.01%**
7	Zero	-0.18	-0.24%	-0.21	-0.27%	**-0.20**	**-0.03%**
	Upscale	113.97	0.57%	113.37	0.04%	**113.67**	**-0.53%**
8	Zero	-0.21	-0.27%	-0.24	-0.29%	**-0.23**	**-0.03%**
	Upscale	113.37	0.04%	113.46	0.12%	**113.42**	**0.08%**
9	Zero	-0.24	-0.29%	-0.20	-0.26%	**-0.22**	**0.04%**
	Upscale	113.46	0.12%	114.22	0.80%	**113.84**	**0.67%**
10	Zero	-0.20	-0.26%	-0.24	-0.29%	**-0.22**	**-0.04%**
	Upscale	114.22	0.80%	114.23	0.80%	**114.23**	**0.01%**

	Cylinder Value	Analyzer Response
Zero	0.00 ppm	0.09 ppm
Upscale	113.20 ppm	113.32 ppm
Span	113.20 ppm	113.20 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
S20 Boiler Stack
9/22/2011
Test 3L

SO_2

		Initial	Pre-Cal Bias	Final	Post-Cal Bias	Avg.	% Drift of Span
1	Zero	0.21	0.00%	0.12	-0.04%	**0.17**	**-0.04%**
	Upscale	114.25	0.00%	114.83	0.23%	**114.54**	**0.23%**
2	Zero	0.12	-0.04%	0.23	0.01%	**0.18**	**0.04%**
	Upscale	114.83	0.23%	114.68	0.17%	**114.76**	**-0.06%**
3	Zero	0.23	0.01%	0.26	0.02%	**0.25**	**0.01%**
	Upscale	114.68	0.17%	113.58	-0.27%	**114.13**	**-0.44%**
4	Zero	0.26	0.02%	0.25	0.02%	**0.26**	**0.00%**
	Upscale	113.58	-0.27%	115.31	0.43%	**114.45**	**0.69%**
5	Zero	0.25	0.02%	0.37	0.06%	**0.31**	**0.05%**
	Upscale	115.31	0.43%	114.78	0.21%	**115.05**	**-0.21%**
6	Zero	0.37	0.06%	0.50	0.12%	**0.44**	**0.05%**
	Upscale	114.78	0.21%	115.40	0.46%	**115.09**	**0.25%**
7	Zero	0.50	0.12%	0.44	0.09%	**0.47**	**-0.02%**
	Upscale	115.40	0.46%	114.72	0.19%	**115.06**	**-0.27%**
8	Zero	0.44	0.09%	0.40	0.08%	**0.42**	**-0.02%**
	Upscale	114.72	0.19%	115.69	0.58%	**115.21**	**0.39%**
9	Zero	0.40	0.08%	0.09	-0.05%	**0.25**	**-0.12%**
	Upscale	115.69	0.58%	115.14	0.36%	**115.42**	**-0.22%**
10	Zero	0.09	-0.05%	0.23	0.01%	**0.16**	**0.06%**
	Upscale	115.14	0.36%	115.59	0.54%	**115.37**	**0.18%**

	Cylinder Value	Analyzer Response
Zero	0.00 ppm	0.21 ppm
Upscale	114.40 ppm	114.25 ppm
Span	249.00 ppm	249.00 ppm

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

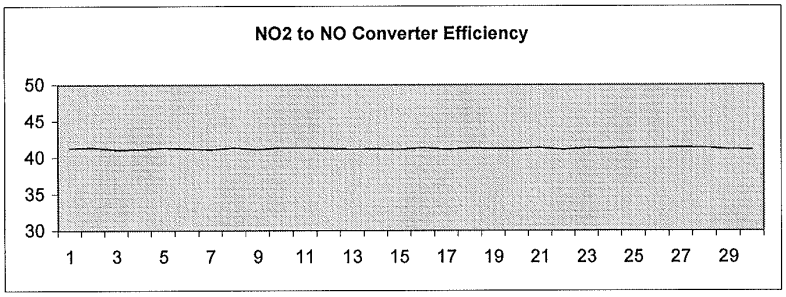
Interpoll Laboratories
(763) 786-6020

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

Job	MSI / Manitowoc PU
Source	S20 Boiler Stack
Date	9/22/2011
Operator	Rory Elynck / Andrew Strong
Analyzer	TECO Model 42i-LS (NOx)
Analyzer S/N	615216893

Time (min)	NOx Response
5:00 AM	41.310
5:01 AM	41.382
5:02 AM	41.105
5:03 AM	41.161
5:04 AM	41.345
5:05 AM	41.220
5:06 AM	41.126
5:07 AM	41.359
5:08 AM	41.146
5:09 AM	41.337
5:10 AM	41.374
5:11 AM	41.282
5:12 AM	41.176
5:13 AM	41.234
5:14 AM	41.173
5:15 AM	41.368
5:16 AM	41.151
5:17 AM	41.272
5:18 AM	41.242
5:19 AM	41.241
5:20 AM	41.360
5:21 AM	41.134
5:22 AM	41.333
5:23 AM	41.265
5:24 AM	41.360
5:25 AM	41.352
5:26 AM	41.375
5:27 AM	41.342
5:28 AM	41.169
5:29 AM	41.123
Highest Peak Value	41.38
Percent Drift	0.6%
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.



INTERPOLL LABORATORIES, INC.
(763) 786-6020

EPA Appendix A Stratification Test

Job:	MSI / Manitowoc PU	**Date:**	9/22/2011
Source:	S20 Boiler Stack	**Personnel:**	Rory Eiynck / Andrew Strong
Test	3L	**Bar. Press. (in. Hg)**	29.43
PDT Number	85 / 138		
Measurement Response Time:	113	seconds	

Stack Diameter 168.00 **in.** **Port Length in.** 14.00

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	28.00	**42.00**	12:20	117.47	44.50	14.27	5.89
2	0.50	84.00	**98.00**	12:27	160.23	39.81	14.01	6.13
3	0.83	140.00	**154.00**	12:34	184.28	38.04	13.74	6.39
Average				**0.52**	**154.00**	**40.78**	**14.01**	**6.14**
			Largest Value		184.28	44.50	14.27	6.39
			Smallest Value		117.47	38.04	13.74	5.89
			%Deviation		**56.87%**	**16.97%**	**3.84%**	**8.62%**

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

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
9/22/2011
Stratification Test Data

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	% CO_2, w
12:20:42	113.32	45.17	14.29	5.96
12:21:42	107.61	45.61	14.42	5.85
12:22:42	110.09	45.64	14.27	5.89
12:23:42	114.20	45.26	14.21	5.95
12:24:42	119.02	44.29	14.24	5.86
12:25:42	125.61	43.44	14.24	5.86
12:26:42	132.46	42.08	14.23	5.85
Average	**117.47**	**44.50**	**14.27**	**5.89**

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	% CO_2, w
12:27:42	136.00	42.93	14.14	5.99
12:28:42	146.93	40.83	14.14	5.93
12:29:42	154.92	39.19	14.10	5.99
12:30:42	160.12	40.12	14.04	6.07
12:31:42	170.57	38.36	14.14	6.15
12:32:42	175.01	39.43	13.89	6.29
12:33:42	178.09	37.81	13.64	6.47
Average	**160.23**	**39.81**	**14.01**	**6.13**

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	% CO_2, w
12:34:42	180.15	36.01	13.64	6.44
12:35:42	181.97	36.43	13.68	6.36
12:36:42	177.26	37.45	13.87	6.26
12:37:42	187.26	38.49	13.84	6.34
12:38:42	197.93	38.80	13.71	6.42
12:39:42	188.08	39.50	13.73	6.44
12:40:42	177.34	39.63	13.73	6.49
Average	**184.28**	**38.04**	**13.74**	**6.39**

APPENDIX E

CALIBRATION GAS CERTIFICATION SHEETS

Airgas

Airgas
630 United Drive
Durham, NC 27713
(919) 544-3772
Fax (919) 544-6297
www.airgas.com

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number:	E03NI62E15A0224	Reference Number:	122-124177728-2
Cylinder Number:	CC148479	Cylinder Volume:	157 Cu.Ft.
Laboratory:	ASG - Durham - NC	Cylinder Pressure:	2015 PSIG
Analysis Date:	May 15, 2009	Valve Outlet:	660

Expiration Date: May 15, 2012

Certification performed in accordance with "EPA Traceability Protocol (Sept. 1997)" using the assay procedures listed. Analytical Methodology does not require correction for analytical interferences. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.
Do Not Use This Cylinder below 150 psig.i.e. 1 Mega Pascal

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
CARBON DIOXIDE	17.00 %	17.36 %	G1	+/- 1% NIST Traceable
OXYGEN	21.00 %	20.99 %	G1	+/- 1% NIST Traceable
NITROGEN	Balance			

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Expiration Date
NTRM	060608	CC206165	22.51% OXYGEN/NITROGEN	May 01, 2010
NTRM	080613	CC254471	20.09% CARBON DIOXIDE/NITROGEN	Jul 15, 2012

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 CO2	FTIR	May 11, 2009
Horiba MPA-510 O2 (0.5-25%)	Paramagnetic	May 04, 2009

Triad Data Available Upon Request

Notes:ANW PART #781381

QA Approval

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#5000/AD

MPU00689

Linde SPECTRA Environmental Gases, 80 Industrial Drive, Alpha, NJ 08865

THE LINDE GROUP

Linde

CERTIFICATE OF ANALYSIS

EPA PROTOCOL MIXTURE

PROCEDURE # : G1

PGVP ID#:	I12011	**GAS CODE:**	OC2
CUSTOMER:	Linde Hammond Plant	**CYLINDER # :**	CC-88408
SALES#:	108169806	**CYLINDER PRES:**	2000 PSIG
PROD#:	1180579	**CYLINDER VALVE:**	CGA 590
P.O.# :	4501781249	**CYLINDER SIZE:**	2A
MATERIAL#:	24086339	**CYLINDER MATERIAL:**	Aluminum
CERTIFICATION DATE:	03-Jun-2011	**GAS VOLUME:**	4000 Liter
EXPIRATION DATE:	03-Jun-2014	**BLEND TOLERANCE:**	5% Relative
		PAGE:	1 of 1

CERTIFICATION HISTORY

COMPONENT	DATE OF ASSAY	MEAN CONCENTRATION	CERTIFIED CONCENTRATION	ANALYTICAL ACCURACY
Carbon Dioxide	03-Jun-2011	8.52 %	8.52 %	+/- 1%
Oxygen	03-Jun-2011	11.00 %	11.00 %	+/- 1%

BALANCE Nitrogen

PREVIOUS CERTIFICATION DATES: **None**

REFERENCE STANDARDS

COMPONENT	SRM/NTRM#	CYLINDER#	CONCENTRATION
Carbon Dioxide	GMIS-1	CC-109878	9.98 %
Oxygen	NTRM-82659X	CC-83903	22.80 %

INSTRUMENTATION

COMPONENT	MAKE/MODEL	SERIAL #	DETECTOR	CALIBRATION DATE(S)
Carbon Dioxide	CAI-300	S03001	NDIR	18-May-2011
Oxygen	CAI 300	S03001	PM	13-May-2011

THIS STANDARD IS NIST TRACEABLE. IT WAS CERTIFIED ACCORDING TO THE EPA PROTOCOL PROCEDURES.
DO NOT USE THIS STANDARD IF THE CYLINDER PRESSURE IS LESS THAN 150 PSIG.

ANALYST: MATTHEW JACKSON

Linde Gas North America LLC

DATE: 03-Jun-2011

(908) 329-9700 Main (908) 329-9740 Fax
www.Lindeus.com

20617

MPU00690

THE LINDE GROUP

CERTIFICATE OF ANALYSIS

EPA PROTOCOL MIXTURE

PROCEDURE # : G1

CUSTOMER: Linde Gas North America
SALES#: 107578918
PROD#: 1150533
P.O.# : 4501764807

CYLINDER # : CC-128758
CYLINDER PRES: 2000 PSIG
CGA OUTLET: 660

CERTIFICATION DATE: 9/2/2010
EXPIRATION DATE: 9/2/2012

CERTIFICATION HISTORY

COMPONENT	DATE OF ASSAY	MEAN CONCENTRATION	CERTIFIED CONCENTRATION	ANALYTICAL ACCURACY
Carbon Monoxide	8/26/2010 9/2/2010	254.1 ppm 253.8 ppm	254 ppm	+/- 1%
Nitric Oxide	8/26/2010 9/2/2010	255.1 ppm 254.0 ppm	255 ppm	+/- 1%
NOx			255 ppm	Reference Value Only
Sulfur Dioxide	8/26/2010 9/2/2010	248.9 ppm 249.7 ppm	249 ppm	+/- 1%

BALANCE Nitrogen

PREVIOUS CERTIFICATION DATES: None

REFERENCE STANDARDS

COMPONENT	SRM/NTRM#	CYLINDER#	CONCENTRATION
Carbon Monoxide	GMIS-1	CC-82186	504 ppm
Nitric Oxide	GMIS-1	CC-250174	1020 ppm
Sulfur Dioxide	GMIS-1	CC-118849	510 ppm

INSTRUMENTATION

COMPONENT	MAKE/MODEL	SERIAL #	DETECTOR	CALIBRATION DATE(S)
Carbon Monoxide	Horiba VIA-510	570423011	NDIR	8/30/2010
Nitric Oxide	CAI-400-CLD	6L09004	Chemi	8/10/2010
Sulfur Dioxide	Horiba VIA-510	851221093	NDIR	8/26/2010

THIS STANDARD IS NIST TRACEABLE. IT WAS CERTIFIED ACCORDING TO THE EPA PROTOCOL PROCEDURES.
DO NOT USE THIS STANDARD IF THE CYLINDER PRESSURE IS LESS THAN 150 PSIG.

ANALYST: CODY HAMLIN

Linde Gas North America LLC

DATE: 9/2/2010

(908) 454-7455 Main (908) 252-0811 Fax
www.spectragases.com

THE LINDE GROUP Linde

CERTIFICATE OF ANALYSIS

EPA PROTOCOL MIXTURE

PROCEDURE # : G1

CUSTOMER: Linde HAMMOND PLANT
SALES#: 107998857
PROD#: 1172309
P.O.# : 4501778098
MATERIAL#: 24089260
CERTIFICATION DATE: 03/25/2011
EXPIRATION DATE: 03/25/2013

CYLINDER # : CC-267376
CYLINDER PRES: 2000 PSIG
CYLINDER VALVE: CGA 660
CYLINDER SIZE: 2A
CYLINDER MATERIAL: Aluminum
GAS VOLUME: 4000 Liter
BLEND TOLERANCE: 5% Relative
PAGE: 1 of 1

CERTIFICATION HISTORY

COMPONENT	DATE OF ASSAY	MEAN CONCENTRATION	CERTIFIED CONCENTRATION	ANALYTICAL ACCURACY
Carbon Monoxide	03/18/2011 03/25/2011	112.4 ppm 112.0 ppm	112.2 ppm	+/- 1%
Nitric Oxide	03/18/2011 03/25/2011	112.7 ppm 113.8 ppm	113.2 ppm	+/- 1%
NOx			113.2 ppm	Reference Value Only
Sulfur Dioxide	03/18/2011 03/25/2011	114.8 ppm 114.0 ppm	114.4 ppm	+/- 1%

BALANCE Nitrogen

PREVIOUS CERTIFICATION DATES: None

REFERENCE STANDARDS

COMPONENT	SRM/NTRM#	CYLINDER#	CONCENTRATION
Carbon Monoxide	GMIS-1	CC-118482	502 ppm
Nitric Oxide	GMIS-1	CC-250092	250 ppm
Sulfur Dioxide	GMIS-1	CC-197153	493 ppm

INSTRUMENTATION

COMPONENT	MAKE/MODEL	SERIAL #	DETECTOR	CALIBRATION DATE(S)
Carbon Monoxide	Horiba VIA-510	570423011	NDIR	03/01/2011
Nitric Oxide	CAI 400-CLD	6L09004	Chemi	3/17/2011
Sulfur Dioxide	Horiba VIA-510	851221093	NDIR	3/11/2011

THIS STANDARD IS NIST TRACEABLE. IT WAS CERTIFIED ACCORDING TO THE EPA PROTOCOL PROCEDURES.
DO NOT USE THIS STANDARD IF THE CYLINDER PRESSURE IS LESS THAN 150 PSIG.

ANALYST: MATTHEW JACKSON

Linde Gas North America LLC

DATE: 03/25/2011

(908) 329-9700 Main (908) 329-9740 Fax
www.Lindeus.com

20420

MPU00692

THE LINDE GROUP

CERTIFICATE OF ANALYSIS

EPA PROTOCOL MIXTURE
PROCEDURE # : G1

CUSTOMER: Linde Hammond Plant
SALES#: 108072150
PROD#: 1176156
P.O.# : 45017806046
MATERIAL#: 24086350
CERTIFICATION DATE: 04/27/2011
EXPIRATION DATE: 04/27/2013

CYLINDER # : SA-17929
CYLINDER PRES: 2000 PSIG
CYLINDER VALVE: CGA 660
CYLINDER SIZE: 2A
CYLINDER MATERIAL: Aluminum
GAS VOLUME: 4000 Liter
BLEND TOLERANCE: 5% Relative
PAGE: 1 of 1

CERTIFICATION HISTORY

COMPONENT	DATE OF ASSAY	MEAN CONCENTRATION	CERTIFIED CONCENTRATION	ANALYTICAL ACCURACY
Carbon Monoxide	04/20/2011 04/27/2011	50.31 ppm 50.42 ppm	50.4 ppm	+/- 1%
Nitric Oxide	04/20/2011 04/27/2011	49.41 ppm 49.55 ppm	49.5 ppm	+/- 1%
NOx			49.5 ppm	Reference Value Only
Sulfur Dioxide	04/20/2011 04/27/2011	50.44 ppm 50.03 ppm	50.2 ppm	+/- 1%

BALANCE Nitrogen

PREVIOUS CERTIFICATION DATES: None

REFERENCE STANDARDS

COMPONENT	SRM/NTRM#	CYLINDER#	CONCENTRATION
Carbon Monoxide	NTRM-81679	CC-135124	101 ppm
Nitric Oxide	GMIS-1	CC-202692	98.8 ppm
Sulfur Dioxide	NTRM-81694	CC-162819	96.1 ppm

INSTRUMENTATION

COMPONENT	MAKE/MODEL	SERIAL #	DETECTOR	CALIBRATION DATE(S)
Carbon Monoxide	Horiba VIA-510	H0002L2Y	NDIR	03/28/2011
Nitric Oxide	CAI 400-CLD	6L09004	Chemi	4/26/2011
Sulfur Dioxide	Horiba VIA-510	851221093	NDIR	4/19/2011

THIS STANDARD IS NIST TRACEABLE. IT WAS CERTIFIED ACCORDING TO THE EPA PROTOCOL PROCEDURES.
DO NOT USE THIS STANDARD IF THE CYLINDER PRESSURE IS LESS THAN 150 PSIG.

ANALYST: JUSTIN KUTZ

Linde Gas North America LLC

DATE: 04/27/2011

(908) 329-9700 Main (908) 329-9740 Fax
www.Lindeus.com

MPU00693

APPENDIX F

GAS ANALYZER SPECIFICATIONS

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.

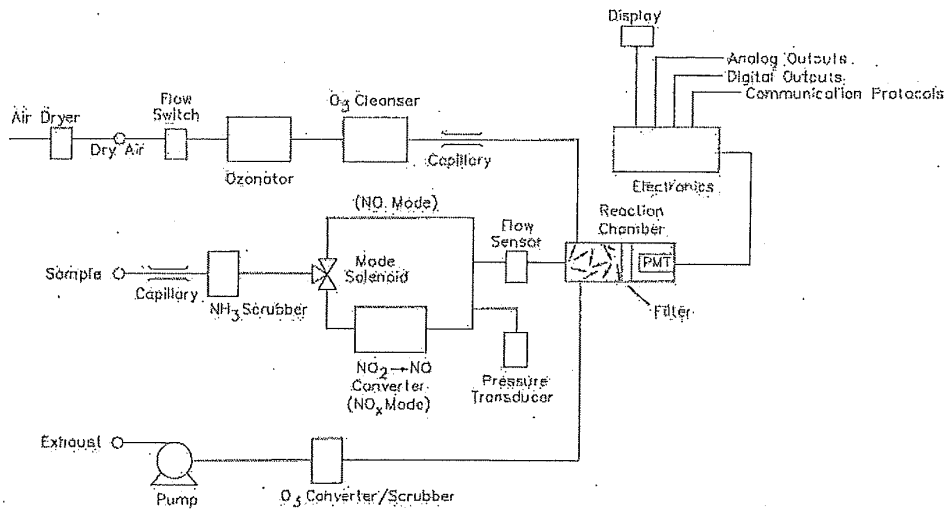

Figure 1-1. Model 42*i* Low Source Flow Schematic

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)

MPU00695

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.

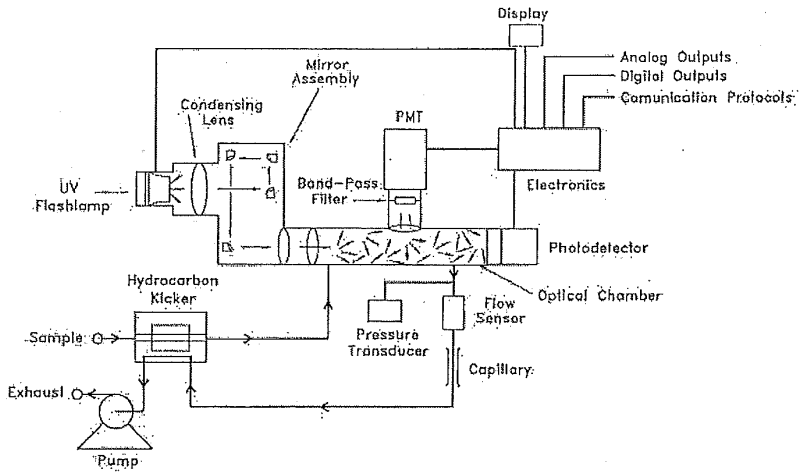

Figure 1-1. Model 43*i* Flow Schematic

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

MPU00697

Sample flow rate	0.5 LPM (standard) 1 LPM (optional)
Interferences (tested at levels specified by EPA)	less than lower detectable limit except for the following: NO: < 3 ppb, tested at 500 ppb M-Xylene: tested at 200 ppb H_2O: tested at 2% of reading
Operating temperature	20–30 °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 165 watts
Physical dimensions	16.75" (W) X 8.62" (H) X 23" (D)
Weight	Approximately 48 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, 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 within 20–30 °C range.

Table 1-2. Model 43*i* Optional Permeation Oven Specifications

Temperature control	Single Point 45 °C
Temperature stability	± 0.1 °C
Warm-up time	1 hour (permeation device can take 24 to 48 hours to stabilize)
Carrier gas flow	≈ 70 scc/min
Chamber size	Accepts permeation tubes up to 9 cm in total length; 1 cm in diameter
Temperature range	20–30 °C
Physical dimensions	Contained inside the Model 43*i*
Power requirements	120 VAC @ 50/60 Hz, 50 watts (in addition to the standard Model 43*i*)
Weight	Approximatedly 5 lbs. (in addition to the standard Model 43*i*)

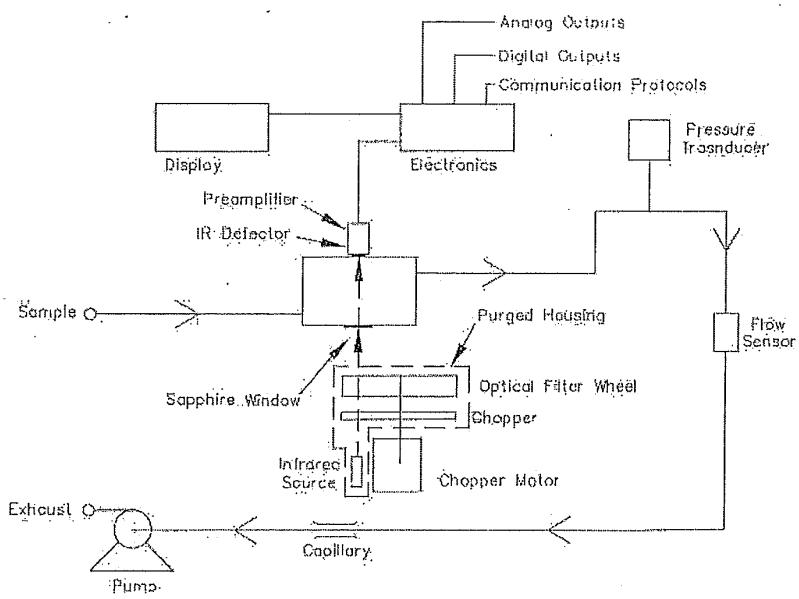

Figure 1-1. Model 410*i* Flow Schematic

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

MPU00699

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

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.

Z:\Word\Methods\Analyzer Specs\Dilution Trailer\Servomex O2.doc

MPU00701

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

APPENDIX G

CEM INSTRUMENT INFORMATION SHEETS

INTERPOLL LABORATORIES, INC.
(763) 786-6020

CEM Relative Accuracy Certification Instrument Information Sheet

Plant Name: Manitowoc Public Utilities

Pollutant Gas Monitor Data:

Vendor: Thermo

Model: 43i S/N 0908635559

Location: S20 stack

Gas (es): ☑ SO_2 ☐ NOx ☐ CO

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

Installation Date: 10 Sept. 09

Start-Up Date: 10 Sept. 09

Data Recording System:

☐ Strip Chart Recorder ☑ Data Logger System

☑ Computer

Relative Accuracy Certification Units:

☐ ppm, dry ☐ LB/10^6BTU by O_2 F-Factor

☑ ppm, wet ☐ LB/10^6BTU by CO_2 F-Factor

☐ LBS/HR

Span Value (ppm):

SO_2 0 - 1200

NOx 0 - 500

CO

Signature of Person Responsible for Data

Plant Location: Manitowoc, WI

Diluent Monitor Data:

Vendor: Thermo

Model: 410i S/N 0811429266

Location: S20 stack

Gas: ☐ O_2 ☐ CO_2

Type of System: ☑ In-Situ ☐ Extractive

Installation Date: 08 Sept. 08

Start-Up Date: 08 Sept. 08

Data Recording System:

☐ Strip Chart Recorder ☑ Data Logger System

☑ Computer

Output Units:

☐ %O_2, dry ☐ % CO_2, dry

☐ %O_2, wet ☑ % CO_2, wet

Span Gas Values (% v/v):

	*********Oxygen********	***Carbon Dioxide***
Low		5.15
High		17.21

9-18-09

Date

1

MPU00704

INTERPOLL LABORATORIES, INC.
(763) 786-6020

CEM Relative Accuracy Certification Instrument Information Sheet

Plant Name: Manitowoc Public Utilities

Pollutant Gas Monitor Data:

Vendor: Thermo

Model: 421-D S/N 0908635558

Location: 520 stack

Gas (es): ☐ SO_2 ☑ NOx ☐ CO

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

Installation Date: 10 Sept. 09

Start-Up Date: 10 Sept. 09

Data Recording System:

☐ Strip Chart Recorder ☑ Data Logger System

☑ Computer

Relative Accuracy Certification Units:

☐ ppm, dry ☐ LB/10^6BTU by O_2 F-Factor

☑ ppm, wet ☑ LB/10^6BTU by CO_2 F-Factor

☐ LBS/HR

Span Value (ppm):

SO_2 0-1200

NOx 0-500

CO

Signature of Person Responsible for Data

Plant Location: Manitowoc, WI

Diluent Monitor Data:

Vendor: Thermo

Model: 410i S/N 0811429266

Location: 520 stack

Gas: ☐ O_2 ☑ CO_2

Type of System: ☑ In-Situ ☐ Extractive

Installation Date: 08 Sept. 08

Start-Up Date: 08 Sept. 08

Data Recording System:

☐ Strip Chart Recorder ☑ Data Logger System

☑ Computer

Output Units:

☐ $\%O_2$, dry ☐ $\%CO_2$, dry

☐ $\%O_2$, wet ☑ $\%CO_2$, wet

Span Gas Values (% v/v):

*********Oxygen********		***Carbon Dioxide***
Low		J.F. 5.15
High		17.21

9-18-09

Date

2

MPU00705

APPENDIX H

CEM DATA

S20 mid flow RATA
Run 1

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 09/21/2011 20:35 Through 09/21/2011 20:44
Time Online Criteria: 1 minute(s)

Source	S20				
Parameter (Unit)	S20CPFLO (SCFH)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
09/21/11 20:35	4,071,950.9	67.9	5.820	143	193.6
09/21/11 20:36	4,046,416.0	67.4	5.821	143	193.6
09/21/11 20:37	3,929,290.0	65.5	5.821	143	192.8
09/21/11 20:38	4,127,191.0	68.8	5.821	143	193.3
09/21/11 20:39	4,080,092.0	68.0	5.822	143	193.7
09/21/11 20:40	4,000,858.0	66.7	5.822	143	193.3
09/21/11 20:41	4,011,904.0	66.9	5.822	142	192.7
09/21/11 20:42	4,089,478.0	68.2	5.822	142	192.5
09/21/11 20:43	3,676,339.0	61.3	5.822	142	191.4
09/21/11 20:44	4,006,232.0	66.8	5.822	141	191.4
Average	4,003,975.1	66.8	5.822	143	192.8
Minimum	3,676,339.0	61.3	5.820	141	191.4
Maximum	4,127,191.0	68.8	5.822	143	193.7
Summation	40,039,750.9	667.5	58.215	1,425	1,928.3
Included Data Points	10	10	10	10	10
Total number of Data Points	10	10	10	10	10

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

Report Generated: 09/21/11 20:46 Report Version 3.0.0914 STACKVISION- 1 of 1

MPU00707

S20 mid flow RATA
Run 2

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 09/21/2011 20:45 Through 09/21/2011 20:52
Time Online Criteria: 1 minute(s)

Source	S20				
Parameter (Unit)	S20CPFLO (SCFH)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
09/21/11 20:45	4,082,550.0	68.0	5.822	142	191.7
09/21/11 20:46	4,103,951.0	68.4	5.822	141	191.8
09/21/11 20:47	4,376,433.0	72.9	5.822	141	192.3
09/21/11 20:48	4,162,249.0	69.4	5.822	141	192.5
09/21/11 20:49	4,175,977.0	69.6	5.822	141	192.3
09/21/11 20:50	4,024,894.0	67.1	5.822	141	191.9
09/21/11 20:51	3,981,894.0	66.4	5.822	141	191.4
09/21/11 20:52	3,983,353.0	66.4	5.821	141	191.3
Average	4,111,412.6	68.5	5.822	141	191.9
Minimum	3,981,894.0	66.4	5.821	141	191.3
Maximum	4,376,433.0	72.9	5.822	142	192.5
Summation	32,891,301.0	548.2	46.575	1,129	1,535.2
Included Data Points	8	8	8	8	8
Total number of Data Points	8	8	8	8	8

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

Report Generated: 09/21/11 21:06 Report Version 3.0.0914 STACKVISION- 1 of 1

MPU00708

S20 mid Flow RATA
Run 3

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 09/21/2011 20:53 Through 09/21/2011 21:00
Time Online Criteria: 1 minute(s)

Source	S20				
Parameter (Unit)	S20CPFLO (SCFH)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
09/21/11 20:53	3,985,368.0	66.4	5.821	141	191.4
09/21/11 20:54	3,991,699.0	66.5	5.821	142	191.3
09/21/11 20:55	4,020,511.0	67.0	5.821	143	191.3
09/21/11 20:56	4,068,801.0	67.8	5.821	143	192.0
09/21/11 20:57	4,100,702.0	68.3	5.821	143	192.2
09/21/11 20:58	4,077,330.0	68.0	5.821	143	192.6
09/21/11 20:59	4,243,816.0	70.7	5.822	143	192.4
09/21/11 21:00	4,058,670.0	67.6	5.821	143	192.2
Average	4,068,362.1	67.8	5.821	143	191.9
Minimum	3,985,368.0	66.4	5.821	141	191.3
Maximum	4,243,816.0	70.7	5.822	143	192.6
Summation	32,546,897.0	542.3	46.569	1,141	1,535.4
Included Data Points	8	8	8	8	8
Total number of Data Points	8	8	8	8	8

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

S20 mid flow RATA
Run 4

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 09/21/2011 21:12 Through 09/21/2011 21:18
Time Online Criteria: 1 minute(s)

Source	S20				
Parameter (Unit)	S20CPFLO (SCFH)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
09/21/11 21:12	4,395,566.0	73.3	5.822	142	191.6
09/21/11 21:13	4,086,891.0	68.1	5.823	142	191.3
09/21/11 21:14	4,267,707.0	71.1	5.822	142	192.3
09/21/11 21:15	3,969,908.0	66.2	5.822	142	192.2
09/21/11 21:16	3,952,707.0	65.9	5.821	142	191.8
09/21/11 21:17	4,060,299.0	67.7	5.821	142	191.7
09/21/11 21:18	4,140,416.0	69.0	5.821	143	191.9
Average	4,124,784.9	68.8	5.822	142	191.8
Minimum	3,952,707.0	65.9	5.821	142	191.3
Maximum	4,395,566.0	73.3	5.823	143	192.3
Summation	28,873,494.0	481.3	40.752	995	1,342.8
Included Data Points	7	7	7	7	7
Total number of Data Points	7	7	7	7	7

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

S20 mid flow RATA
Run 5

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 09/21/2011 21:19 Through 09/21/2011 21:26
Time Online Criteria: 1 minute(s)

Source	S20				
Parameter (Unit)	S20CPFLO (SCFH)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
09/21/11 21:19	3,997,512.0	66.6	5.821	143	192.1
09/21/11 21:20	4,195,107.0	69.9	5.822	144	191.7
09/21/11 21:21	4,126,261.0	68.8	5.821	145	191.5
09/21/11 21:22	4,191,654.0	69.9	5.822	146	191.7
09/21/11 21:23	4,177,185.0	69.6	5.822	147	192.0
09/21/11 21:24	3,976,940.0	66.3	5.822	145	193.2
09/21/11 21:25	4,085,001.0	68.1	5.821	143	193.3
09/21/11 21:26	4,098,987.0	68.3	5.822	142	193.0
Average	4,106,080.9	68.4	5.822	144	192.3
Minimum	3,976,940.0	66.3	5.821	142	191.5
Maximum	4,195,107.0	69.9	5.822	147	193.3
Summation	32,848,647.0	547.5	46.573	1,155	1,538.5
Included Data Points	8	8	8	8	8
Total number of Data Points	8	8	8	8	8

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

Report Generated: 09/21/11 21:35 Report Version 3.0.0914 STACKVISION- 1 of 1

MPU00711

S20 mid Flow RATA
Run 6

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 09/21/2011 21:27 Through 09/21/2011 21:33
Time Online Criteria: 1 minute(s)

Source	S20				
Parameter (Unit)	S20CPFLO (SCFH)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
09/21/11 21:27	4,081,028.0	68.0	5.822	142	192.9
09/21/11 21:28	4,084,138.0	68.1	5.822	142	192.7
09/21/11 21:29	4,017,734.0	67.0	5.822	142	193.0
09/21/11 21:30	3,960,970.0	66.0	5.822	141	192.3
09/21/11 21:31	4,123,567.0	68.7	5.822	141	191.8
09/21/11 21:32	4,110,183.0	68.5	5.821	141	192.1
09/21/11 21:33	4,054,344.0	67.6	5.821	142	192.4
Average	4,061,709.1	67.7	5.822	142	192.5
Minimum	3,960,970.0	66.0	5.821	141	191.8
Maximum	4,123,567.0	68.7	5.822	142	193.0
Summation	28,431,964.0	473.9	40.752	991	1,347.2
Included Data Points	7	7	7	7	7
Total number of Data Points	7	7	7	7	7

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

Report Generated: 09/21/11 21:36 Report Version 3.0.0914 STACKVISION- 1 of 1

MPU00712

S20 mid load RATA
Run 7

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 09/21/2011 21:42 Through 09/21/2011 21:48
Time Online Criteria: 1 minute(s)

Source	S20				
Parameter (Unit)	S20CPFLO (SCFH)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
09/21/11 21:42	4,010,492.0	66.8	5.822	141	192.4
09/21/11 21:43	3,968,873.0	66.1	5.822	142	192.4
09/21/11 21:44	3,968,722.0	66.1	5.822	142	192.4
09/21/11 21:45	3,985,835.0	66.4	5.822	142	192.1
09/21/11 21:46	3,896,930.0	64.9	5.822	142	192.7
09/21/11 21:47	4,020,319.0	67.0	5.822	142	193.3
09/21/11 21:48	4,044,158.0	67.4	5.822	142	193.2
Average	3,985,047.0	66.4	5.822	142	192.6
Minimum	3,896,930.0	64.9	5.822	141	192.1
Maximum	4,044,158.0	67.4	5.822	142	193.3
Summation	27,895,329.0	464.7	40.754	993	1,348.5
Included Data Points	7	7	7	7	7
Total number of Data Points	7	7	7	7	7

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

S20 midload RATA
Run 8

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 09/21/2011 21:49 Through 09/21/2011 21:55
Time Online Criteria: 1 minute(s)

Source	S20				
Parameter (Unit)	S20CPFLO (SCFH)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
09/21/11 21:49	4,083,449.0	68.1	5.822	142	192.6
09/21/11 21:50	4,108,200.0	68.5	5.822	142	192.6
09/21/11 21:51	4,051,410.0	67.5	5.822	142	192.8
09/21/11 21:52	4,055,720.0	67.6	5.822	143	193.4
09/21/11 21:53	4,272,996.0	71.2	5.822	144	192.2
09/21/11 21:54	3,952,332.0	65.9	5.822	144	191.5
09/21/11 21:55	4,065,413.0	67.8	5.822	144	192.1
Average	4,084,217.1	68.1	5.822	143	192.5
Minimum	3,952,332.0	65.9	5.822	142	191.5
Maximum	4,272,996.0	71.2	5.822	144	193.4
Summation	28,589,520.0	476.6	40.754	1,001	1,347.2
Included Data Points	7	7	7	7	7
Total number of Data Points	7	7	7	7	7

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

Report Generated: 09/21/11 22:11 Report Version 3.0.0914 STACKVISION- 1 of 1

MPU00714

S20 mid load RATA
Run 9

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 09/21/2011 21:56 Through 09/21/2011 22:02
Time Online Criteria: 1 minute(s)

Source	S20				
Parameter (Unit)	S20CPFLO (SCFH)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
09/21/11 21:56	4,153,624.0	69.2	5.822	144	192.6
09/21/11 21:57	4,103,102.0	68.4	5.822	144	192.5
09/21/11 21:58	4,115,012.0	68.6	5.822	144	192.3
09/21/11 21:59	4,091,816.0	68.2	5.821	143	192.4
09/21/11 22:00	3,996,113.0	66.6	5.822	143	192.8
09/21/11 22:01	4,014,730.0	66.9	5.821	142	193.2
09/21/11 22:02	4,042,094.0	67.4	5.821	142	193.2
Average	4,073,784.4	67.9	5.822	143	192.7
Minimum	3,996,113.0	66.6	5.821	142	192.3
Maximum	4,153,624.0	69.2	5.822	144	193.2
Summation	28,516,491.0	475.3	40.751	1,002	1,349.0
Included Data Points	7	7	7	7	7
Total number of Data Points	7	7	7	7	7

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

Report Generated: 09/21/11 22:12 Report Version 3.0.0914 STACKVISION- 1 of 1

MPU00715

S20 mid load RATA
Run 10

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 09/21/2011 22:03 Through 09/21/2011 22:08
Time Online Criteria: 1 minute(s)

Source	S20				
Parameter (Unit)	S20CPFLO (SCFH)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
09/21/11 22:03	3,786,742.0	63.1	5.821	142	192.5
09/21/11 22:04	4,045,779.0	67.4	5.821	141	192.5
09/21/11 22:05	3,977,204.0	66.3	5.821	141	193.0
09/21/11 22:06	4,010,893.0	66.8	5.820	141	193.4
09/21/11 22:07	4,089,696.0	68.2	5.820	140	192.9
09/21/11 22:08	4,090,647.0	68.2	5.820	140	192.7
Average	4,000,160.2	66.7	5.821	141	192.8
Minimum	3,786,742.0	63.1	5.820	140	192.5
Maximum	4,090,647.0	68.2	5.821	142	193.4
Summation	24,000,961.0	400.0	34.923	845	1,157.0
Included Data Points	6	6	6	6	6
Total number of Data Points	6	6	6	6	6

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

Report Generated: 09/21/11 22:12 Report Version 3.0.0914 STACKVISION-

S20 Gas RATA
Run 1

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 09/22/2011 12:20 Through 09/22/2011 12:40
Time Online Criteria: 1 minute(s)

Source	S20						
Parameter (Unit)	S20CPCO2 (PERCENT)	S20CPNOX (PPM)	S20CPSO2 (PPM)	S20FFACT (MMBTU/CF)	S20NOX#M (LB/MMBTU)	S20SO2#M (LB/MMBTU)	S20STEAM (KLBS/HR)
09/22/11 12:20	5.9	45.3	112.6	1,839.0	0.169	0.583	81
09/22/11 12:21	6.0	46.4	112.7	1,839.0	0.170	0.573	80
09/22/11 12:22	5.9	47.6	106.8	1,839.0	0.177	0.553	78
09/22/11 12:23	5.9	46.9	108.5	1,839.0	0.175	0.561	78
09/22/11 12:24	6.0	46.5	112.2	1,839.0	0.170	0.571	78
09/22/11 12:25	6.0	45.5	116.1	1,839.0	0.167	0.591	78
09/22/11 12:26	5.9	44.4	120.9	1,839.0	0.165	0.626	78
09/22/11 12:27	5.9	43.2	129.2	1,839.0	0.161	0.668	81
09/22/11 12:28	6.1	43.4	131.7	1,839.0	0.156	0.659	82
09/22/11 12:29	6.1	41.6	141.3	1,839.0	0.150	0.707	82
09/22/11 12:30	6.1	40.8	150.1	1,839.0	0.147	0.751	78
09/22/11 12:31	6.2	41.3	154.3	1,839.0	0.146	0.760	76
09/22/11 12:32	6.2	39.7	164.6	1,839.0	0.141	0.810	83
09/22/11 12:33	6.3	41.0	168.2	1,839.0	0.143	0.815	92
09/22/11 12:34	6.6	39.7	172.8	1,839.0	0.132	0.799	89
09/22/11 12:35	6.5	38.3	172.1	1,839.0	0.129	0.808	82
09/22/11 12:36	6.5	38.5	176.1	1,839.0	0.130	0.827	79
09/22/11 12:37	6.4	39.6	171.3	1,839.0	0.136	0.817	79
09/22/11 12:38	6.5	40.7	178.5	1,839.0	0.137	0.838	80
09/22/11 12:39	6.5	41.0	187.2	1,839.0	0.139	0.879	87
09/22/11 12:40	6.5	42.1	184.9	1,839.0	0.142	0.868	90
Average	6.2	42.5	146.3	1,839.0	0.152	0.717	81
Minimum	5.9	38.3	106.8	1,839.0	0.129	0.553	76
Maximum	6.6	47.6	187.2	1,839.0	0.177	0.879	92
Summation	130.0	893.5	3,072.1	38,619.0	3.182	15.064	1,711
Included Data Points	21	21	21	21	21	21	21
Total number of Data Points	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

S20 Gas RATA
Run 2

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 09/22/2011 12:50 Through 09/22/2011 13:10
Time Online Criteria: 1 minute(s)

Source	S20						
Parameter (Unit)	S20CPCO2 (PERCENT)	S20CPNOX (PPM)	S20CPSO2 (PPM)	S20FFACT (MMBTU/CF)	S20NOX#M (LB/MMBTU)	S20SO2#M (LB/MMBTU)	S20STEAM (KLBS/HR)
09/22/11 12:50	6.3	48.4	85.0	1,839.0	0.169	0.412	78
09/22/11 12:51	6.3	50.2	82.8	1,839.0	0.175	0.401	83
09/22/11 12:52	6.2	50.9	80.2	1,839.0	0.180	0.395	85
09/22/11 12:53	6.2	49.7	81.6	1,839.0	0.176	0.402	79
09/22/11 12:54	6.2	49.6	82.3	1,839.0	0.176	0.405	76
09/22/11 12:55	6.3	49.6	82.7	1,839.0	0.173	0.401	78
09/22/11 12:56	6.3	51.0	79.7	1,839.0	0.178	0.386	82
09/22/11 12:57	6.2	50.1	77.7	1,839.0	0.177	0.383	82
09/22/11 12:58	6.1	49.9	77.1	1,839.0	0.180	0.386	80
09/22/11 12:59	6.1	49.0	78.4	1,839.0	0.176	0.392	77
09/22/11 13:00	6.1	49.0	81.0	1,839.0	0.176	0.405	76
09/22/11 13:01	6.1	48.4	84.2	1,839.0	0.174	0.421	78
09/22/11 13:02	6.0	48.7	84.7	1,839.0	0.178	0.431	78
09/22/11 13:03	6.1	48.3	86.1	1,839.0	0.174	0.431	76
09/22/11 13:04	6.0	47.0	86.6	1,839.0	0.172	0.441	77
09/22/11 13:05	6.2	48.3	88.4	1,839.0	0.171	0.435	80
09/22/11 13:06	6.3	48.3	93.3	1,839.0	0.168	0.452	84
09/22/11 13:07	6.2	48.5	89.9	1,839.0	0.172	0.443	83
09/22/11 13:08	6.2	48.3	93.1	1,839.0	0.171	0.458	78
09/22/11 13:09	6.1	47.6	91.6	1,839.0	0.171	0.458	74
09/22/11 13:10	6.2	48.4	92.9	1,839.0	0.171	0.457	78
Average	6.2	49.0	84.7	1,839.0	0.174	0.419	79
Minimum	6.0	47.0	77.1	1,839.0	0.168	0.383	74
Maximum	6.3	51.0	93.3	1,839.0	0.180	0.458	85
Summation	129.7	1,029.2	1,779.3	38,619.0	3.658	8.795	1,662
Included Data Points	21	21	21	21	21	21	21
Total number of Data Points	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

S20 Gas RATA
Run 3

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 09/22/2011 13:20 Through 09/22/2011 13:40
Time Online Criteria: 1 minute(s)

Source	S20						
Parameter (Unit)	S20CPCO2 (PERCENT)	S20CPNOX (PPM)	S20CPSO2 (PPM)	S20FFACT (MMBTU/CF)	S20NOX#M (LB/MMBTU)	S20SO2#M (LB/MMBTU)	S20STEAM (KLBS/HR)
09/22/11 13:20	6.2	48.1	92.2	1,839.0	0.170	0.454	80
09/22/11 13:21	6.3	48.6	94.7	1,839.0	0.169	0.459	79
09/22/11 13:22	6.2	47.8	96.2	1,839.0	0.169	0.474	78
09/22/11 13:23	6.2	48.6	96.2	1,839.0	0.172	0.474	76
09/22/11 13:24	6.1	45.9	100.7	1,839.0	0.165	0.504	80
09/22/11 13:25	6.2	45.6	105.3	1,839.0	0.161	0.518	83
09/22/11 13:26	6.3	44.5	109.7	1,839.0	0.155	0.532	82
09/22/11 13:27	6.3	43.2	111.2	1,839.0	0.151	0.539	79
09/22/11 13:28	6.4	44.0	115.6	1,839.0	0.151	0.551	78
09/22/11 13:29	6.4	44.9	114.7	1,839.0	0.154	0.547	77
09/22/11 13:30	6.4	43.9	110.1	1,839.0	0.151	0.525	79
09/22/11 13:31	6.5	44.3	109.8	1,839.0	0.150	0.516	81
09/22/11 13:32	6.5	44.8	107.0	1,839.0	0.151	0.503	83
09/22/11 13:33	6.5	45.3	106.0	1,839.0	0.153	0.498	83
09/22/11 13:34	6.6	46.4	103.7	1,839.0	0.154	0.480	82
09/22/11 13:35	6.6	46.9	98.8	1,839.0	0.156	0.457	81
09/22/11 13:36	6.5	44.8	98.8	1,839.0	0.151	0.464	81
09/22/11 13:37	6.5	46.4	95.6	1,839.0	0.157	0.449	80
09/22/11 13:38	6.5	45.7	94.7	1,839.0	0.154	0.445	81
09/22/11 13:39	6.5	47.0	95.2	1,839.0	0.159	0.447	81
09/22/11 13:40	6.6	46.4	96.9	1,839.0	0.154	0.448	80
Average	6.4	45.9	102.5	1,839.0	0.157	0.490	80
Minimum	6.1	43.2	92.2	1,839.0	0.150	0.445	76
Maximum	6.6	48.6	115.6	1,839.0	0.172	0.551	83
Summation	134.3	963.1	2,153.1	38,619.0	3.307	10.284	1,684
Included Data Points	21	21	21	21	21	21	21
Total number of Data Points	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

S20 Gas RATA
Run 4

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 09/22/2011 13:50 Through 09/22/2011 14:10
Time Online Criteria: 1 minute(s)

Source	S20						
Parameter (Unit)	S20CPCO2 (PERCENT)	S20CPNOX (PPM)	S20CPSO2 (PPM)	S20FFACT (MMBTU/CF)	S20NOX#M (LB/MMBTU)	S20SO2#M (LB/MMBTU)	S20STEAM (KLBS/HR)
09/22/11 13:50	6.4	50.5	77.4	1,839.0	0.173	0.369	79
09/22/11 13:51	6.5	50.5	81.1	1,839.0	0.171	0.381	83
09/22/11 13:52	6.5	51.5	76.0	1,839.0	0.174	0.357	84
09/22/11 13:53	6.5	51.8	77.2	1,839.0	0.175	0.363	82
09/22/11 13:54	6.4	52.7	76.8	1,839.0	0.181	0.366	79
09/22/11 13:55	6.4	52.2	78.0	1,839.0	0.179	0.372	77
09/22/11 13:56	6.4	51.8	81.1	1,839.0	0.178	0.387	77
09/22/11 13:57	6.4	51.7	78.8	1,839.0	0.177	0.376	83
09/22/11 13:58	6.4	51.8	73.6	1,839.0	0.178	0.351	86
09/22/11 13:59	6.4	51.9	75.3	1,839.0	0.178	0.359	80
09/22/11 14:00	6.3	53.6	75.0	1,839.0	0.187	0.363	76
09/22/11 14:01	6.3	52.1	76.3	1,839.0	0.182	0.370	76
09/22/11 14:02	6.3	52.1	79.7	1,839.0	0.182	0.386	85
09/22/11 14:03	6.4	52.1	81.2	1,839.0	0.179	0.387	83
09/22/11 14:04	6.2	50.7	80.3	1,839.0	0.180	0.395	79
09/22/11 14:05	6.1	50.8	83.9	1,839.0	0.183	0.420	76
09/22/11 14:06	6.3	50.6	89.1	1,839.0	0.176	0.432	77
09/22/11 14:07	6.2	50.8	91.6	1,839.0	0.180	0.451	79
09/22/11 14:08	6.3	49.6	97.1	1,839.0	0.173	0.471	80
09/22/11 14:09	6.4	49.9	96.5	1,839.0	0.171	0.460	86
09/22/11 14:10	6.4	49.5	99.6	1,839.0	0.170	0.475	85
Average	6.4	51.3	82.2	1,839.0	0.177	0.395	81
Minimum	6.1	49.5	73.6	1,839.0	0.170	0.351	76
Maximum	6.5	53.6	99.6	1,839.0	0.187	0.475	86
Summation	133.5	1,078.2	1,725.6	38,619.0	3.727	8.291	1,692
Included Data Points	21	21	21	21	21	21	21
Total number of Data Points	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

S20 Gas RATA
Run 5

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 09/22/2011 14:30 Through 09/22/2011 14:50
Time Online Criteria: 1 minute(s)

Source	S20						
Parameter (Unit)	S20CPCO2 (PERCENT)	S20CPNOX (PPM)	S20CPSO2 (PPM)	S20FFACT (MMBTU/CF)	S20NOX#M (LB/MMBTU)	S20SO2#M (LB/MMBTU)	S20STEAM (KLBS/HR)
09/22/11 14:30	6.4	46.7	88.8	1,839.0	0.160	0.424	81
09/22/11 14:31	6.4	45.9	93.4	1,839.0	0.157	0.446	78
09/22/11 14:32	6.3	46.2	93.3	1,839.0	0.161	0.452	79
09/22/11 14:33	6.3	46.6	93.1	1,839.0	0.162	0.451	81
09/22/11 14:34	6.2	47.2	90.6	1,839.0	0.167	0.446	80
09/22/11 14:35	6.2	46.7	90.7	1,839.0	0.165	0.447	84
09/22/11 14:36	6.4	48.6	94.2	1,839.0	0.167	0.449	80
09/22/11 14:37	6.3	47.3	95.5	1,839.0	0.165	0.463	79
09/22/11 14:38	6.3	47.0	97.0	1,839.0	0.164	0.470	81
09/22/11 14:39	6.4	47.9	94.9	1,839.0	0.164	0.453	76
09/22/11 14:40	6.5	48.2	95.8	1,839.0	0.163	0.450	79
09/22/11 14:41	6.3	47.3	93.5	1,839.0	0.165	0.453	79
09/22/11 14:42	6.3	47.7	94.4	1,839.0	0.166	0.457	80
09/22/11 14:43	6.3	47.7	89.3	1,839.0	0.166	0.433	81
09/22/11 14:44	6.4	47.9	90.2	1,839.0	0.164	0.430	81
09/22/11 14:45	6.4	47.8	92.4	1,839.0	0.164	0.441	83
09/22/11 14:46	6.3	48.4	91.2	1,839.0	0.169	0.442	82
09/22/11 14:47	6.3	48.4	87.9	1,839.0	0.169	0.426	80
09/22/11 14:48	6.3	48.2	86.6	1,839.0	0.168	0.420	79
09/22/11 14:49	6.3	48.8	89.3	1,839.0	0.170	0.433	81
09/22/11 14:50	6.3	48.3	91.5	1,839.0	0.168	0.443	80
Average	6.3	47.6	92.1	1,839.0	0.165	0.444	80
Minimum	6.2	45.9	86.6	1,839.0	0.157	0.420	76
Maximum	6.5	48.8	97.0	1,839.0	0.170	0.470	84
Summation	132.9	998.8	1,933.6	38,619.0	3.464	9.329	1,684
Included Data Points	21	21	21	21	21	21	21
Total number of Data Points	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

S20 Gas RATA
Run 6

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 09/22/2011 15:00 Through 09/22/2011 15:20
Time Online Criteria: 1 minute(s)

Source	S20						
Parameter (Unit)	S20CPCO2 (PERCENT)	S20CPNOX (PPM)	S20CPSO2 (PPM)	S20FFACT (MMBTU/CF)	S20NOX#M (LB/MMBTU)	S20SO2#M (LB/MMBTU)	S20STEAM (KLBS/HR)
09/22/11 15:00	6.3	49.0	88.6	1,839.0	0.171	0.429	76
09/22/11 15:01	6.3	48.0	91.5	1,839.0	0.167	0.443	76
09/22/11 15:02	6.2	47.8	91.9	1,839.0	0.169	0.452	79
09/22/11 15:03	6.3	47.0	97.4	1,839.0	0.164	0.472	83
09/22/11 15:04	6.4	47.2	97.8	1,839.0	0.162	0.466	84
09/22/11 15:05	6.3	47.3	95.8	1,839.0	0.165	0.464	80
09/22/11 15:06	6.3	48.1	94.7	1,839.0	0.168	0.459	79
09/22/11 15:07	6.4	47.9	96.6	1,839.0	0.164	0.461	82
09/22/11 15:08	6.5	48.7	96.0	1,839.0	0.165	0.451	83
09/22/11 15:09	6.5	48.3	89.8	1,839.0	0.163	0.422	83
09/22/11 15:10	6.3	47.4	86.0	1,839.0	0.165	0.417	79
09/22/11 15:11	6.2	47.3	82.0	1,839.0	0.168	0.404	77
09/22/11 15:12	6.2	47.3	87.0	1,839.0	0.168	0.428	77
09/22/11 15:13	6.5	48.4	93.5	1,839.0	0.164	0.439	83
09/22/11 15:14	6.6	48.2	88.9	1,839.0	0.160	0.411	82
09/22/11 15:15	6.4	48.7	86.7	1,839.0	0.167	0.414	82
09/22/11 15:16	6.3	49.6	86.8	1,839.0	0.173	0.421	84
09/22/11 15:17	6.4	47.8	88.5	1,839.0	0.164	0.422	79
09/22/11 15:18	6.3	48.5	90.4	1,839.0	0.169	0.438	76
09/22/11 15:19	6.3	49.2	89.1	1,839.0	0.171	0.432	76
09/22/11 15:20	6.3	49.1	89.7	1,839.0	0.171	0.435	78
Average	6.3	48.1	90.9	1,839.0	0.167	0.437	80
Minimum	6.2	47.0	82.0	1,839.0	0.160	0.404	76
Maximum	6.6	49.6	97.8	1,839.0	0.173	0.472	84
Summation	133.3	1,010.8	1,908.7	38,619.0	3.498	9.180	1,678
Included Data Points	21	21	21	21	21	21	21
Total number of Data Points	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

S20 Gas RATA
Run 7

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 09/22/2011 15:30 Through 09/22/2011 15:50
Time Online Criteria: 1 minute(s)

Source	S20						
Parameter (Unit)	S20CPCO2 (PERCENT)	S20CPNOX (PPM)	S20CPSO2 (PPM)	S20FFACT (MMBTU/CF)	S20NOX#M (LB/MMBTU)	S20SO2#M (LB/MMBTU)	S20STEAM (KLBS/HR)
09/22/11 15:30	6.3	48.2	89.4	1,839.0	0.168	0.433	77
09/22/11 15:31	6.4	48.1	94.0	1,839.0	0.165	0.448	79
09/22/11 15:32	6.3	47.5	94.8	1,839.0	0.166	0.459	82
09/22/11 15:33	6.4	47.4	99.8	1,839.0	0.163	0.476	82
09/22/11 15:34	6.5	46.8	102.9	1,839.0	0.158	0.483	82
09/22/11 15:35	6.4	47.2	98.4	1,839.0	0.162	0.469	82
09/22/11 15:36	6.5	49.3	97.7	1,839.0	0.167	0.459	81
09/22/11 15:37	6.5	48.1	99.1	1,839.0	0.162	0.465	79
09/22/11 15:38	6.4	48.2	97.9	1,839.0	0.165	0.467	79
09/22/11 15:39	6.5	49.5	96.0	1,839.0	0.167	0.451	79
09/22/11 15:40	6.4	47.8	97.3	1,839.0	0.164	0.464	78
09/22/11 15:41	6.4	48.1	96.5	1,839.0	0.165	0.460	79
09/22/11 15:42	6.5	48.4	94.6	1,839.0	0.164	0.444	81
09/22/11 15:43	6.5	48.0	96.4	1,839.0	0.162	0.453	80
09/22/11 15:44	6.5	48.2	96.4	1,839.0	0.163	0.453	82
09/22/11 15:45	6.5	50.0	93.5	1,839.0	0.169	0.439	85
09/22/11 15:46	6.5	49.7	89.5	1,839.0	0.168	0.420	81
09/22/11 15:47	6.4	49.4	91.1	1,839.0	0.169	0.435	77
09/22/11 15:48	6.4	49.3	89.0	1,839.0	0.169	0.425	78
09/22/11 15:49	6.4	50.3	88.8	1,839.0	0.173	0.424	80
09/22/11 15:50	6.4	51.6	84.3	1,839.0	0.177	0.402	84
Average	6.4	48.6	94.6	1,839.0	0.166	0.449	80
Minimum	6.3	46.8	84.3	1,839.0	0.158	0.402	77
Maximum	6.5	51.6	102.9	1,839.0	0.177	0.483	85
Summation	135.1	1,021.1	1,987.4	38,619.0	3.486	9.429	1,687
Included Data Points	21	21	21	21	21	21	21
Total number of Data Points	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

MPU00723

S20 Gas RATA
Run 8

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 09/22/2011 16:00 Through 09/22/2011 16:20
Time Online Criteria: 1 minute(s)

Source	S20						
Parameter (Unit)	S20CPCO2 (PERCENT)	S20CPNOX (PPM)	S20CPSO2 (PPM)	S20FFACT (MMBTU/CF)	S20NOX#M (LB/MMBTU)	S20SO2#M (LB/MMBTU)	S20STEAM (KLBS/HR)
09/22/11 16:00	6.4	50.8	89.6	1,839.0	0.174	0.427	79
09/22/11 16:01	6.5	50.7	91.4	1,839.0	0.171	0.429	80
09/22/11 16:02	6.4	50.4	88.5	1,839.0	0.173	0.422	77
09/22/11 16:03	6.3	50.3	87.5	1,839.0	0.175	0.424	77
09/22/11 16:04	6.3	50.4	84.9	1,839.0	0.176	0.411	76
09/22/11 16:05	6.3	49.9	84.3	1,839.0	0.174	0.408	79
09/22/11 16:06	6.4	50.5	90.7	1,839.0	0.173	0.433	81
09/22/11 16:07	6.4	50.8	91.3	1,839.0	0.174	0.435	81
09/22/11 16:08	6.3	49.5	89.0	1,839.0	0.173	0.431	81
09/22/11 16:09	6.4	50.9	90.4	1,839.0	0.175	0.431	81
09/22/11 16:10	6.3	50.8	88.5	1,839.0	0.177	0.429	81
09/22/11 16:11	6.2	51.0	85.4	1,839.0	0.181	0.420	80
09/22/11 16:12	6.2	50.6	87.9	1,839.0	0.179	0.433	78
09/22/11 16:13	6.2	50.0	88.4	1,839.0	0.177	0.435	75
09/22/11 16:14	6.2	50.2	90.3	1,839.0	0.178	0.445	76
09/22/11 16:15	6.4	51.2	95.7	1,839.0	0.176	0.456	79
09/22/11 16:16	6.4	49.5	98.2	1,839.0	0.170	0.468	86
09/22/11 16:17	6.4	50.4	94.4	1,839.0	0.173	0.450	85
09/22/11 16:18	6.4	50.3	91.3	1,839.0	0.173	0.435	81
09/22/11 16:19	6.3	51.1	87.5	1,839.0	0.178	0.424	76
09/22/11 16:20	6.2	50.4	85.1	1,839.0	0.178	0.419	74
Average	6.3	50.5	89.5	1,839.0	0.175	0.432	79
Minimum	6.2	49.5	84.3	1,839.0	0.170	0.408	74
Maximum	6.5	51.2	98.2	1,839.0	0.181	0.468	86
Summation	132.9	1,059.7	1,880.3	38,619.0	3.678	9.065	1,663
Included Data Points	21	21	21	21	21	21	21
Total number of Data Points	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

S20 Gas RATA
Run 9

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 09/22/2011 16:30 Through 09/22/2011 16:50
Time Online Criteria: 1 minute(s)

Source	S20						
Parameter (Unit)	S20CPCO2 (PERCENT)	S20CPNOX (PPM)	S20CPSO2 (PPM)	S20FFACT (MMBTU/CF)	S20NOX#M (LB/MMBTU)	S20SO2#M (LB/MMBTU)	S20STEAM (KLBS/HR)
09/22/11 16:30	6.4	52.0	89.9	1,839.0	0.178	0.429	80
09/22/11 16:31	6.4	52.4	87.0	1,839.0	0.180	0.415	82
09/22/11 16:32	6.3	52.2	85.4	1,839.0	0.182	0.414	82
09/22/11 16:33	6.3	52.4	83.2	1,839.0	0.183	0.403	79
09/22/11 16:34	6.3	52.6	82.7	1,839.0	0.183	0.401	78
09/22/11 16:35	6.3	53.5	79.8	1,839.0	0.186	0.387	78
09/22/11 16:36	6.3	52.1	79.0	1,839.0	0.182	0.383	79
09/22/11 16:37	6.4	51.5	81.6	1,839.0	0.177	0.389	78
09/22/11 16:38	6.3	51.0	84.6	1,839.0	0.178	0.410	77
09/22/11 16:39	6.3	51.7	87.7	1,839.0	0.180	0.425	76
09/22/11 16:40	6.2	52.4	87.8	1,839.0	0.186	0.432	80
09/22/11 16:41	6.2	50.9	91.4	1,839.0	0.180	0.450	83
09/22/11 16:42	6.3	50.7	94.6	1,839.0	0.177	0.458	78
09/22/11 16:43	6.2	49.9	96.7	1,839.0	0.177	0.476	75
09/22/11 16:44	6.3	49.5	102.4	1,839.0	0.173	0.496	76
09/22/11 16:45	6.3	51.0	101.8	1,839.0	0.178	0.493	80
09/22/11 16:46	6.3	48.6	101.9	1,839.0	0.169	0.494	82
09/22/11 16:47	6.4	48.4	101.4	1,839.0	0.166	0.484	84
09/22/11 16:48	6.4	49.7	101.2	1,839.0	0.171	0.483	80
09/22/11 16:49	6.4	50.2	97.6	1,839.0	0.172	0.466	80
09/22/11 16:50	6.4	50.4	95.2	1,839.0	0.173	0.454	79
Average	6.3	51.1	91.1	1,839.0	0.178	0.440	79
Minimum	6.2	48.4	79.0	1,839.0	0.166	0.383	75
Maximum	6.4	53.5	102.4	1,839.0	0.186	0.496	84
Summation	132.7	1,073.1	1,912.9	38,619.0	3.731	9.242	1,666
Included Data Points	21	21	21	21	21	21	21
Total number of Data Points	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

S20 Gas RATA
Run 10

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 09/22/2011 17:00 Through 09/22/2011 17:20
Time Online Criteria: 1 minute(s)

Source	S20						
Parameter (Unit)	S20CPCO2 (PERCENT)	S20CPNOX (PPM)	S20CPSO2 (PPM)	S20FFACT (MMBTU/CF)	S20NOX#M (LB/MMBTU)	S20SO2#M (LB/MMBTU)	S20STEAM (KLBS/HR)
09/22/11 17:00	6.4	51.4	91.9	1,839.0	0.176	0.438	82
09/22/11 17:01	6.5	50.7	92.7	1,839.0	0.171	0.435	81
09/22/11 17:02	6.4	51.4	91.9	1,839.0	0.176	0.438	77
09/22/11 17:03	6.3	51.2	89.6	1,839.0	0.178	0.434	74
09/22/11 17:04	6.4	52.1	89.5	1,839.0	0.179	0.427	79
09/22/11 17:05	6.4	52.9	84.2	1,839.0	0.181	0.402	78
09/22/11 17:06	6.4	52.3	84.5	1,839.0	0.179	0.403	80
09/22/11 17:07	6.3	51.7	83.0	1,839.0	0.180	0.402	83
09/22/11 17:08	6.3	52.2	83.1	1,839.0	0.182	0.403	83
09/22/11 17:09	6.3	53.3	83.5	1,839.0	0.186	0.405	80
09/22/11 17:10	6.2	53.7	83.0	1,839.0	0.190	0.409	79
09/22/11 17:11	6.3	52.6	84.1	1,839.0	0.183	0.408	78
09/22/11 17:12	6.3	52.8	85.5	1,839.0	0.184	0.414	76
09/22/11 17:13	6.3	52.4	85.3	1,839.0	0.183	0.413	74
09/22/11 17:14	6.4	53.2	86.9	1,839.0	0.183	0.415	78
09/22/11 17:15	6.3	52.7	84.2	1,839.0	0.184	0.408	83
09/22/11 17:16	6.3	52.2	87.4	1,839.0	0.182	0.424	81
09/22/11 17:17	6.3	51.1	92.4	1,839.0	0.178	0.448	77
09/22/11 17:18	6.3	51.4	96.1	1,839.0	0.179	0.466	75
09/22/11 17:19	6.3	52.0	96.9	1,839.0	0.181	0.470	75
09/22/11 17:20	6.3	51.1	97.1	1,839.0	0.178	0.471	80
Average	6.3	52.1	88.2	1,839.0	0.181	0.425	79
Minimum	6.2	50.7	83.0	1,839.0	0.171	0.402	74
Maximum	6.5	53.7	97.1	1,839.0	0.190	0.471	83
Summation	133.0	1,094.4	1,852.8	38,619.0	3.793	8.933	1,653
Included Data Points	21	21	21	21	21	21	21
Total number of Data Points	21	21	21	21	21	21	21

20

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

S20 low flow RATA
Run 1

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 09/22/2011 12:27 Through 09/22/2011 12:35
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
09/22/11 12:27	3,105,694.0	1,839.0	51.8	4.595	81	172.6
09/22/11 12:28	3,344,198.0	1,839.0	55.7	4.594	82	172.7
09/22/11 12:29	3,368,043.0	1,839.0	56.1	4.593	82	172.9
09/22/11 12:30	3,375,275.0	1,839.0	56.3	4.593	78	172.4
09/22/11 12:31	3,422,424.0	1,839.0	57.0	4.593	76	171.6
09/22/11 12:32	3,349,619.0	1,839.0	55.8	4.593	83	171.5
09/22/11 12:33	3,484,754.0	1,839.0	58.1	4.593	92	171.4
09/22/11 12:34	3,575,488.0	1,839.0	59.6	4.593	89	170.6
09/22/11 12:35	3,423,750.0	1,839.0	57.1	4.593	82	170.1
Average	3,383,249.4	1,839.0	56.4	4.593	83	171.8
Minimum	3,105,694.0	1,839.0	51.8	4.593	76	170.1
Maximum	3,575,488.0	1,839.0	59.6	4.595	92	172.9
Summation	30,449,245.0	16,551.0	507.5	41.340	745	1,545.8
Included Data Points	9	9	9	9	9	9
Total number of Data Points	9	9	9	9	9	9

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

Report Generated: 09/22/11 12:43 Report Version 3.0.0914 STACKVISION- 1 of 1

MPU00727

S20 Low Load RATA
Run 2

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 09/22/2011 12:50 Through 09/22/2011 13:00
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
09/22/11 12:50	3,576,390.0	1,839.0	59.6	4.591	78	171.1
09/22/11 12:51	3,433,576.0	1,839.0	57.2	4.590	83	170.9
09/22/11 12:52	3,366,349.0	1,839.0	56.1	4.590	85	170.9
09/22/11 12:53	3,467,327.0	1,839.0	57.8	4.590	79	171.3
09/22/11 12:54	3,511,835.0	1,839.0	58.5	4.590	76	171.4
09/22/11 12:55	3,461,523.0	1,839.0	57.7	4.590	78	171.1
09/22/11 12:56	3,437,487.0	1,839.0	57.3	4.590	82	171.0
09/22/11 12:57	3,477,498.0	1,839.0	58.0	4.590	82	171.6
09/22/11 12:58	3,371,045.0	1,839.0	56.2	4.590	80	172.4
09/22/11 12:59	3,237,658.0	1,839.0	54.0	4.590	77	172.1
09/22/11 13:00	3,347,921.0	1,839.0	55.8	4.590	76	171.7
Average	3,426,237.2	1,839.0	57.1	4.590	80	171.4
Minimum	3,237,658.0	1,839.0	54.0	4.590	76	170.9
Maximum	3,576,390.0	1,839.0	59.6	4.591	85	172.4
Summation	37,688,609.0	20,229.0	628.2	50.491	876	1,885.5
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
I = Invalid M = Maintenance T = Out Of Control * = Suspect

Report Generated: 09/22/11 13:11 Report Version 3.0.0914 STACKVISION- 1 of 1

MPU00728

S20 Low Flow RATA
Run 3

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 09/22/2011 13:20 Through 09/22/2011 13:30
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
09/22/11 13:20	3,439,427.0	1,839.0	57.3	4.590	80	171.7
09/22/11 13:21	3,698,830.0	1,839.0	61.6	4.590	79	171.2
09/22/11 13:22	3,637,642.0	1,839.0	60.6	4.590	78	171.5
09/22/11 13:23	3,541,954.0	1,839.0	59.0	4.590	76	171.6
09/22/11 13:24	3,491,640.0	1,839.0	58.2	4.591	80	171.7
09/22/11 13:25	3,466,069.0	1,839.0	57.8	4.592	83	171.4
09/22/11 13:26	3,492,620.0	1,839.0	58.2	4.591	82	171.1
09/22/11 13:27	3,539,113.0	1,839.0	59.0	4.591	79	170.9
09/22/11 13:28	3,487,391.0	1,839.0	58.1	4.591	78	170.7
09/22/11 13:29	3,462,090.0	1,839.0	57.7	4.591	77	171.2
09/22/11 13:30	3,351,052.0	1,839.0	55.9	4.591	79	170.9
Average	3,509,802.5	1,839.0	58.5	4.591	79	171.3
Minimum	3,351,052.0	1,839.0	55.9	4.590	76	170.7
Maximum	3,698,830.0	1,839.0	61.6	4.592	83	171.7
Summation	38,607,828.0	20,229.0	643.4	50.498	871	1,883.9
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**
I = Invalid **M = Maintenance** **T = Out Of Control** *** = Suspect**

S20 Low flow RATA
Run 4

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 09/22/2011 13:50 Through 09/22/2011 14:00
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
09/22/11 13:50	3,526,725.0	1,839.0	58.8	4.590	79	170.7
09/22/11 13:51	3,404,742.0	1,839.0	56.7	4.590	83	170.7
09/22/11 13:52	3,431,819.0	1,839.0	57.2	4.590	84	170.6
09/22/11 13:53	3,482,380.0	1,839.0	58.0	4.590	82	170.7
09/22/11 13:54	3,481,845.0	1,839.0	58.0	4.590	79	171.1
09/22/11 13:55	3,893,551.0	1,839.0	64.9	4.591	77	172.2
09/22/11 13:56	3,792,128.0	1,839.0	63.2	4.591	77	173.1
09/22/11 13:57	3,277,675.0	1,839.0	54.6	4.591	83	171.9
09/22/11 13:58	3,445,720.0	1,839.0	57.4	4.591	86	171.1
09/22/11 13:59	3,520,890.0	1,839.0	58.7	4.590	80	171.2
09/22/11 14:00	3,430,769.0	1,839.0	57.2	4.590	76	171.5
Average	3,517,113.1	1,839.0	58.6	4.590	81	171.3
Minimum	3,277,675.0	1,839.0	54.6	4.590	76	170.6
Maximum	3,893,551.0	1,839.0	64.9	4.591	86	173.1
Summation	38,688,244.0	20,229.0	644.7	50.494	886	1,884.8
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**
I = Invalid **M = Maintenance** **T = Out Of Control** * = Suspect

Report Generated: 09/22/11 14:16 Report Version 3.0.0914 STACKVISION- 1 of 1

MPU00730

S20 Low Flow RATA
Run 5

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 09/22/2011 14:30 Through 09/22/2011 14:40
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
09/22/11 14:30	3,550,975.0	1,839.0	59.2	4.594	81	172.4
09/22/11 14:31	3,538,541.0	1,839.0	59.0	4.593	78	172.7
09/22/11 14:32	3,709,989.0	1,839.0	61.8	4.593	79	172.3
09/22/11 14:33	3,234,418.0	1,839.0	53.9	4.593	81	173.0
09/22/11 14:34	3,383,068.0	1,839.0	56.4	4.593	80	173.4
09/22/11 14:35	3,424,948.5	1,839.0	57.1	4.593	84	171.8
09/22/11 14:36	3,495,259.0	1,839.0	58.3	4.593	80	171.7
09/22/11 14:37	3,433,422.0	1,839.0	57.2	4.592	79	171.8
09/22/11 14:38	3,419,287.0	1,839.0	57.0	4.592	81	172.1
09/22/11 14:39	3,574,225.0	1,839.0	59.6	4.593	76	172.3
09/22/11 14:40	3,510,608.0	1,839.0	58.5	4.593	79	172.3
Average	3,479,521.9	1,839.0	58.0	4.593	80	172.3
Minimum	3,234,418.0	1,839.0	53.9	4.592	76	171.7
Maximum	3,709,989.0	1,839.0	61.8	4.594	84	173.4
Summation	38,274,740.5	20,229.0	638.0	50.522	878	1,895.8
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**
I = Invalid **M = Maintenance** **T = Out Of Control** *** = Suspect**

Report Generated: 09/22/11 14:57 Report Version 3.0.0914 STACKVISION- 1 of 1

MPU00731

S20 Low Load RATA
Run 6

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 09/22/2011 15:00 Through 09/22/2011 15:10
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
09/22/11 15:00	3,481,011.0	1,839.0	58.0	4.596	76	172.5
09/22/11 15:01	3,638,555.0	1,839.0	60.6	4.597	76	171.8
09/22/11 15:02	3,200,540.0	1,839.0	53.3	4.596	79	172.6
09/22/11 15:03	3,344,319.0	1,839.0	55.7	4.597	83	173.1
09/22/11 15:04	3,867,832.0	1,839.0	64.5	4.597	84	172.6
09/22/11 15:05	3,571,337.0	1,839.0	59.5	4.598	80	172.2
09/22/11 15:06	3,475,115.0	1,839.0	57.9	4.598	79	171.8
09/22/11 15:07	3,619,160.0	1,839.0	60.3	4.598	82	172.1
09/22/11 15:08	3,626,066.0	1,839.0	60.4	4.599	83	172.0
09/22/11 15:09	3,505,511.0	1,839.0	58.4	4.598	83	172.0
09/22/11 15:10	3,421,677.0	1,839.0	57.0	4.599	79	171.7
Average	3,522,829.4	1,839.0	58.7	4.598	80	172.2
Minimum	3,200,540.0	1,839.0	53.3	4.596	76	171.7
Maximum	3,867,832.0	1,839.0	64.5	4.599	84	173.1
Summation	38,751,123.0	20,229.0	645.6	50.573	884	1,894.4
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**
I = Invalid **M = Maintenance** **T = Out Of Control** *** = Suspect**

Report Generated: 09/22/11 15:21 Report Version 3.0.0914 STACKVISION- 1 of 1

MPU00732

S20 Low Flow RATA
Run 7

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 09/22/2011 15:30 Through 09/22/2011 15:40
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
09/22/11 15:30	3,287,254.0	1,839.0	54.8	4.599	77	172.2
09/22/11 15:31	3,392,689.0	1,839.0	56.5	4.599	79	172.0
09/22/11 15:32	3,209,792.0	1,839.0	53.5	4.600	82	171.8
09/22/11 15:33	3,382,599.0	1,839.0	56.4	4.600	82	172.0
09/22/11 15:34	3,414,681.0	1,839.0	56.9	4.600	82	171.8
09/22/11 15:35	3,681,561.4	1,839.0	61.4	4.600	82	172.1
09/22/11 15:36	3,643,956.0	1,839.0	60.7	4.599	81	172.7
09/22/11 15:37	3,524,992.0	1,839.0	58.7	4.599	79	172.6
09/22/11 15:38	3,440,798.0	1,839.0	57.3	4.599	79	172.1
09/22/11 15:39	3,408,959.0	1,839.0	56.8	4.599	79	171.5
09/22/11 15:40	3,414,849.0	1,839.0	56.9	4.599	78	171.5
Average	3,436,557.3	1,839.0	57.3	4.599	80	172.0
Minimum	3,209,792.0	1,839.0	53.5	4.599	77	171.5
Maximum	3,681,561.4	1,839.0	61.4	4.600	82	172.7
Summation	37,802,130.4	20,229.0	629.9	50.593	880	1,892.3
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**
I = Invalid **M = Maintenance** **T = Out Of Control** *** = Suspect**

Report Generated: 09/22/11 15:46 Report Version 3.0.0914 STACKVISION- 1 of 1

MPU00733

S20 Low Flow RATA
Run 8

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 09/22/2011 16:00 Through 09/22/2011 16:10
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
09/22/11 16:00	3,528,365.0	1,839.0	58.8	4.601	79	172.0
09/22/11 16:01	3,623,216.0	1,839.0	60.4	4.601	80	171.9
09/22/11 16:02	3,620,747.0	1,839.0	60.3	4.602	77	172.3
09/22/11 16:03	3,537,476.0	1,839.0	59.0	4.602	77	172.5
09/22/11 16:04	3,478,376.0	1,839.0	58.0	4.602	76	172.4
09/22/11 16:05	3,488,710.0	1,839.0	58.1	4.602	79	172.9
09/22/11 16:06	3,643,522.0	1,839.0	60.7	4.601	81	174.5
09/22/11 16:07	3,442,401.0	1,839.0	57.4	4.601	81	173.6
09/22/11 16:08	3,389,993.0	1,839.0	56.5	4.601	81	172.6
09/22/11 16:09	3,327,914.0	1,839.0	55.5	4.601	81	171.8
09/22/11 16:10	3,421,019.0	1,839.0	57.0	4.601	81	172.2
Average	3,500,158.1	1,839.0	58.3	4.601	79	172.6
Minimum	3,327,914.0	1,839.0	55.5	4.601	76	171.8
Maximum	3,643,522.0	1,839.0	60.7	4.602	81	174.5
Summation	38,501,739.0	20,229.0	641.7	50.615	873	1,898.7
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**
I = Invalid **M = Maintenance** **T = Out Of Control** *** = Suspect**

Report Generated: 09/22/11 16:21 Report Version 3.0.0914 STACKVISION- 1 of 1

MPU00734

S20 Low flow RATA
Run 9

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 09/22/2011 16:30 Through 09/22/2011 16:40
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
09/22/11 16:30	3,538,035.0	1,839.0	59.0	4.601	80	171.9
09/22/11 16:31	3,522,775.0	1,839.0	58.7	4.601	82	171.8
09/22/11 16:32	3,275,810.0	1,839.0	54.6	4.602	82	171.4
09/22/11 16:33	3,386,910.0	1,839.0	56.4	4.602	79	171.7
09/22/11 16:34	3,428,543.0	1,839.0	57.1	4.603	78	171.6
09/22/11 16:35	3,420,015.3	1,839.0	57.0	4.603	78	171.8
09/22/11 16:36	3,709,176.0	1,839.0	61.9	4.603	79	172.8
09/22/11 16:37	3,477,253.0	1,839.0	58.0	4.602	78	172.6
09/22/11 16:38	3,459,481.0	1,839.0	57.7	4.602	77	172.0
09/22/11 16:39	3,429,787.0	1,839.0	57.2	4.602	76	171.6
09/22/11 16:40	3,477,915.0	1,839.0	58.0	4.601	80	171.7
Average	3,465,972.8	1,839.0	57.8	4.602	79	171.9
Minimum	3,275,810.0	1,839.0	54.6	4.601	76	171.4
Maximum	3,709,176.0	1,839.0	61.9	4.603	82	172.8
Summation	38,125,700.3	20,229.0	635.6	50.622	869	1,890.9
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**
I = Invalid **M = Maintenance** **T = Out Of Control** *** = Suspect**

Report Generated: 09/22/11 16:41 Report Version 3.0.0914 STACKVISION- 1 of 1

MPU00735

S20 Low Flow RATA
Run 10

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 09/22/2011 17:00 Through 09/22/2011 17:10
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
09/22/11 17:00	3,575,210.0	1,839.0	59.6	4.603	82	171.2
09/22/11 17:01	3,565,141.0	1,839.0	59.4	4.603	81	171.2
09/22/11 17:02	3,290,571.0	1,839.0	54.8	4.603	77	171.0
09/22/11 17:03	3,230,215.0	1,839.0	53.8	4.602	74	171.9
09/22/11 17:04	3,494,543.0	1,839.0	58.2	4.603	79	172.4
09/22/11 17:05	3,575,437.0	1,839.0	59.6	4.603	78	172.4
09/22/11 17:06	3,331,192.0	1,839.0	55.5	4.603	80	171.0
09/22/11 17:07	3,538,530.0	1,839.0	59.0	4.603	83	171.1
09/22/11 17:08	3,574,100.0	1,839.0	59.6	4.604	83	170.9
09/22/11 17:09	3,497,222.0	1,839.0	58.3	4.604	80	170.6
09/22/11 17:10	3,395,780.0	1,839.0	56.6	4.603	79	170.8
Average	3,460,721.9	1,839.0	57.7	4.603	80	171.3
Minimum	3,230,215.0	1,839.0	53.8	4.602	74	170.6
Maximum	3,575,437.0	1,839.0	59.6	4.604	83	172.4
Summation	38,067,941.0	20,229.0	634.4	50.634	876	1,884.5
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**
I = Invalid **M = Maintenance** **T = Out Of Control** *** = Suspect**

RATA Test - Part 75

Plant: MPU Source: S20

Parameter: S20CPCO2
Effective Date/Time: 09/22/2011 18:20
Monitoring System ID: X09
Test Reason: QA-Periodic Quality Assurance
CEMS Time Offset :
Test Comment:

Unit of Measure: PERCENT
Test Number: XML (X09-Q3-2011-002) / EDR (1)
Test Result: **Passed**
Overall BAF: 1.000
Frequency: 4QTRS

Operating Level: Low
Mean CEMS: 6.300
Mean Reference: 6.144
Mean Difference: -0.156

Level BAF: 1.000
Relative Accuracy: 3.19
Standard Deviation: 0.053
Confidence Coefficient: 0.041

APS Indicator: False
tValue: 2.306
Avg Load: 80

Report in EDR: Y
Use BAF: Y
Reference Method: 3A

Run	Started	Ended	Reference Value	CEMS Value	Difference	Load	Use
1	09/22/2011 12:20	09/22/2011 12:40	6.1	6.2	-0.1	81	Y
2	09/22/2011 12:50	09/22/2011 13:10	6.0	6.2	-0.2	79	Y
3	09/22/2011 13:20	09/22/2011 13:40	6.2	6.4	-0.2	80	Y
4	09/22/2011 13:50	09/22/2011 14:10	6.2	6.3	-0.1	81	Y
5	09/22/2011 14:30	09/22/2011 14:50	6.2	6.3	-0.1	80	Y
6	09/22/2011 15:00	09/22/2011 15:20	6.2	6.3	-0.1	80	Y
7	09/22/2011 15:30	09/22/2011 15:50	6.2	6.4	-0.2	80	Y
8	09/22/2011 16:00	09/22/2011 16:20	6.1	6.3	-0.2	79	Y
9	09/22/2011 16:30	09/22/2011 16:50	6.1	6.3	-0.2	79	Y
10	09/22/2011 17:00	09/22/2011 17:20	6.1	6.3	-0.2	79	

RATA Test - Part 75

Plant: MPU Source: S20

Parameter:	S20CPFLO	Unit of Measure:	SCFH
Effective Date/Time:	09/22/2011 18:10	Test Number:	XML (X03-Q3-2011-003) / EDR (1)
Monitoring System ID:	X03	Test Result:	**Passed**
Test Reason:	QA-Periodic Quality Assurance	Overall BAF:	1.000
CEMS Time Offset :		Frequency:	4QTRS
Test Comment:			

Operating Level:	Low	Level BAF:	1.000	APS Indicator:	False	Report in EDR:	Y
Mean CEMS:	3,465,888.889	Relative Accuracy:	1.74	tValue:	2.306	Use BAF:	Y
Mean Reference:	3,459,555.556	Standard Deviation:	70,041.059	Avg Load:	80	Reference Method:	2
Mean Difference:	-6,333.333	Confidence Coefficient:	53,838.228				
Flow/Load Ratio:	0.43	CO/O2 RM Used:		Stack Dia:		Default WAF:	
Heat/Load Ratio:	1481	Reference Heat:		Stack Area:		Calculated WAF:	

Run	Started	Ended	Reference Value	CEMS Value	Difference	Load	Use
1	09/22/2011 12:27	09/22/2011 12:35	3,453,000.0	3,383,000.0	70,000.0	83	Y
2	09/22/2011 12:50	09/22/2011 13:00	3,440,000.0	3,426,000.0	14,000.0	80	Y
3	09/22/2011 13:20	09/22/2011 13:30	3,378,000.0	3,510,000.0	-132,000.0	79	
4	09/22/2011 13:50	09/22/2011 14:00	3,389,000.0	3,517,000.0	-128,000.0	81	Y
5	09/22/2011 14:30	09/22/2011 14:40	3,538,000.0	3,480,000.0	58,000.0	80	Y
6	09/22/2011 15:00	09/22/2011 15:10	3,482,000.0	3,523,000.0	-41,000.0	80	Y
7	09/22/2011 15:30	09/22/2011 15:40	3,385,000.0	3,437,000.0	-52,000.0	80	Y
8	09/22/2011 16:00	09/22/2011 16:10	3,429,000.0	3,500,000.0	-71,000.0	79	Y
9	09/22/2011 16:30	09/22/2011 16:40	3,490,000.0	3,466,000.0	24,000.0	79	Y
10	09/22/2011 17:00	09/22/2011 17:10	3,530,000.0	3,461,000.0	69,000.0	80	Y

RATA Test - Part 75

Plant: MPU Source: S20

Parameter:	S20CPFLO	Unit of Measure:	SCFH
Effective Date/Time:	09/22/2011 18:10	Test Number:	XML (X03-Q3-2011-003) / EDR (1)
Monitoring System ID:	X03	Test Result:	**Passed**
Test Reason:	QA-Periodic Quality Assurance	Overall BAF:	1.000
CEMS Time Offset :		Frequency:	4QTRS
Test Comment:			

Operating Level:	Mid	Level BAF:	1.000	APS Indicator:	False	Report in EDR:	Y
Mean CEMS:	4,057,000.000	Relative Accuracy:	2.93	tValue:	2.306	Use BAF:	Y
Mean Reference:	3,994,111.111	Standard Deviation:	70,420.956	Avg Load:	142	Reference Method:	2
Mean Difference:	-62,888.889	Confidence Coefficient:	54,130.242				
Flow/Load Ratio:	0.28	CO/O2 RM Used:		Stack Dia:		Default WAF:	
Heat/Load Ratio:	1204	Reference Heat:		Stack Area:		Calculated WAF:	

Run	Started	Ended	Reference Value	CEMS Value	Difference	Load	Use
1	09/21/2011 20:35	09/21/2011 20:44	4,053,000.0	4,004,000.0	49,000.0	143	Y
2	09/21/2011 20:45	09/21/2011 20:52	3,982,000.0	4,111,000.0	-129,000.0	141	Y
3	09/21/2011 20:53	09/21/2011 21:00	4,088,000.0	4,068,000.0	20,000.0	143	Y
4	09/21/2011 21:12	09/21/2011 21:18	3,995,000.0	4,125,000.0	-130,000.0	142	Y
5	09/21/2011 21:19	09/21/2011 21:26	3,879,000.0	4,106,000.0	-227,000.0	144	
6	09/21/2011 21:27	09/21/2011 21:33	3,978,000.0	4,062,000.0	-84,000.0	142	Y
7	09/21/2011 21:42	09/21/2011 21:48	3,985,000.0	3,985,000.0	0.0	142	Y
8	09/21/2011 21:49	09/21/2011 21:55	4,006,000.0	4,084,000.0	-78,000.0	143	Y
9	09/21/2011 21:56	09/21/2011 22:02	3,929,000.0	4,074,000.0	-145,000.0	143	Y
10	09/21/2011 22:03	09/21/2011 22:08	3,931,000.0	4,000,000.0	-69,000.0	141	Y

RATA Test - Part 75

Plant: MPU Source: S20

Parameter:	S20CPNOX	Unit of Measure:	PPM
Effective Date/Time:	09/22/2011 18:20	Test Number:	XML (X06-Q3-2011-002) / EDR (1)
Monitoring System ID:	X06	Test Result:	**Passed**
Test Reason:	QA-Periodic Quality Assurance	Overall BAF:	1.000
CEMS Time Offset :		Frequency:	4QTRS
Test Comment:			

Operating Level:	Low	Level BAF:	1.000	APS Indicator:	False	Report in EDR:	Y
Mean CEMS:	48.489	Relative Accuracy:	2.62	tValue:	2.306	Use BAF:	Y
Mean Reference:	48.711	Standard Deviation:	1.373	Avg Load:	80	Reference Method:	7E
Mean Difference:	0.222	Confidence Coefficient:	1.055				

Run	Started	Ended	Reference Value	CEMS Value	Difference	Load	Use
1	09/22/2011 12:20	09/22/2011 12:40	40.6	42.6	-2.0	81	Y
2	09/22/2011 12:50	09/22/2011 13:10	47.0	49.0	-2.0	79	Y
3	09/22/2011 13:20	09/22/2011 13:40	46.1	45.9	0.2	80	Y
4	09/22/2011 13:50	09/22/2011 14:10	51.2	51.4	-0.2	81	Y
5	09/22/2011 14:30	09/22/2011 14:50	48.6	47.6	1.0	80	Y
6	09/22/2011 15:00	09/22/2011 15:20	49.4	48.1	1.3	80	Y
7	09/22/2011 15:30	09/22/2011 15:50	50.1	48.6	1.5	80	Y
8	09/22/2011 16:00	09/22/2011 16:20	52.3	50.5	1.8	79	
9	09/22/2011 16:30	09/22/2011 16:50	52.4	51.1	1.3	79	Y
10	09/22/2011 17:00	09/22/2011 17:20	53.0	52.1	0.9	79	Y

RATA Test - Part 75

Plant: MPU Source: S20

Parameter:	S20CPSO2	Unit of Measure:	PPM
Effective Date/Time:	09/22/2011 18:20	Test Number:	XML (X01-Q3-2011-002) / EDR (1)
Monitoring System ID:	X01	Test Result:	**Passed**
Test Reason:	QA-Periodic Quality Assurance	Overall BAF:	1.040
CEMS Time Offset :		Frequency:	4QTRS
Test Comment:			

Operating Level:	Low	Level BAF:	1.040	APS Indicator:	False	Report in EDR:	Y
Mean CEMS:	90.644	Relative Accuracy:	4.51	tValue:	2.306	Use BAF:	Y
Mean Reference:	94.233	Standard Deviation:	0.855	Avg Load:	80	Reference Method:	6C
Mean Difference:	3.589	Confidence Coefficient:	0.657				

Run	Started	Ended	Reference Value	CEMS Value	Difference	Load	Use
1	09/22/2011 12:20	09/22/2011 12:40	153.9	146.3	7.6	81	
2	09/22/2011 12:50	09/22/2011 13:10	88.0	84.7	3.3	79	Y
3	09/22/2011 13:20	09/22/2011 13:40	107.8	102.5	5.3	80	Y
4	09/22/2011 13:50	09/22/2011 14:10	86.6	82.2	4.4	81	Y
5	09/22/2011 14:30	09/22/2011 14:50	95.6	92.1	3.5	80	Y
6	09/22/2011 15:00	09/22/2011 15:20	95.0	90.9	4.1	80	Y
7	09/22/2011 15:30	09/22/2011 15:50	97.4	94.6	2.8	80	Y
8	09/22/2011 16:00	09/22/2011 16:20	92.7	89.5	3.2	79	Y
9	09/22/2011 16:30	09/22/2011 16:50	93.8	91.1	2.7	79	Y
10	09/22/2011 17:00	09/22/2011 17:20	91.2	88.2	3.0	79	Y

RATA Test - Part 75

Plant: MPU Source: S20

Parameter:	S20NOX#M	Unit of Measure:	LB/MMBTU
Effective Date/Time:	09/22/2011 18:20	Test Number:	XML (X05-Q3-2011-002) / EDR (1)
Monitoring System ID:	X05	Test Result:	**Passed**
Test Reason:	QA-Periodic Quality Assurance	Overall BAF:	1.032
CEMS Time Offset :		Frequency:	4QTRS
Test Comment:			

Operating Level:	Low	Level BAF:	1.032	APS Indicator:	False	Report in EDR:	Y
Mean CEMS:	0.169	Relative Accuracy:	5.61	tValue:	2.306	Use BAF:	Y
Mean Reference:	0.174	Standard Deviation:	0.006	Avg Load:	80	Reference Method:	7E,3A
Mean Difference:	0.005	Confidence Coefficient:	0.004				

Run	Started	Ended	Reference Value	CEMS Value	Difference	Load	Use
1	09/22/2011 12:20	09/22/2011 12:40	0.146	0.151	-0.005	81	Y
2	09/22/2011 12:50	09/22/2011 13:10	0.172	0.174	-0.002	79	Y
3	09/22/2011 13:20	09/22/2011 13:40	0.162	0.158	0.004	80	Y
4	09/22/2011 13:50	09/22/2011 14:10	0.182	0.177	0.005	81	Y
5	09/22/2011 14:30	09/22/2011 14:50	0.173	0.165	0.008	80	Y
6	09/22/2011 15:00	09/22/2011 15:20	0.175	0.167	0.008	80	Y
7	09/22/2011 15:30	09/22/2011 15:50	0.177	0.166	0.011	80	Y
8	09/22/2011 16:00	09/22/2011 16:20	0.188	0.175	0.013	79	
9	09/22/2011 16:30	09/22/2011 16:50	0.188	0.178	0.010	79	Y
10	09/22/2011 17:00	09/22/2011 17:20	0.191	0.181	0.010	79	Y

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

data; correct each wet CEMS run using the corresponding CEMS moisture monitor date using Equation 2-1.

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

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.

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

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

$$\text{lbs/MMBtu} = \text{Conc}_{(dry)}\ (\text{F-factor})\ (20.9/20.9-\ \%O_2)$$

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.

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

MPU00745

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

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

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

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

where: $t_{0.975}$ = t-value (see Table 2-1).

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

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

where:

$|\bar{d}|$ = Absolute value of the mean differences (from Equation 2-3).

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

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$\overline{RM}$ = 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 of $\overline{RM}$. In all other cases, use $\overline{RM}$.

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 $\overline{RM}$ is 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).

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MSI/ Manitowoc PU
Test 3L Run 1
Sample Calculations

LB/mmBtu

Calculator		Equations - CFR 40, Part 60,Method 19
SO2 : Calculator		**SO2 : Equations**
SO2 ppm,w =	153.86	*19-7* Using the wet SO2 and CO2 numbers.
CO2 %,w =	6.11	Fc * 0.000000002595 * 64 *100 * SO2 ppm (wet) /CO2 % (wet)
F-factor (Fc) =	1839	
lb/million Btu =	0.769101367	
NOx : Calculator		**NOx : Equations**
NOx ppm,w =	40.57	*19-7* Using wet NOx and CO2 numbers:
CO2 %,w =	6.11	Fc * 0.000000002595 * 46 * 100 * NOx ppm (wet)/ CO2 % (wet)
F-factor (Fc) =	1839	
lb/million Btu =	0.145760792	

MPU00748