RESULTS OF THE AUGUST 6-7, 2012 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

interpoll

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Submitted to:

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

Attention:

Rocky Orzechowski

Reviewed by:

Kathleen Eickstadt
Coordinator
Source Testing

Report Number 12-31301 (S20)
August 28, 2012
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 August 6-7, 2012, 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. Jim Fanning of Mechanical Systems, Inc. and Tim Harding of Manitowoc Public Utilities 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 and 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.

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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 psychometrically. 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.

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2 SUMMARY AND DISCUSSION

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

S20 STACK RELATIVE ACCURACY RESULTS

Parameter	Units	Measured
NO_x	LB/10^6BTU	6.29
NO_x	ppm,w	8.58
SO_2	ppm,w	8.37
SO_2	LB/10^6BTU	4.62
CO_2	% v/v,w	4.40
Flow (LOW)	SCFH	3.96
Flow (MID)	SCFH	5.38
Flow (HIGH)	SCFH	4.48

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

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Summary of the Results of the August 6-7th, 2012, Relative Accuracy Test Audit of the NOx Analyzer Installed on the S20 Boiler 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		08/06/12	23:10 - 23:30	0.153	0.138	0.015
2	*	08/06/12	23:40 - 0:00	0.157	0.145	0.012
3		08/07/12	0:10 - 0:30	0.152	0.142	0.010
4		08/07/12	0:40 - 1:00	0.160	0.152	0.008
5		08/07/12	1:10 - 1:30	0.151	0.147	0.004
6		08/07/12	1:40 - 2:00	0.141	0.137	0.004
7		08/07/12	2:10 - 2:30	0.148	0.146	0.002
8		08/07/12	2:40 - 3:00	0.153	0.150	0.003
9		08/07/12	3:10 - 3:30	0.156	0.151	0.005
10		08/07/12	3:40 - 4:00	0.143	0.137	0.006
Average Diff.				0.151	0.144	0.006333
Standard Deviation						0.004
Confidence Coefficient						0.003146
Relative Accuracy						6.29
Bias Test						Fail
Bias Adjustment Factor						1.044

* Run was not used in Relative Accuracy calculation

RM = Reference Method

CEM = Continuous Emission Monitor

Summary of the Results of the August 6-7th, 2012, Relative Accuracy Test Audit of the NOx Analyzer Installed on the S20 Boiler Stack at the Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

Low "Normal" Load (80 Klbs/Hr)

Run		Date	Time	Nox ppm, wet RM	CEM	DIFF.
1		08/06/12	23:10 - 23:30	41.5	37.5	4.0
2	*	08/06/12	23:40 - 0:00	43.2	38.7	4.5
3		08/07/12	0:10 - 0:30	42.0	38.1	3.9
4		08/07/12	0:40 - 1:00	43.5	39.9	3.6
5		08/07/12	1:10 - 1:30	41.7	39.0	2.7
6		08/07/12	1:40 - 2:00	39.7	37.2	2.5
7		08/07/12	2:10 - 2:30	41.2	39.1	2.1
8		08/07/12	2:40 - 3:00	41.9	39.7	2.2
9		08/07/12	3:10 - 3:30	42.5	39.7	2.8
10		08/07/12	3:40 - 4:00	39.5	36.2	3.3
Average Diff.				41.500	38.489	3.011
Standard Deviation						0.715
Confidence Coefficient						0.549535
Relative Accuracy						8.58
Bias Test						Fail
Bias Adjustment Factor						1.078

* Run was not used in Relative Accuracy calculation

RM = Reference Method

CEM = Continuous Emission Monitor

Summary of the Results of the August 6-7th, 2012, Relative Accuracy Test Audit of the SO2 Analyzer Installed on the S20 Boiler Stack at the Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

Low "Normal" Load (80 Klbs/Hr)

Run	Date	Time	SO_2 ppm, wet RM	CEM	DIFF.
1	08/06/12	23:10 - 23:30	80.3	78.9	1.4
2	08/06/12	23:40 - 0:00	88.5	81.8	6.7
3	08/07/12	0:10 - 0:30	85.6	79.0	6.6
4	08/07/12	0:40 - 1:00	85.5	78.5	7.0
5	08/07/12	1:10 - 1:30	89.1	82.4	6.7
6	08/07/12	1:40 - 2:00	86.3	79.9	6.4
7	08/07/12	2:10 - 2:30	82.7	77.2	5.5
8	08/07/12	2:40 - 3:00	85.4	79.7	5.7
9	08/07/12	3:10 - 3:30	76.7	70.9	5.8
10 *	08/07/12	3:40 - 4:00	90.1	82.9	7.2
Average Diff.			84.456	78.700	5.755556
Standard Deviation					1.714
Confidence Coefficient					1.317491
Relative Accuracy					8.37
Bias Test					Fail
Bias Adjustment Factor					1.073

* Run was not used in Relative Accuracy calculation

RM = Reference Method

CEM = Continuous Emission Monitor

Summary of the Results of the August 6-7th, 2012, Relative Accuracy Test Audit of the SO2 Analyzer Installed on the S20 Boiler 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	08/06/12	23:10 - 23:30	0.410	0.403	0.007
2	08/06/12	23:40 - 0:00	0.446	0.426	0.020
3	08/07/12	0:10 - 0:30	0.431	0.410	0.021
4 *	08/07/12	0:40 - 1:00	0.439	0.417	0.022
5	08/07/12	1:10 - 1:30	0.448	0.430	0.018
6	08/07/12	1:40 - 2:00	0.425	0.410	0.015
7	08/07/12	2:10 - 2:30	0.413	0.400	0.013
8	08/07/12	2:40 - 3:00	0.435	0.418	0.017
9	08/07/12	3:10 - 3:30	0.391	0.374	0.017
10	08/07/12	3:40 - 4:00	0.454	0.434	0.020
Average Diff.			0.428	0.412	0.016444
Standard Deviation					0.004
Confidence Coefficient					0.003353
Relative Accuracy					4.62
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 August 6-7th, 2012, Relative Accuracy Test Audit on the CO2 Analyzer Installed on the S20 Boiler 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	08/06/12	23:10 - 23:30	6.0	6.0	0.0
2	08/06/12	23:40 - 0:00	6.1	5.9	0.2
3	08/07/12	0:10 - 0:30	6.1	5.9	0.2
4	08/07/12	0:40 - 1:00	5.9	5.7	0.2
5	08/07/12	1:10 - 1:30	6.1	5.8	0.3
6	08/07/12	1:40 - 2:00	6.2	5.9	0.3
7	08/07/12	2:10 - 2:30	6.1	5.9	0.2
8	08/07/12	2:40 - 3:00	6.0	5.8	0.2
9	08/07/12	3:10 - 3:30	6.0	5.8	0.2
10 *	08/07/12	3:40 - 4:00	6.1	5.8	0.3
Average Difference			6.056	5.856	0.20000
Standard Deviation					0.087
Confidence Coefficient					0.066568
Relative Accuracy					4.40
Bias Test					Fail
Bias Adjustment Factor					1.034

* Run was not used in Relative Accuracy calculation

RM = Reference Method

CEM = Continuous Emission Monitor

Summary of the Results of the August 6-7th, 2012, Relative Accuracy Test Audit on the Flow Analyzer Installed on the S20 Boiler Stack at the Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

			Low "Normal" Load (80 Klbs/Hr)		
			Flow (SCFH) Summary		
Run	Date	Time	RM	CEM	DIFF.
1	08/06/12	23:10 - 23:20	3,432,000	3,480,271	-48,271
2	08/06/12	23:40 - 23:50	3,374,000	3,410,937	-36,937
3	08/07/12	0:10 - 0:20	3,570,000	3,487,938	82,062
4	08/07/12	0:40 - 0:50	3,511,000	3,370,503	140,497
5	08/07/12	1:10 - 1:20	3,482,000	3,485,674	-3,674
6 *	08/07/12	1:40 - 1:50	3,689,000	3,372,582	316,419
7	08/07/12	2:10 - 2:20	3,483,000	3,461,695	21,306
8	08/07/12	2:40 - 2:50	3,555,000	3,434,045	120,955
9	08/07/12	3:10 - 3:20	3,529,000	3,337,817	191,183
10	08/07/12	3:40 - 3:50	3,533,000	3,371,952	161,048
Average Difference			3496555.556	3426759.040	69796.51556
Standard Deviation					89379.075
Confidence Coefficient					68702.715832
Relative Accuracy					3.96
Bias Test					Fail
Bias Adjustment Factor					1.020

* Run was not used in Relative Accuracy calculation

RM = Reference Method

CEM = Continuous Emission Monitor

Results of the August 7th, 2012 Relative Accuracy Test Audit of the Flow Analyzer Installed on the S20 Boiler Stack at the Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

			Mid Load (140 Klbs/Hr)		
			Flow (SCFH)		
Run	Date	Time	RM	CEM	DIFF.
1	08/07/12	5:17 - 5:25	4,232,000	4,061,553	170,447
2	08/07/12	5:26 - 5:32	4,270,000	4,053,727	216,273
3	08/07/12	5:33 - 5:42	4,241,000	4,011,142	229,859
4	08/07/12	6:00 - 6:07	4,216,000	3,985,706	230,294
5	08/07/12	6:08 - 6:15	4,100,000	3,918,154	181,846
6	08/07/12	6:16 - 6:23	4,225,000	3,985,907	239,093
7 *	08/07/12	6:24 - 6:31	4,236,000	3,975,450	260,551
8	08/07/12	6:32 - 6:40	4,152,000	4,086,043	65,957
9	08/07/12	6:41 - 6:48	4,043,000	4,024,684	18,316
10	08/07/12	6:49 - 6:56	4,216,000	4,085,764	130,236
Average Diff.			4188333.333	4023630.978	164702.356
Confidence Coefficient					60424.342169
Standard Deviation					78609.292
Relative Accuracy					5.38
Bias Test					Fail
Bias Adjustment Factor					1.041

* Run was not used in Relative Accuracy calculation

RM = Reference Method

CEM = Continuous Emission Monitor

Results of the August 7th, 2012 Relative Accuracy Test Audit of the Flow Analyzer Installed on the S20 Boiler Stack at the Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

			High Load (190 Klbs/Hr)		
			Flow (SCFH)		
Run	Date	Time	RM	CEM	DIFF.
1	08/07/12	8:02 - 8:09	5,322,000	5,137,654	184,346
2	08/07/12	8:10 - 8:16	5,276,000	5,098,857	177,143
3	08/07/12	8:17 - 8:24	5,369,000	5,287,722	81,278
4	08/07/12	9:06 - 9:13	5,495,000	5,386,355	108,645
5	08/07/12	9:14 - 9:20	5,622,000	5,357,410	264,590
6	08/07/12	9:21 - 9:29	5,675,000	5,473,967	201,033
7	08/07/12	9:37 - 9:45	5,658,000	5,444,409	213,591
8 *	08/07/12	9:46 - 9:52	5,771,000	5,451,719	319,281
9	08/07/12	9:53 - 10:01	5,662,000	5,391,448	270,552
10	08/07/12	10:02 - 10:09	5,616,000	5,355,320	260,680
Average Diff.			5521666.667	5325904.778	195761.889
Confidence Coefficient					51609.375720
Standard Deviation					67141.425
Relative Accuracy					4.48
Bias Test					Fail
Bias Adjustment Factor					1.036756551

* 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: 6/25/2012
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})
29.34	78	0.132	29.21	29.19	-0.018

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.

MPU00980

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 Elynck
Date of Calibration	6/25/2012	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	
		Δ t (°F)	%
0	7	7	1.522
100	101	1	0.179
200	209	9	1.364
300	303	3	0.395
400	405	5	0.581
500	501	1	0.104
600	606	6	0.566
700	701	1	0.086
800	806	6	0.476
900	902	2	0.147
1000	1007	7	0.479
1100	1105	5	0.321
1200	1207	7	0.422
1300	1306	6	0.341
1400	1407	7	0.376
1500	1506	6	0.306
1600	1607	7	0.340
1700	1704	4	0.185
1800	1803	3	0.133
1900	1904	4	0.169
2000			
2100	OF		
	Average:	5	0.425

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	Cen Tech	Serial Number	6048682
Model	92242	Thermocouple Type	Type K
Range	0-2000	Technician	Mike Bonham
Date of Calibration	8/2/2012	PDT Number	138

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	
		Δ t (°F)	%
0	9	9	1.919
100	103	3	0.533
200	210	10	1.493
300	304	4	0.524
400	405	5	0.578
500	501	1	0.104
600	605	5	0.469
700	700	0	0.000
800	804	4	0.316
900	901	1	0.073
1000	1006	6	0.409
1100	1103	3	0.192
1200	1204	4	0.240
1300	1301	1	0.057
1400	1404	4	0.215
1500	1503	3	0.153
1600	1604	4	0.194
1700	1700	0	0.000
1800	1800	0	0.000
1900	1901	1	0.042
2000	2000	0	0.000
2100			
	Average:	3.24	0.3577

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

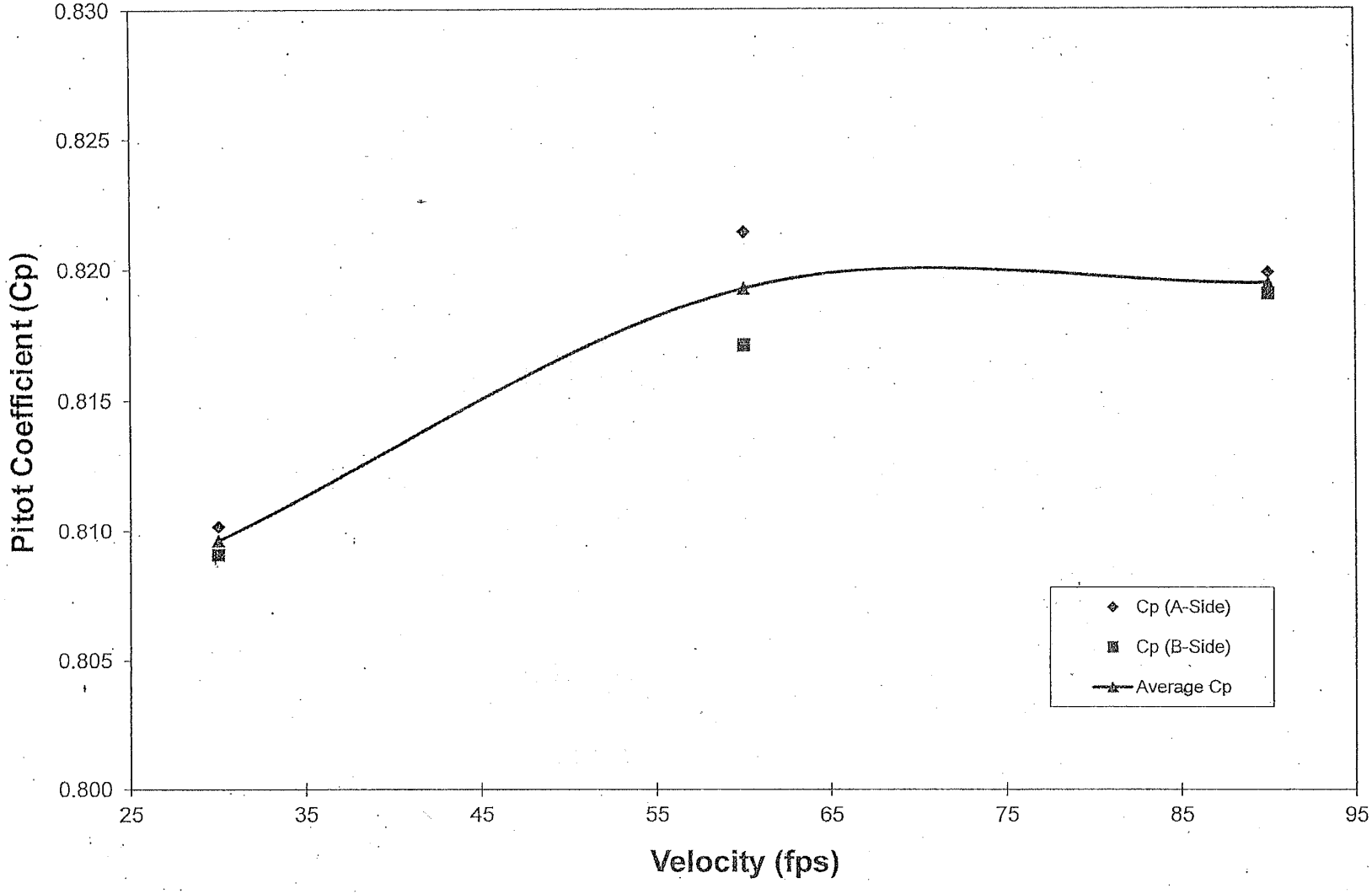
5/10/2011
Date

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

MPU00983

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

Environmental Supply Company Wind Tunnel - 5/11/2011



MPU00984

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.

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

MPU00985

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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MPU00986

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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MPU00987

APPENDIX B

REFERENCE METHOD COMPUTER PRINTOUTS

LOW LOAD

MPU00989

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

8/6/2012
Test 1L 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	0.017	0.130	184	11:10 PM
2	A-2	0.010	0.100	184	
3	A-3	0.011	0.105	184	
4	A-4	0.017	0.130	184	
5	B-1	0.022	0.148	182	
6	B-2	0.023	0.152	186	
7	B-3	0.024	0.155	186	
8	B-4	0.014	0.118	186	
9	C-1	0.026	0.161	185	
10	C-2	0.023	0.152	185	
11	C-3	0.026	0.161	185	
12	C-4	0.012	0.110	185	
13	D-1	0.018	0.134	186	
14	D-2	0.010	0.100	186	
15	D-3	0.010	0.100	186	
16	D-4	0.010	0.100	186	11:20 PM
Average		0.0171	0.129	185	

Moisture Content Data	
Dry Bulb (°F)	185
Wet Bulb (°F)	106.0
TRA	1.19
Vapor Pressure of Water	2.31
ZT	79.00
PM	146.88
Barometric Pressure	29.31
Moisture Content	5.02
O_2 %	14.016
CO_2 %	6.294
Standard CFH	3,431,771
K Standard CFH	57.196

Flow Rate Data	
Static Pressure	-0.35
Pitot Coefficient	0.815
Duct Width (in.)	0.0
Duct Length (in.)	0.0
Duct Area (ft^2)	0.0
Stack Diameter (in.)	168.0
Stack Area (ft^2)	153.938
Molecular Weight (dry)	29.568
Molecular Weight (wet)	28.987
Stack Pressure	29.284
Feet per Second	7.729
Actual CFM	71387.16
DSCFM	54327.48

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration
O_2 (dry)	14.06	0.05	11.08	11.03	14.02
CO_2 (wet)	5.98	0.02	8.54	8.54	5.98
NOx (wet)	41.61	0.14	113.65	113.70	41.54
SO_2 (wet)	80.52	0.42	117.95	117.80	80.29

Moisture	5.02	Standard CFH	3,431,771
Fuel Factor	1839	K Standard CFM	57.196
DSCFM	54327		

Results

Flow Start	11:10 PM	Gases Start	11:10 PM
Flow Stop	11:20 PM	Gases Stop	11:30 PM

CO_2 %, wet	5.98
NOX ppm, wet	41.5
NOx LB/mmBTU	0.153
SO_2 ppm, wet	80.3
SO_2 LB/mmBTU	0.4102
SCFH	3,432,000
WAF applied	0.9900

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
8/6/2012
Run 1

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	% CO_2, w
23:10	94.89	39.23	13.71	6.19
23:11	95.38	40.69	13.75	6.159
23:12	96.2	41.38	13.76	6.227
23:13	89.51	41.42	13.69	6.302
23:14	87.19	40.01	13.77	6.21
23:15	67.31	37.74	14.95	5.211
23:16	60.32	39.7	14.6	5.472
23:17	59.94	38.66	14.69	5.419
23:18	63.67	37.53	14.2	5.817
23:19	68.41	44.69	13.81	6.156
23:20	73.63	44.88	13.89	6.063
23:21	74.05	43.41	13.96	6.008
23:22	77.77	45.08	13.91	6.048
23:23	80.48	42.84	14.18	5.978
23:24	87.61	42.38	14.34	6.109
23:25	97.17	41.71	14.17	6.074
23:26	94.21	42.94	14.08	5.982
23:27	88.76	44.86	14.16	5.986
23:28	82	40.5	14.26	5.802
23:29	85.15	42.52	13.98	5.99
23:30	67.26	41.61	13.39	6.458
Average	**80.520**	**41.609**	**14.060**	**5.984**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

8/6/2012
Test 1L 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	0.013	0.114	191	11:40 PM
2	A-2	0.012	0.110	191	
3	A-3	0.010	0.100	191	
4	A-4	0.010	0.100	191	
5	B-1	0.026	0.161	192	
6	B-2	0.030	0.173	192	
7	B-3	0.022	0.148	192	
8	B-4	0.011	0.105	192	
9	C-1	0.025	0.158	189	
10	C-2	0.028	0.167	189	
11	C-3	0.022	0.148	189	
12	C-4	0.015	0.122	189	
13	D-1	0.012	0.110	190	
14	D-2	0.013	0.114	190	
15	D-3	0.010	0.100	190	
16	D-4	0.010	0.100	190	11:50 PM
Average		0.0168	0.127	191	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	191		
Wet Bulb (°F)	107.0	Static Pressure	-0.37
TRA	1.19	Pitot Coefficient	0.815
Vapor Pressure of Water	2.38		
ZT	83.50	Duct Width (in.)	0.00
PM	148.96	Duct Length (in.)	0.00
Barometric Pressure	29.31	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	168.00
		Stack Area (ft^2)	153.94
Moisture Content	5.09		
		Molecular Weight (dry)	29.578
O_2 %	13.918	Molecular Weight (wet)	28.989
CO_2 %	6.38	Stack Pressure	29.283
		Feet per Second	7.665
Standard CFH	3,374,372	Actual CFM	70795.25
K Standard CFH	56.24	DSCFM	53378.67

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration
O_2 (dry)	13.98	0.06	11.10	11.03	13.92
CO_2 (wet)	6.06	0.02	8.54	8.54	6.06
NOx (wet)	43.51	0.23	114.10	113.70	43.22
SO_2 (wet)	88.68	0.32	117.95	117.80	88.49

Moisture	5.09	Standard CFH	3,374,372
Fuel Factor	1839	K Standard CFM	56.24
DSCFM	53379		

Results

Flow Start	11:40 PM	Gases Start	11:40 PM
Flow Stop	11:50 PM	Gases Stop	12:00 AM

CO_2 %, wet	6.1
NOX ppm, wet	43.2
NOx LB/mmBTU	0.157
SO_2 ppm, wet	88.5
SO_2 LB/mmBTU	0.446
SCFH	3,374,000
WAF applied	0.9900

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
8/6/2012
Run 2

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	% CO_2, w
23:40	77.48	45.84	13.88	6.069
23:41	87.78	42.62	13.76	6.132
23:42	91.2	38.42	14	5.935
23:43	73.95	43.85	14.21	5.774
23:44	89.43	46	13.95	6.004
23:45	87.36	45.21	13.89	6.073
23:46	89.49	42.53	13.84	6.118
23:47	81.53	44.02	14.07	5.969
23:48	85.81	46.06	14.1	6.091
23:49	76.53	44.51	14.13	6.081
23:50	79.71	45.2	14.14	6.052
23:51	77.31	45.99	14.07	6.062
23:52	87.64	43.37	14.01	6.082
23:53	81.55	43.85	14.03	6.076
23:54	86	45.38	13.98	6.091
23:55	97.94	42.31	14	6.069
23:56	93.05	42.96	13.97	6.116
23:57	94.39	42.52	13.98	6.04
23:58	95.41	41.19	13.99	6.052
23:59	113.5	40.89	13.81	6.222
0:00	115.2	41.09	13.85	6.183
Average	**88.679**	**43.515**	**13.984**	**6.061**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

8/7/2012
Test 1L 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	0.018	0.134	191	12:10 AM
2	A-2	0.019	0.138	191	
3	A-3	0.014	0.118	191	
4	A-4	0.012	0.110	191	
5	B-1	0.027	0.164	190	
6	B-2	0.028	0.167	190	
7	B-3	0.025	0.158	190	
8	B-4	0.018	0.134	190	
9	C-1	0.026	0.161	190	
10	C-2	0.027	0.164	191	
11	C-3	0.020	0.141	191	
12	C-4	0.019	0.138	191	
13	D-1	0.014	0.118	192	
14	D-2	0.011	0.105	192	
15	D-3	0.010	0.100	192	
16	D-4	0.010	0.100	192	12:20 AM
Average		0.0186	0.134	191	

Moisture Content Data	
Dry Bulb (°F)	191
Wet Bulb (°F)	105.0
TRA	1.19
Vapor Pressure of Water	2.24
ZT	85.94
PM	132.78
Barometric Pressure	29.31
Moisture Content	4.53
O_2 %	13.937
CO_2 %	6.356
Standard CFH	3,570,197
K Standard CFH	59.503

Flow Rate Data	
Static Pressure	-0.35
Pitot Coefficient	0.815
Duct Width (in.)	0.00
Duct Length (in.)	0.00
Duct Area (ft^2)	0.00
Stack Diameter (in.)	168.00
Stack Area (ft^2)	153.94
Molecular Weight (dry)	29.574
Molecular Weight (wet)	29.05
Stack Pressure	29.284
Feet per Second	8.115
Actual CFM	74950.34
DSCFM	56805.4

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration
O_2 (dry)	14.05	0.07	11.14	11.0	13.94
CO_2 (wet)	6.09	0.02	8.56	8.5	6.07
NOx (wet)	42.27	0.17	114.10	113.7	42.02
SO_2 (wet)	85.65	0.25	117.80	117.8	85.58

Moisture	4.53	Standard CFH	3,570,197
Fuel Factor	1839	K Standard CFM	59.503
DSCFM	56805		

Results

Flow Start	12:10 AM	Gases Start	12:10 AM
Flow Stop	12:20 AM	Gases Stop	12:30 AM

CO_2 %, wet	6.1
NOX ppm, wet	42.0
NOx LB/mmBTU	0.152
SO_2 ppm, wet	85.6
SO_2 LB/mmBTU	0.431
SCFH	3,570,000
WAF applied	0.9900

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
8/7/2012
Run 3

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	% CO_2, w
0:10	70.48	41.54	13.91	6.161
0:11	76.04	40.06	14.06	6.024
0:12	82.8	41.55	13.87	6.18
0:13	80.96	41.83	13.94	6.135
0:14	84.63	41.49	14.5	6.177
0:15	89.99	40.72	14.16	6.208
0:16	77.67	42.85	13.96	6.041
0:17	79.82	43.13	13.94	6.049
0:18	83.62	41.96	13.99	6.004
0:19	86.13	42.92	14.06	5.925
0:20	90.42	42.84	13.88	6.09
0:21	86.64	43.65	14.02	5.988
0:22	89.97	43.65	13.91	6.071
0:23	84.97	42.28	13.9	6.057
0:24	84.11	44.16	13.93	6.052
0:25	89.41	44.56	13.85	6.097
0:26	92.26	41.66	13.79	6.167
0:27	86.17	41.87	14.15	6.055
0:28	88.93	42.86	14.3	6.109
0:29	101.6	40.72	14.4	6.122
0:30	91.94	41.47	14.58	6.11
Average	**85.646**	**42.275**	**14.052**	**6.087**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

8/7/2012
Test 1L 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	0.017	0.130	189	12:40 AM
2	A-2	0.013	0.114	189	
3	A-3	0.013	0.114	189	
4	A-4	0.012	0.110	189	
5	B-1	0.022	0.148	192	
6	B-2	0.028	0.167	192	
7	B-3	0.030	0.173	192	
8	B-4	0.021	0.145	192	
9	C-1	0.022	0.148	190	
10	C-2	0.027	0.164	190	
11	C-3	0.024	0.155	190	
12	C-4	0.012	0.110	190	
13	D-1	0.016	0.126	191	
14	D-2	0.012	0.110	191	
15	D-3	0.010	0.100	191	
16	D-4	0.010	0.100	191	12:50 AM
Average		0.0181	0.132	191	

Moisture Content Data	
Dry Bulb (°F)	191
Wet Bulb (°F)	105.0
TRA	1.19
Vapor Pressure of Watei	2.24
ZT	85.50
PM	133.24
Barometric Pressure	29.31
Moisture Content	4.55
O_2 %	13.949
CO_2 %	6.233
Standard CFH	3,511,260
K Standard CFH	58.521

Flow Rate Data	
Static Pressure	-0.36
Pitot Coefficient	0.815
Duct Width (in.)	0
Duct Length (in.)	0
Duct Area (ft^2)	0
Stack Diameter (in.)	168
Stack Area (ft^2)	153.93804
Molecular Weight (dry)	29.555
Molecular Weight (wet)	29.029
Stack Pressure	29.284
Feet per Second	7.976
Actual CFM	73665.35
DSCFM	55858.21

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration
O_2 (dry)	14.11	0.07	11.17	11.0	13.95
CO_2 (wet)	5.98	0.02	8.57	8.5	5.95
NOx (wet)	43.50	0.15	113.55	113.7	43.47
SO_2 (wet)	85.66	0.30	117.90	117.8	85.51

Moisture	4.55	Standard CFH	3,511,260
Fuel Factor	1839	K Standard CFM	58.521
DSCFM	55858		

Results

Flow Start	12:40 AM	Gases Start	12:40 AM
Flow Stop	12:50 AM	Gases Stop	1:00 AM

CO_2 %, wet	5.9
NOX ppm, wet	43.5
NOx LB/mmBTU	0.160
SO_2 ppm, wet	85.5
SO_2 LB/mmBTU	0.439
SCFH	3,511,000
WAF applied	0.9900

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
8/7/2012
Run 4

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	% CO_2, w
0:40	77.61	45.9	14.17	5.975
0:41	81.97	43.79	14.26	5.918
0:42	74	45.18	14.34	5.789
0:43	73.89	44.37	14.27	5.83
0:44	74.11	44.2	14.25	5.845
0:45	81.06	42.91	14.07	5.992
0:46	80.81	44.74	14.04	6.047
0:47	89.4	43.03	14.1	5.933
0:48	87.36	43.54	14.13	5.939
0:49	86.94	44.49	14.13	5.954
0:50	81.05	45.11	14.13	5.952
0:51	86.68	43.82	14.11	5.98
0:52	80.73	41.95	14.04	6.075
0:53	80.74	43.1	14	6.08
0:54	82.39	43.09	14.12	5.958
0:55	89.62	42.78	14.06	6.001
0:56	103.3	41.35	13.91	6.117
0:57	97.13	41.2	13.96	6.074
0:58	94.65	42.72	14.1	5.964
0:59	101.2	42.87	14	6.058
1:00	94.29	43.42	14.07	6.022
Average	**85.663**	**43.503**	**14.108**	**5.976**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

8/7/2012
Test 1L 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	0.012	0.110	191	1:10 AM
2	A-2	0.011	0.105	191	
3	A-3	0.011	0.105	191	
4	A-4	0.011	0.105	191	
5	B-1	0.028	0.167	192	
6	B-2	0.029	0.170	192	
7	B-3	0.026	0.161	192	
8	B-4	0.012	0.110	192	
9	C-1	0.022	0.148	189	
10	C-2	0.030	0.173	189	
11	C-3	0.025	0.158	189	
12	C-4	0.024	0.155	189	
13	D-1	0.017	0.130	190	
14	D-2	0.010	0.100	190	
15	D-3	0.010	0.100	190	
16	D-4	0.010	0.100	190	1:20 AM
Average		0.0180	0.131	191	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	191		
Wet Bulb (°F)	105.0	Static Pressure	-0.37
TRA	1.19	Pitot Coefficient	0.815
Vapor Pressure of Water	2.24		
ZT	85.50	Duct Width (in.)	0
PM	133.25	Duct Length (in.)	0
Barometric Pressure	29.31	Duct Area (ft^2)	0
		Stack Diameter (in.)	168
		Stack Area (ft^2)	153.93804
Moisture Content	4.55		
		Molecular Weight (dry)	29.571
O_2 %	13.826	Molecular Weight (wet)	29.044
CO_2 %	6.36	Stack Pressure	29.283
		Feet per Second	7.908
Standard CFH	3,481,562	Actual CFM	73044.13
K Standard CFH	58.026	DSCFM	55385.65

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration
O_2 (dry)	13.95	0.07	11.14	11.0	13.83
CO_2 (wet)	6.09	0.02	8.56	8.5	6.07
NOx (wet)	41.92	0.22	113.85	113.7	41.73
SO_2 (wet)	89.37	0.37	118.05	117.8	89.10

Moisture	4.55	Standard CFH	3,481,562
Fuel Factor	1839	K Standard CFM	58.026
DSCFM	55386		

Results

Flow Start	1:10 AM	Gases Start	1:10 AM
Flow Stop	1:20 AM	Gases Stop	1:30 AM

CO_2 %, wet	6.1
NOX ppm, wet	41.7
NOx LB/mmBTU	0.151
SO_2 ppm, wet	89.1
SO_2 LB/mmBTU	0.448
SCFH	3,482,000
WAF applied	0.9900

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
8/7/2012
Run 5

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	% CO_2, w
1:10	98.33	42.24	13.98	6.073
1:11	102.7	42.3	13.82	6.093
1:12	97.53	43.26	13.86	6.057
1:13	99.67	42.21	13.87	6.055
1:14	98.35	38.37	13.83	6.111
1:15	86.72	41.41	13.81	6.121
1:16	86.08	42.07	13.71	6.22
1:17	83.22	40.56	13.81	6.17
1:18	91.59	42.12	13.8	6.168
1:19	86.04	42.3	13.9	6.063
1:20	83.9	43.04	13.83	6.097
1:21	83.16	42.67	13.79	6.132
1:22	83.82	42.45	13.98	5.979
1:23	78.61	42.46	14.03	5.9
1:24	81.59	40.58	14.05	5.911
1:25	88.75	39.6	14.42	6.001
1:26	92.69	42.1	14.45	6.182
1:27	91.29	43.05	14.27	6.162
1:28	86.34	41.35	13.89	6.129
1:29	93.38	42.16	13.89	6.097
1:30	83.1	44.08	13.91	6.081
Average	**89.374**	**41.923**	**13.948**	**6.086**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

8/7/2012
Test 1L 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	0.018	0.134	189	1:40 AM
2	A-2	0.011	0.105	189	
3	A-3	0.012	0.110	189	
4	A-4	0.010	0.100	189	
5	B-1	0.028	0.167	190	
6	B-2	0.028	0.167	190	
7	B-3	0.028	0.167	190	
8	B-4	0.018	0.134	190	
9	C-1	0.031	0.176	191	
10	C-2	0.029	0.170	191	
11	C-3	0.033	0.182	191	
12	C-4	0.025	0.158	191	
13	D-1	0.015	0.122	190	
14	D-2	0.016	0.126	190	
15	D-3	0.010	0.100	190	
16	D-4	0.010	0.100	190	1:50 AM
Average		0.0201	0.139	190	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	190		
Wet Bulb (°F)	107.0	Static Pressure	-0.38
TRA	1.19	Pitot Coefficient	0.815
Vapor Pressure of Water	2.38		
ZT	83.00	Duct Width (in.)	0.00
PM	149.49	Duct Length (in.)	0.00
Barometric Pressure	29.31	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	168.00
		Stack Area (ft^2)	153.94
Moisture Content	5.11		
		Molecular Weight (dry)	29.594
O_2 %	13.697	Molecular Weight (wet)	29.002
CO_2 %	6.539	Stack Pressure	29.282
		Feet per Second	8.372
Standard CFH	3,688,599	Actual CFM	77330.28
K Standard CFH	61.477	DSCFM	58338.06

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration
O_2 (dry)	13.74	0.07	11.08	11.0	13.70
CO_2 (wet)	6.20	0.01	8.53	8.5	6.20
NOx (wet)	40.07	0.22	114.25	113.7	39.74
SO_2 (wet)	86.89	0.33	118.50	117.8	86.29

Moisture	5.11	Standard CFH	3,688,599
Fuel Factor	1839	K Standard CFM	61.477
DSCFM	58338		

Results

Flow Start	1:40 AM	Gases Start	1:40 AM
Flow Stop	1:50 AM	Gases Stop	2:00 AM

CO_2 %, wet	6.2
NOX ppm, wet	39.7
NOx LB/mmBTU	0.141
SO_2 ppm, wet	86.3
SO_2 LB/mmBTU	0.425
SCFH	3,689,000
WAF applied	0.9900

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
8/7/2012
Run 6

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	$\% CO_2$, w
1:40	89.6	41.19	13.74	6.185
1:41	90.5	43.2	13.91	6.037
1:42	94.39	42.29	13.78	6.168
1:43	92.91	41.45	13.96	6.008
1:44	88.87	42.19	13.85	6.093
1:45	86.06	41.84	13.85	6.127
1:46	87.62	40.63	13.92	6.063
1:47	96.25	39.35	13.8	6.168
1:48	93.89	40.01	13.7	6.217
1:49	91.27	39.98	13.67	6.289
1:50	87.72	39.98	13.68	6.257
1:51	86.79	37.8	13.7	6.222
1:52	79.44	39.97	13.77	6.181
1:53	81.34	39.77	13.63	6.323
1:54	74.17	39.77	13.61	6.321
1:55	75.52	39.71	13.61	6.302
1:56	77.02	39.74	13.71	6.225
1:57	85.8	39.46	13.64	6.275
1:58	92.44	37.35	13.58	6.281
1:59	86.94	36.84	13.71	6.186
2:00	86.11	39.01	13.66	6.205
Average	**86.888**	**40.073**	**13.737**	**6.197**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

8/7/2012
Test 1L 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	0.016	0.126	191	2:10 AM
2	A-2	0.014	0.118	191	
3	A-3	0.011	0.105	191	
4	A-4	0.010	0.100	191	
5	B-1	0.028	0.167	192	
6	B-2	0.029	0.170	192	
7	B-3	0.025	0.158	192	
8	B-4	0.018	0.134	192	
9	C-1	0.027	0.164	192	
10	C-2	0.019	0.138	192	
11	C-3	0.022	0.148	192	
12	C-4	0.020	0.141	192	
13	D-1	0.013	0.114	189	
14	D-2	0.013	0.114	189	
15	D-3	0.010	0.100	189	
16	D-4	0.010	0.100	189	2:20 AM
Average		0.0178	0.131	191	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	191		
Wet Bulb (°F)	105.0	Static Pressure	-0.42
TRA	1.19	Pitot Coefficient	0.815
Vapor Pressure of Water	2.24		
ZT	86.00	Duct Width (in.)	0.00
PM	132.72	Duct Length (in.)	0.00
Barometric Pressure	29.31	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	168.00
		Stack Area (ft^2)	153.94
Moisture Content	4.53		
		Molecular Weight (dry)	29.576
O_2 %	13.791	Molecular Weight (wet)	29.051
CO_2 %	6.403	Stack Pressure	29.279
		Feet per Second	7.918
Standard CFH	3,482,869	Actual CFM	73136.89
K Standard CFH	58.048	DSCFM	55416.45

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration
O_2 (dry)	13.82	0.07	11.07	11.0	**13.79**
CO_2 (wet)	6.09	0.01	8.51	8.5	**6.11**
NOx (wet)	41.38	0.20	113.75	113.7	**41.23**
SO_2 (wet)	83.65	0.28	119.05	117.8	**82.69**

Moisture	4.53	Standard CFH	3,482,869
Fuel Factor	1839	K Standard CFM	58.048
DSCFM	55416		

Results

Flow Start	2:10 AM	Gases Start	2:10 AM
Flow Stop	2:20 AM	Gases Stop	2:30 AM

CO_2 %, wet	6.1
NOX ppm, wet	41.2
NOx LB/mmBTU	0.148
SO_2 ppm, wet	82.7
SO_2 LB/mmBTU	0.413
SCFH	3,483,000
WAF applied	0.9900

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
8/7/2012
Run 7

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	$\%\ CO_2$, w
2:10	87.95	39.92	13.93	6.014
2:11	86.92	40.75	13.82	6.095
2:12	90.09	40.17	13.81	6.116
2:13	88.49	40.25	13.77	6.125
2:14	92.79	41.11	13.81	6.108
2:15	91.21	41.92	13.78	6.138
2:16	92.84	40.92	13.74	6.131
2:17	93.52	40.52	13.73	6.134
2:18	94.82	41.6	13.77	6.127
2:19	88.91	42	13.66	6.225
2:20	89.22	41.05	13.76	6.169
2:21	84.14	40.21	13.83	6.093
2:22	75.5	43	13.88	6.083
2:23	77.97	42.65	13.76	6.176
2:24	76.77	42.32	13.79	6.145
2:25	68.19	42.99	13.83	6.073
2:26	76.04	41.73	13.88	6.036
2:27	71.41	41.25	13.9	6.016
2:28	72.36	40.2	13.99	5.958
2:29	76.33	42.89	13.88	6
2:30	81.13	41.45	13.86	6.02
Average	**83.648**	**41.376**	**13.818**	**6.094**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

8/7/2012
Test 1L 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	0.020	0.141	186	2:40 AM
2	A-2	0.011	0.105	186	
3	A-3	0.012	0.110	186	
4	A-4	0.010	0.100	186	
5	B-1	0.022	0.148	190	
6	B-2	0.027	0.164	190	
7	B-3	0.027	0.164	190	
8	B-4	0.015	0.122	190	
9	C-1	0.026	0.161	191	
10	C-2	0.027	0.164	191	
11	C-3	0.029	0.170	191	
12	C-4	0.021	0.145	191	
13	D-1	0.016	0.126	190	
14	D-2	0.011	0.105	190	
15	D-3	0.010	0.100	190	
16	D-4	0.012	0.110	190	2:50 AM
Average		0.019	0.134	189	

Moisture Content Data	
Dry Bulb (°F)	189
Wet Bulb (°F)	107.0
TRA	1.19
Vapor Pressure of Water	2.38
ZT	82.25
PM	150.29
Barometric Pressure	29.31
Moisture Content	5.13
O_2 %	13.848
CO_2 %	6.315
Standard CFH	3,554,891
K Standard CFH	59.248

Flow Rate Data	
Static Pressure	-0.37
Pitot Coefficient	0.815
Duct Width (in.)	0.00
Duct Length (in.)	0.00
Duct Area (ft^2)	0.00
Stack Diameter (in.)	168.00
Stack Area (ft^2)	153.94
Molecular Weight (dry)	29.564
Molecular Weight (wet)	28.971
Stack Pressure	29.283
Feet per Second	8.059
Actual CFM	74439.27
DSCFM	56207.31

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration
O_2 (dry)	13.88	0.07	11.07	11.0	13.85
CO_2 (wet)	5.95	-0.02	8.49	8.5	5.99
NOx (wet)	41.89	0.20	113.45	113.7	41.86
SO_2 (wet)	86.61	0.34	119.35	117.8	85.39

Moisture	5.13	Standard CFH	3,554,891
Fuel Factor	1839	K Standard CFM	59.248
DSCFM	56207		

Results

Flow Start	2:40 AM	Gases Start	2:40 AM
Flow Stop	2:50 AM	Gases Stop	3:00 AM

CO_2 %, wet	6.0
NOX ppm, wet	41.9
NOx LB/mmBTU	0.153
SO_2 ppm, wet	85.4
SO_2 LB/mmBTU	0.435
SCFH	3,555,000
WAF applied	0.9900

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
8/7/2012
Run 8

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	% CO_2, w
2:40	93.03	40.8	13.91	5.885
2:41	91.22	42.03	13.89	5.915
2:42	101.4	39.3	13.77	6.058
2:43	96.25	42.59	13.94	5.878
2:44	95.7	42.37	13.89	5.961
2:45	93.62	41.32	13.89	5.935
2:46	85.8	43.23	13.91	5.912
2:47	91.22	42.41	13.82	6.018
2:48	100	39.7	13.68	6.099
2:49	91.61	40.43	13.83	5.982
2:50	81.86	41.9	14.06	5.828
2:51	80.48	42.8	13.92	5.945
2:52	86.4	43.66	13.77	6.057
2:53	80.38	41.48	13.88	5.969
2:54	78.37	43.16	13.86	5.954
2:55	77.95	41.6	13.89	5.945
2:56	80.68	41.63	13.82	5.992
2:57	77.89	42.01	13.89	5.932
2:58	76	41.87	13.93	5.905
2:59	80.36	42.07	13.89	5.918
3:00	78.51	43.35	13.94	5.893
Average	**86.606**	**41.891**	**13.875**	**5.951**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

8/7/2012
Test 1L 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	3:10 AM
2	A-2	0.013	0.114	192	
3	A-3	0.010	0.100	192	
4	A-4	0.010	0.100	192	
5	B-1	0.028	0.167	193	
6	B-2	0.027	0.164	193	
7	B-3	0.027	0.164	193	
8	B-4	0.016	0.126	193	
9	C-1	0.028	0.167	191	
10	C-2	0.028	0.167	191	
11	C-3	0.027	0.164	191	
12	C-4	0.021	0.145	191	
13	D-1	0.012	0.110	191	
14	D-2	0.011	0.105	191	
15	D-3	0.010	0.100	191	
16	D-4	0.010	0.100	191	3:20 AM
Average		0.019	0.133	192	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	192		
Wet Bulb (°F)	104.0	Static Pressure	-0.37
TRA	1.19	Pitot Coefficient	0.815
Vapor Pressure of Water	2.18		
ZT	87.75	Duct Width (in.)	0.00
PM	124.31	Duct Length (in.)	0.00
Barometric Pressure	29.31	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	168.00
		Stack Area (ft^2)	153.94
Moisture Content	4.25		
		Molecular Weight (dry)	29.556
O_2 %	13.885	Molecular Weight (wet)	29.066
CO_2 %	6.254	Stack Pressure	29.283
		Feet per Second	8.032
Standard CFH	3,529,007	Actual CFM	74181.82
K Standard CFH	58.817	DSCFM	56319.88

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration
O_2 (dry)	13.92	0.07	11.07	11.0	13.89
CO_2 (wet)	5.94	-0.03	8.49	8.5	5.99
NOx (wet)	42.47	0.06	113.65	113.7	42.45
SO_2 (wet)	77.67	0.28	119.10	117.8	76.73

Moisture	4.25	Standard CFH	3,529,007
Fuel Factor	1839	K Standard CFM	58.817
DSCFM	56320		

Results

Flow Start	3:10 AM	Gases Start	3:10 AM
Flow Stop	3:20 AM	Gases Stop	3:30 AM
CO_2 %, wet	6.0		
NOX ppm, wet	42.5		
NOx LB/mmBTU	0.156		
SO_2 ppm, wet	76.7		
SO_2 LB/mmBTU	0.391		
SCFH	3,529,000		
WAF applied	0.9900		

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
8/7/2012
Run 9

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	$\% CO_2$, w
3:10	85.04	40.95	13.78	6.105
3:11	87.15	42.48	13.88	6.03
3:12	91.58	41.98	13.83	6.036
3:13	99.05	38.99	13.77	6.062
3:14	100	40.76	13.72	6.134
3:15	97.58	42.64	13.86	6.015
3:16	88.83	42.53	13.98	5.888
3:17	85.75	41.45	13.96	5.863
3:18	90.75	39.46	13.72	6.058
3:19	91.89	37.8	13.69	6.107
3:20	79.12	40.27	13.94	5.928
3:21	85.72	39.7	13.76	6.055
3:22	66.43	43.1	13.93	5.957
3:23	58.21	44.55	14.05	5.877
3:24	55.11	47.05	14.03	5.928
3:25	53.8	46.78	14.06	5.866
3:26	52.25	45.84	14.19	5.738
3:27	54.16	47.94	14.11	5.749
3:28	62.61	44.7	14.04	5.773
3:29	69.58	41.94	13.98	5.812
3:30	76.55	41.01	13.99	5.789
Average	**77.674**	**42.472**	**13.918**	**5.941**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

8/7/2012
Test 1L 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	0.015	0.122	189	3:40 AM
2	A-2	0.016	0.126	189	
3	A-3	0.014	0.118	189	
4	A-4	0.010	0.100	189	
5	B-1	0.022	0.148	191	
6	B-2	0.027	0.164	191	
7	B-3	0.027	0.164	191	
8	B-4	0.017	0.130	191	
9	C-1	0.026	0.161	192	
10	C-2	0.028	0.167	192	
11	C-3	0.023	0.152	192	
12	C-4	0.020	0.141	192	
13	D-1	0.015	0.122	190	
14	D-2	0.011	0.105	190	
15	D-3	0.011	0.105	190	
16	D-4	0.010	0.100	190	3:50 AM
Average		0.018	0.133	191	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	191		
Wet Bulb (°F)	105.0	Static Pressure	-0.36
TRA	1.19	Pitot Coefficient	0.815
Vapor Pressure of Water	2.24		
ZT	85.50	Duct Width (in.)	0.00
PM	133.24	Duct Length (in.)	0.00
Barometric Pressure	29.31	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	168.00
		Stack Area (ft^2)	153.94
Moisture Content	4.55		
		Molecular Weight (dry)	29.567
O_2 %	13.783	Molecular Weight (wet)	29.041
CO_2 %	6.348	Stack Pressure	29.284
		Feet per Second	8.026
Standard CFH	3,533,227	Actual CFM	74126.21
K Standard CFH	58.887	DSCFM	56207.66

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration
O_2 (dry)	13.82	0.07	11.08	11.0	13.78
CO_2 (wet)	6.05	-0.01	8.53	8.5	6.06
NOx (wet)	39.54	-0.08	113.95	113.7	39.51
SO_2 (wet)	91.06	0.29	118.95	117.8	90.11

Moisture	4.55	Standard CFH	3,533,227
Fuel Factor	1839	K Standard CFM	58.887
DSCFM	56208		

Results

Flow Start	3:40 AM	Gases Start	3:40 AM
Flow Stop	3:50 AM	Gases Stop	4:00 AM

CO_2 %, wet	6.1
NOX ppm, wet	39.5
NOx LB/mmBTU	0.143
SO_2 ppm, wet	90.1
SO_2 LB/mmBTU	0.454
SCFH	3,533,000
WAF applied	0.9900

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
8/7/2012
Run 10

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	% CO_2, w
3:40	90.86	38.21	13.84	6.016
3:41	86.2	38.08	13.96	5.919
3:42	86.29	38.95	13.96	5.871
3:43	83.11	39.02	13.75	6.057
3:44	77.86	40.54	13.85	5.959
3:45	71.93	40.05	13.85	6
3:46	74.28	42.38	13.9	5.961
3:47	77.13	41.3	13.89	5.972
3:48	79.23	42.33	13.87	6.001
3:49	94.32	40.02	13.88	5.995
3:50	105.3	38.46	13.73	6.05
3:51	119.5	38.18	13.75	6.079
3:52	123.7	36.79	13.69	6.14
3:53	117.4	37.11	13.73	6.096
3:54	124	35.57	13.57	6.291
3:55	102.8	38.84	13.83	6.114
3:56	92.47	40.27	13.81	6.117
3:57	86.68	40.15	13.78	6.168
3:58	79.91	41.67	13.87	6.088
3:59	68.26	41.23	13.92	6.034
4:00	70.99	41.26	13.86	6.059
Average	**91.058**	**39.543**	**13.823**	**6.047**

MID LOAD

MPU01010

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

8/7/2012
Test 1M Run 1
Mid Load (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	5:17 AM
2	A-2	0.028	0.167	214	
3	A-3	0.027	0.164	214	
4	A-4	0.018	0.134	214	
5	B-1	0.037	0.192	211	
6	B-2	0.040	0.200	211	
7	B-3	0.038	0.195	211	
8	B-4	0.036	0.190	211	
9	C-1	0.029	0.170	213	
10	C-2	0.038	0.195	213	
11	C-3	0.027	0.164	213	
12	C-4	0.038	0.195	213	
13	D-1	0.017	0.130	214	
14	D-2	0.017	0.130	214	
15	D-3	0.013	0.114	214	
16	D-4	0.013	0.114	214	5:25 AM
Average		0.027	0.163	213	

Moisture Content Data	
Dry Bulb (°F)	214
Wet Bulb (°F)	108.0
TRA	1.18
Vapor Pressure of Water	2.45
ZT	106.00
PM	132.10
Barometric Pressure	29.29
Standard Meter Volume	
Moisture Content	4.51
O_2 %	11.478
CO_2 %	8.384
Standard CFH	4,232,224
K Standard CFH	70.537

Flow Rate Data	
Static Pressure	-0.39
Pitot Coefficient	0.815
Duct Width (in.)	0.0
Duct Length (in.)	0.0
Duct Area (ft^2)	0.0
Stack Diameter (in.)	168.0
Stack Area (ft^2)	153.938
Molecular Weight (dry)	29.801
Molecular Weight (wet)	29.268
Stack Pressure	29.261
Feet per Second	9.953
Actual CFM	91931.89
DSCFM	67352.57

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	11.55	0.07	11.10	11.03	**11.48**	dry
CO_2 (wet)	8.05	0.04	8.59	8.54	**8.01**	wet

Moisture	4.51	**Standard CFH**	**4,232,224**
Fuel Factor C	1839	K Standard CFM	70.537
DSCFM	67353		

Results

Start Time	**5:17 AM**
Stop Time	**5:25 AM**
Standard CFH	**4,232,000**
CO_2 %, wet	**8.01**
WAF applied	**0.9900**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
8/7/2012
Run 1-3

Time	$\%O_2$, d	$\%\ CO_2$, w
5:17	11.44	8.147
5:18	11.48	8.103
5:19	11.41	8.155
5:20	11.52	8.065
5:21	11.44	8.14
5:22	11.43	8.143
5:23	11.52	8.092
5:24	11.65	7.958
5:25	11.63	7.973
5:26	11.65	7.966
5:27	11.64	7.964
5:28	11.6	7.99
5:29	11.57	8.018
5:30	11.46	8.109
5:31	11.47	8.107
5:32	11.46	8.093
5:33	11.6	7.986
5:34	11.6	8.036
5:35	11.58	8.109
5:36	11.56	8.09
5:37	11.52	8.085
5:38	11.57	8.087
5:39	11.54	8.075
5:40	11.61	8.009
5:41	11.69	7.878
5:42	11.61	7.937
Average	**11.548**	**8.051**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

8/7/2012
Test 1M Run 2
Mid Load (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	212	5:26 AM
2	A-2	0.028	0.167	212	
3	A-3	0.029	0.170	212	
4	A-4	0.015	0.122	212	
5	B-1	0.035	0.187	211	
6	B-2	0.038	0.195	211	
7	B-3	0.042	0.205	211	
8	B-4	0.033	0.182	211	
9	C-1	0.029	0.170	212	
10	C-2	0.040	0.200	212	
11	C-3	0.039	0.197	212	
12	C-4	0.038	0.195	212	
13	D-1	0.018	0.134	213	
14	D-2	0.015	0.122	213	
15	D-3	0.013	0.114	213	
16	D-4	0.011	0.105	213	5:32 AM
Average		0.028	0.163	212	

Moisture Content Data	
Dry Bulb (°F)	212
Wet Bulb (°F)	115.0
TRA	1.17
Vapor Pressure of Water	3.00
ZT	97.00
PM	196.30
Barometric Pressure	29.29
Standard Meter Volume	
Moisture Content	6.71
O_2 %	11.447
CO_2 %	8.556
Standard CFH	4,270,142
K Standard CFH	71.169

Flow Rate Data	
Static Pressure	-0.39
Pitot Coefficient	0.82
Duct Width (in.)	0.00
Duct Length (in.)	0.00
Duct Area (ft^2)	0.00
Stack Diameter (in.)	168.00
Stack Area (ft^2)	153.94
Molecular Weight (dry)	29.827
Molecular Weight (wet)	29.033
Stack Pressure	29.261
Feet per Second	10.028
Actual CFM	92617.71
DSCFM	66394.77

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	11.55	0.07	11.13	11.03	11.45	dry
CO_2 (wet)	8.05	0.05	8.61	8.54	7.98	wet

Moisture	6.71	Standard CFH	4,270,142
Fuel Factor C	1839	K Standard CFM	71.169
DSCFM	66395		

Results

Start Time	5:26 AM
Stop Time	5:32 AM
Standard CFH	4,270,000
CO_2 %, wet	7.98
WAF applied	0.9900

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

8/7/2012
Test 1M Run 3
Mid Load (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	211	5:33 AM
2	A-2	0.028	0.167	211	
3	A-3	0.027	0.164	211	
4	A-4	0.018	0.134	211	
5	B-1	0.032	0.179	211	
6	B-2	0.042	0.205	211	
7	B-3	0.045	0.212	211	
8	B-4	0.034	0.184	211	
9	C-1	0.032	0.179	213	
10	C-2	0.037	0.192	213	
11	C-3	0.043	0.207	213	
12	C-4	0.040	0.200	213	
13	D-1	0.016	0.126	214	
14	D-2	0.011	0.105	214	
15	D-3	0.010	0.100	214	
16	D-4	0.010	0.100	214	5:42 AM
Average		0.028	0.162	212	

Moisture Content Data	
Dry Bulb (°F)	211
Wet Bulb (°F)	115.0
TRA	1.17
Vapor Pressure of Water	3.00
ZT	96.00
PM	197.36
Barometric Pressure	29.29
Standard Meter Volume	
Moisture Content	6.75
O_2 %	11.447
CO_2 %	8.559
Standard CFH	4,240,623
K Standard CFH	70.677

Flow Rate Data	
Static Pressure	-0.40
Pitot Coefficient	0.815
Duct Width (in.)	0.00
Duct Length (in.)	0.00
Duct Area (ft^2)	0.00
Stack Diameter (in.)	168.00
Stack Area (ft^2)	153.94
Molecular Weight (dry)	29.827
Molecular Weight (wet)	29.03
Stack Pressure	29.261
Feet per Second	9.962
Actual CFM	92013.99
DSCFM	65909.88

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	11.55	0.07	11.13	11.03	**11.45**	dry
CO_2 (wet)	8.05	0.05	8.61	8.54	**7.98**	wet

Moisture	6.75	**Standard CFH**	**4,240,623**
Fuel Factor C	1839	K Standard CFM	70.677
DSCFM	65910		

Results

Start Time	**5:33 AM**
Stop Time	**5:42 AM**
Standard CFH	**4,241,000**
CO_2 %, wet	**7.98**
WAF applied	**0.9900**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
8/7/2012
Run 4-6

Time	$\%O_2$, d	$\%\ CO_2$, w
6:00	11.61	8.017
6:01	11.47	8.121
6:02	11.43	8.186
6:03	11.52	8.117
6:04	11.46	8.145
6:05	11.58	8.084
6:06	11.49	8.111
6:07	11.62	8.033
6:08	11.44	8.17
6:09	11.55	8.046
6:10	11.53	8.059
6:11	11.41	8.155
6:12	11.44	8.115
6:13	11.41	8.162
6:14	11.64	7.994
6:15	11.7	7.898
6:16	11.46	8.09
6:17	11.54	8.017
6:18	11.56	8.033
6:19	11.42	8.198
6:20	11.48	8.134
6:21	11.53	8.103
6:22	11.51	8.147
6:23	11.49	8.126
6:24	11.53	8.09
6:25	11.46	8.178
6:26	11.43	8.134
6:27	11.5	8.097
6:28	11.5	8.006
6:29	11.57	8.022
6:30	11.41	8.193
6:31	11.67	7.977
6:32	11.58	8.078
6:33	11.58	8.073
6:34	11.66	7.99
6:35	11.5	8.097
6:36	11.57	8.021
6:37	11.56	8.049
6:38	11.42	8.155
6:39	11.56	8.062
6:40	11.44	8.102
6:41	11.47	8.059
6:42	11.52	8.076
6:43	11.53	8.052
6:44	11.48	8.058
6:45	11.39	8.175
6:46	11.36	8.265
6:47	11.67	7.958
6:48	11.54	8.07
6:49	11.58	8.044
6:50	11.55	8.06
6:51	11.51	8.095
6:52	11.52	8.058
6:53	11.48	8.097
6:54	11.47	8.131
6:55	11.44	8.144
6:56	11.39	8.159
Average	**11.511**	**8.089**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

8/7/2012
Test 1M Run 4
Mid Load (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	0.018	0.134	213	6:00 AM
2	A-2	0.025	0.158	213	
3	A-3	0.027	0.164	213	
4	A-4	0.019	0.138	213	
5	B-1	0.028	0.167	214	
6	B-2	0.041	0.202	214	
7	B-3	0.040	0.200	214	
8	B-4	0.033	0.182	214	
9	C-1	0.038	0.195	215	
10	C-2	0.033	0.182	215	
11	C-3	0.044	0.210	215	
12	C-4	0.038	0.195	215	
13	D-1	0.018	0.134	213	
14	D-2	0.016	0.126	213	
15	D-3	0.010	0.100	213	
16	D-4	0.010	0.100	213	6:07 AM
Average		0.027	0.162	214	

Moisture Content Data	
Dry Bulb (°F)	213
Wet Bulb (°F)	114.0
TRA	1.17
Vapor Pressure of Wate	2.91
ZT	99.00
PM	185.78
Barometric Pressure	29.29
Standard Meter Volume	
Moisture Content	6.35
O_2 %	11.42
CO_2 %	8.589
Standard CFH	4,216,482
K Standard CFH	70.275

Flow Rate Data	
Static Pressure	-0.39
Pitot Coefficient	0.815
Duct Width (in.)	0
Duct Length (in.)	0
Duct Area (ft^2)	0
Stack Diameter (in.)	168
Stack Area (ft^2)	153.94
Molecular Weight (dry)	29.831
Molecular Weight (wet)	29.08
Stack Pressure	29.261
Feet per Second	9.927
Actual CFM	91692.
DSCFM	65813.07

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	11.51	0.07	11.12	11.03	**11.42**	dry
CO_2 (wet)	8.09	0.05	8.59	8.54	**8.04**	wet

Moisture	6.35	**Standard CFH**	4,216,482
Fuel Factor C	1839	K Standard CFM	70.275
DSCFM	65813		

Results

Start Time	**6:00 AM**
Stop Time	**6:07 AM**
Standard CFH	**4,216,000**
CO_2 %, wet	**8.04**
WAF applied	**0.9900**

MPU01016

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

8/7/2012
Test 1M Run 5
Mid Load (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	6:08 AM
2	A-2	0.026	0.161	214	
3	A-3	0.023	0.152	214	
4	A-4	0.020	0.141	214	
5	B-1	0.030	0.173	215	
6	B-2	0.032	0.179	215	
7	B-3	0.044	0.210	215	
8	B-4	0.028	0.167	215	
9	C-1	0.030	0.173	215	
10	C-2	0.037	0.192	215	
11	C-3	0.042	0.205	215	
12	C-4	0.040	0.200	215	
13	D-1	0.015	0.122	213	
14	D-2	0.010	0.100	213	
15	D-3	0.010	0.100	213	
16	D-4	0.010	0.100	213	6:15 AM
Average		0.026	0.157	214	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	214		
Wet Bulb (°F)	114.0	Static Pressure	-0.39
TRA	1.17	Pitot Coefficient	0.815
Vapor Pressure of Water	2.91		
ZT	100.00	Duct Width (in.)	0
PM	184.71	Duct Length (in.)	0
Barometric Pressure	29.29	Duct Area (ft^2)	0
		Stack Diameter (in.)	168
Standard Meter Volume		Stack Area (ft^2)	153.94
Moisture Content	6.31		
		Molecular Weight (dry)	29.835
O_2 %	11.43	Molecular Weight (wet)	29.088
CO_2 %	8.611	Stack Pressure	29.261
		Feet per Second	9.661
Standard CFH	4,100,416	Actual CFM	89234.2
K Standard CFH	68.34	DSCFM	64026.34

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	11.51	0.06	11.11	11.03	**11.43**	dry
CO_2 (wet)	8.09	0.05	8.56	8.54	**8.07**	wet

Moisture	6.31	**Standard CFH**	**4,100,416**
Fuel Factor C	1839	K Standard CFM	68.34
DSCFM	64026		

Results

Start Time	**6:08 AM**
Stop Time	**6:15 AM**
Standard CFH	**4,100,000**
CO_2 %, wet	**8.07**
WAF applied	**0.9900**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

8/7/2012
Test 1M Run 6
Mid Load (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	216	6:16 AM
2	A-2	0.026	0.161	216	
3	A-3	0.028	0.167	216	
4	A-4	0.022	0.148	216	
5	B-1	0.030	0.173	217	
6	B-2	0.036	0.190	217	
7	B-3	0.039	0.197	217	
8	B-4	0.028	0.167	217	
9	C-1	0.027	0.164	215	
10	C-2	0.041	0.202	215	
11	C-3	0.039	0.197	215	
12	C-4	0.041	0.202	215	
13	D-1	0.021	0.145	216	
14	D-2	0.016	0.126	216	
15	D-3	0.013	0.114	216	
16	D-4	0.010	0.100	216	6:23 AM
Average		0.027	0.162	216	

Moisture Content Data	
Dry Bulb (°F)	216
Wet Bulb (°F)	114.0
TRA	1.17
Vapor Pressure of Water	2.91
ZT	102.00
PM	182.58
Barometric Pressure	29.29
Standard Meter Volume	
Moisture Content	6.24
O_2 %	11.43
CO_2 %	8.604
Standard CFH	4,225,267
K Standard CFH	70.421

Flow Rate Data	
Static Pressure	-0.39
Pitot Coefficient	0.815
Duct Width (in.)	0.00
Duct Length (in.)	0.00
Duct Area (ft^2)	0.00
Stack Diameter (in.)	168.00
Stack Area (ft^2)	153.94
Molecular Weight (dry)	29.834
Molecular Weight (wet)	29.096
Stack Pressure	29.261
Feet per Second	9.981
Actual CFM	92189.89
DSCFM	66027.11

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	11.51	0.06	11.11	11.03	**11.43**	dry
CO_2 (wet)	8.09	0.05	8.56	8.54	**8.07**	wet

Moisture	6.24	**Standard CFH**	**4,225,267**
Fuel Factor C	1839	K Standard CFM	70.421
DSCFM	66027		

Results

Start Time	**6:16 AM**
Stop Time	**6:23 AM**
Standard CFH	**4,225,000**
CO_2 %, wet	**8.07**
WAF applied	**0.9900**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
8/7/2012
Run 7-9

Time	$\%O_2$, d	$\%\ CO_2$, w
6:00	11.61	8.017
6:01	11.47	8.121
6:02	11.43	8.186
6:03	11.52	8.117
6:04	11.46	8.145
6:05	11.58	8.084
6:06	11.49	8.111
6:07	11.62	8.033
6:08	11.44	8.17
6:09	11.55	8.046
6:10	11.53	8.059
6:11	11.41	8.155
6:12	11.44	8.115
6:13	11.41	8.162
6:14	11.64	7.994
6:15	11.7	7.898
6:16	11.46	8.09
6:17	11.54	8.017
6:18	11.56	8.033
6:19	11.42	8.198
6:20	11.48	8.134
6:21	11.53	8.103
6:22	11.51	8.147
6:23	11.49	8.126
6:24	11.53	8.09
6:25	11.46	8.178
6:26	11.43	8.134
6:27	11.5	8.097
6:28	11.5	8.006
6:29	11.57	8.022
6:30	11.41	8.193
6:31	11.67	7.977
6:32	11.58	8.078
6:33	11.58	8.073
6:34	11.66	7.99
6:35	11.5	8.097
6:36	11.57	8.021
6:37	11.56	8.049
6:38	11.42	8.155
6:39	11.56	8.062
6:40	11.44	8.102
6:41	11.47	8.059
6:42	11.52	8.076
6:43	11.53	8.052
6:44	11.48	8.058
6:45	11.39	8.175
6:46	11.36	8.265
6:47	11.67	7.958
6:48	11.54	8.07
6:49	11.58	8.044
6:50	11.55	8.06
6:51	11.51	8.095
6:52	11.52	8.058
6:53	11.48	8.097
6:54	11.47	8.131
6:55	11.44	8.144
6:56	11.39	8.159
Average	**11.511**	**8.089**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

8/7/2012
Test 1M Run 7
Mid Load (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	0.021	0.145	217	6:24 AM
2	A-2	0.026	0.161	217	
3	A-3	0.028	0.167	217	
4	A-4	0.020	0.141	217	
5	B-1	0.030	0.173	217	
6	B-2	0.043	0.207	217	
7	B-3	0.040	0.200	217	
8	B-4	0.028	0.167	217	
9	C-1	0.033	0.182	218	
10	C-2	0.047	0.217	218	
11	C-3	0.048	0.219	218	
12	C-4	0.038	0.195	218	
13	D-1	0.015	0.122	217	
14	D-2	0.012	0.110	217	
15	D-3	0.010	0.100	217	
16	D-4	0.010	0.100	217	6:31 AM
Average		0.028	0.163	217	

Moisture Content Data	
Dry Bulb (°F)	217
Wet Bulb (°F)	114.0
TRA	1.17
Vapor Pressure of Water	2.91
ZT	103.00
PM	181.51
Barometric Pressure	29.29
Standard Meter Volume	
Moisture Content	6.20
O_2 %	11.43
CO_2 %	8.601
Standard CFH	4,235,825
K Standard CFH	70.597

Flow Rate Data	
Static Pressure	-0.38
Pitot Coefficient	0.815
Duct Width (in.)	0.00
Duct Length (in.)	0.00
Duct Area (ft^2)	0.00
Stack Diameter (in.)	168.00
Stack Area (ft^2)	153.94
Molecular Weight (dry)	29.833
Molecular Weight (wet)	29.099
Stack Pressure	29.262
Feet per Second	10.024
Actual CFM	92588.82
DSCFM	66217.98

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	11.51	0.06	11.11	11.0	11.43	dry
CO_2 (wet)	8.09	0.05	8.56	8.5	8.07	wet

Moisture	6.20	Standard CFH	4,235,825
Fuel Factor C	1839	K Standard CFM	70.597
DSCFM	66218		

Results

Start Time	6:24 AM
Stop Time	6:31 AM
Standard CFH	4,236,000
CO_2 %, wet	8.07
WAF applied	0.9900

MPU01020

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

8/7/2012
Test 1M Run 8
Mid Load (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	0.018	0.134	218	6:32 AM
2	A-2	0.020	0.141	218	
3	A-3	0.025	0.158	218	
4	A-4	0.018	0.134	218	
5	B-1	0.032	0.179	219	
6	B-2	0.036	0.190	219	
7	B-3	0.041	0.202	219	
8	B-4	0.038	0.195	219	
9	C-1	0.028	0.167	218	
10	C-2	0.039	0.197	218	
11	C-3	0.043	0.207	218	
12	C-4	0.038	0.195	218	
13	D-1	0.016	0.126	220	
14	D-2	0.016	0.126	220	
15	D-3	0.011	0.105	220	
16	D-4	0.010	0.100	220	6:40 AM
Average		0.027	0.160	219	

Moisture Content Data	
Dry Bulb (°F)	218
Wet Bulb (°F)	114.0
TRA	1.17
Vapor Pressure of Water	2.91
ZT	104.00
PM	180.45
Barometric Pressure	29.29
Standard Meter Volume	
Moisture Content	6.17
O_2 %	11.43
CO_2 %	8.598
Standard CFH	4,152,234
K Standard CFH	69.204

Flow Rate Data	
Static Pressure	-0.39
Pitot Coefficient	0.815
Duct Width (in.)	0.00
Duct Length (in.)	0.00
Duct Area (ft^2)	0.00
Stack Diameter (in.)	168.00
Stack Area (ft^2)	153.94
Molecular Weight (dry)	29.833
Molecular Weight (wet)	29.103
Stack Pressure	29.261
Feet per Second	9.849
Actual CFM	90964.96
DSCFM	64936.24

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	11.51	0.06	11.11	11.0	**11.43**	dry
CO_2 (wet)	8.09	0.05	8.56	8.5	**8.07**	wet

Moisture	6.17	**Standard CFH**	**4,152,234**
Fuel Factor C	1839	K Standard CFM	69.204
DSCFM	64936		

Results

Start Time	**6:32 AM**
Stop Time	**6:40 AM**
Standard CFH	**4,152,000**
CO_2 %, wet	**8.07**
WAF applied	**0.9900**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

8/7/2012
Test 1M Run 9
Mid Load (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	218	6:41 AM
2	A-2	0.021	0.145	218	
3	A-3	0.027	0.164	218	
4	A-4	0.017	0.130	218	
5	B-1	0.030	0.173	220	
6	B-2	0.036	0.190	220	
7	B-3	0.038	0.195	220	
8	B-4	0.032	0.179	220	
9	C-1	0.030	0.173	219	
10	C-2	0.036	0.190	219	
11	C-3	0.038	0.195	219	
12	C-4	0.035	0.187	219	
13	D-1	0.015	0.122	219	
14	D-2	0.010	0.100	219	
15	D-3	0.010	0.100	219	
16	D-4	0.010	0.100	219	6:48 AM
Average		0.025	0.156	219	

Moisture Content Data	
Dry Bulb (°F)	218
Wet Bulb (°F)	114.0
TRA	1.17
Vapor Pressure of Water	2.91
ZT	104.00
PM	180.45
Barometric Pressure	29.29
Standard Meter Volume	
Moisture Content	6.17
O_2 %	11.43
CO_2 %	8.598
Standard CFH	4,043,178
K Standard CFH	67.386

Flow Rate Data	
Static Pressure	-0.39
Pitot Coefficient	0.815
Duct Width (in.)	0.00
Duct Length (in.)	0.00
Duct Area (ft^2)	0.00
Stack Diameter (in.)	168.00
Stack Area (ft^2)	153.94
Molecular Weight (dry)	29.833
Molecular Weight (wet)	29.103
Stack Pressure	29.261
Feet per Second	9.594
Actual CFM	88608.44
DSCFM	63230.73

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	11.51	0.06	11.11	11.0	**11.43**	dry
CO_2 (wet)	8.09	0.05	8.56	8.5	**8.07**	wet

Moisture	6.17	**Standard CFH**	4,043,178
Fuel Factor C	1839	K Standard CFM	67.386
DSCFM	63231		

Results

Start Time	**6:41 AM**
Stop Time	**6:48 AM**
Standard CFH	**4,043,000**
CO_2 %, wet	**8.07**
WAF applied	**0.9900**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

8/7/2012
Test 1M Run 10
Mid Load (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	219	6:49 AM
2	A-2	0.024	0.155	219	
3	A-3	0.023	0.152	219	
4	A-4	0.020	0.141	219	
5	B-1	0.030	0.173	220	
6	B-2	0.040	0.200	220	
7	B-3	0.043	0.207	220	
8	B-4	0.039	0.197	220	
9	C-1	0.028	0.167	220	
10	C-2	0.037	0.192	220	
11	C-3	0.038	0.195	220	
12	C-4	0.038	0.195	220	
13	D-1	0.020	0.141	219	
14	D-2	0.016	0.126	219	
15	D-3	0.011	0.105	219	
16	D-4	0.010	0.100	219	6:56 AM
Average		0.028	0.163	220	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	219		
Wet Bulb (°F)	114.0	Static Pressure	-0.39
TRA	1.17	Pitot Coefficient	0.815
Vapor Pressure of Water	2.91		
ZT	105.00	Duct Width (in.)	0.00
PM	179.38	Duct Length (in.)	0.00
Barometric Pressure	29.29	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	168.00
Standard Meter Volume		Stack Area (ft^2)	153.94
Moisture Content	6.13		
		Molecular Weight (dry)	29.832
O_2 %	11.43	Molecular Weight (wet)	29.107
CO_2 %	8.594	Stack Pressure	29.261
		Feet per Second	10.012
Standard CFH	4,216,443	Actual CFM	92473.67
K Standard CFH	70.274	DSCFM	65965.98

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	11.51	0.06	11.11	11.0	11.43	dry
CO_2 (wet)	8.09	0.05	8.56	8.5	8.07	wet

Moisture	6.13	Standard CFH	4,216,443
Fuel Factor C	1839	K Standard CFM	70.274
DSCFM	65966		

Results

Start Time	6:49 AM
Stop Time	6:56 AM
Standard CFH	4,216,000
CO_2 %, wet	8.07
WAF applied	0.9900

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
8/7/2012
Run 10

Time	$\%O_2$, d	$\%\ CO_2$, w
6:00	11.61	8.017
6:01	11.47	8.121
6:02	11.43	8.186
6:03	11.52	8.117
6:04	11.46	8.145
6:05	11.58	8.084
6:06	11.49	8.111
6:07	11.62	8.033
6:08	11.44	8.17
6:09	11.55	8.046
6:10	11.53	8.059
6:11	11.41	8.155
6:12	11.44	8.115
6:13	11.41	8.162
6:14	11.64	7.994
6:15	11.7	7.898
6:16	11.46	8.09
6:17	11.54	8.017
6:18	11.56	8.033
6:19	11.42	8.198
6:20	11.48	8.134
6:21	11.53	8.103
6:22	11.51	8.147
6:23	11.49	8.126
6:24	11.53	8.09
6:25	11.46	8.178
6:26	11.43	8.134
6:27	11.5	8.097
6:28	11.5	8.006
6:29	11.57	8.022
6:30	11.41	8.193
6:31	11.67	7.977
6:32	11.58	8.078
6:33	11.58	8.073
6:34	11.66	7.99
6:35	11.5	8.097
6:36	11.57	8.021
6:37	11.56	8.049
6:38	11.42	8.155
6:39	11.56	8.062
6:40	11.44	8.102
6:41	11.47	8.059
6:42	11.52	8.076
6:43	11.53	8.052
6:44	11.48	8.058
6:45	11.39	8.175
6:46	11.36	8.265
6:47	11.67	7.958
6:48	11.54	8.07
6:49	11.58	8.044
6:50	11.55	8.06
6:51	11.51	8.095
6:52	11.52	8.058
6:53	11.48	8.097
6:54	11.47	8.131
6:55	11.44	8.144
6:56	11.39	8.159
Average	**11.511**	**8.089**

MPU01024

HIGH LOAD

MPU01025

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

8/7/2012
Test 1H Run 3
High Load (190 Klbs/Hr)

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.041	0.202	252	8:17 AM
2	A-2	0.049	0.221	252	
3	A-3	0.050	0.224	252	
4	A-4	0.042	0.205	252	
5	B-1	0.038	0.195	251	
6	B-2	0.051	0.226	251	
7	B-3	0.062	0.249	251	
8	B-4	0.049	0.221	251	
9	C-1	0.050	0.224	251	
10	C-2	0.056	0.237	251	
11	C-3	0.058	0.241	251	
12	C-4	0.049	0.221	251	
13	D-1	0.038	0.195	253	
14	D-2	0.037	0.192	253	
15	D-3	0.035	0.187	253	
16	D-4	0.021	0.145	253	8:24 AM
Average		0.045	0.212	252	

Moisture Content Data	
Dry Bulb (°F)	252
Wet Bulb (°F)	121.0
TRA	1.16
Vapor Pressure of Water	3.54
ZT	131.00
PM	214.91
Barometric Pressure	29.29
Standard Meter Volume	
Moisture Content	7.35
O_2 %	10.321
CO_2 %	9.467
Standard CFH	5,368,790
K Standard CFH	89.48

Flow Rate Data	
Static Pressure	-0.43
Pitot Coefficient	0.815
Duct Width (in.)	0.00
Duct Length (in.)	0.00
Duct Area (ft^2)	0.00
Stack Diameter (in.)	168.00
Stack Area (ft^2)	153.94
Molecular Weight (dry)	29.928
Molecular Weight (wet)	29.051
Stack Pressure	29.258
Feet per Second	13.355
Actual CFM	123347.41
DSCFM	82907.29

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	10.40	0.07	11.11	11.03	**10.32**	dry
CO_2 (wet)	8.82	0.06	8.59	8.54	**8.77**	wet

Moisture	7.35	**Standard CFH**	5,368,790
Fuel Factor C	1839	K Standard CFM	89.48
DSCFM	82907		

Results

Start Time	**8:17 AM**
Stop Time	**8:24 AM**
Standard CFH	**5,369,000**
CO_2 %, wet	**8.77**
WAF applied	**0.9900**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

8/7/2012
Test 1H Run 1
High Load (190 Klbs/Hr)

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.040	0.200	248	8:02 AM
2	A-2	0.045	0.212	248	
3	A-3	0.050	0.224	248	
4	A-4	0.045	0.212	248	
5	B-1	0.041	0.202	249	
6	B-2	0.051	0.226	249	
7	B-3	0.059	0.243	249	
8	B-4	0.048	0.219	249	
9	C-1	0.050	0.224	251	
10	C-2	0.053	0.230	251	
11	C-3	0.062	0.249	251	
12	C-4	0.050	0.224	251	
13	D-1	0.035	0.187	252	
14	D-2	0.030	0.173	252	
15	D-3	0.034	0.184	252	
16	D-4	0.020	0.141	252	8:09 AM
Average		0.045	0.209	250	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	248		
Wet Bulb (°F)	121.0	Static Pressure	-0.44
TRA	1.16	Pitot Coefficient	0.815
Vapor Pressure of Water	3.54		
ZT	127.00	Duct Width (in.)	0.0
PM	219.18	Duct Length (in.)	0.0
Barometric Pressure	29.29	Duct Area (ft^2)	0.0
		Stack Diameter (in.)	168.0
Standard Meter Volume		Stack Area (ft^2)	153.938
Moisture Content	7.49		
		Molecular Weight (dry)	29.933
O_2 %	10.321	Molecular Weight (wet)	29.039
CO_2 %	9.498	Stack Pressure	29.258
		Feet per Second	13.205
Standard CFH	5,321,660	Actual CFM	121967.04
K Standard CFH	88.694	DSCFM	82050.03

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	10.40	0.07	11.11	11.03	10.32	dry
CO_2 (wet)	8.82	0.06	8.58	8.54	8.79	wet

Moisture	7.49	Standard CFH	5,321,660
Fuel Factor C	1839	K Standard CFM	88.694
DSCFM	82050		

Results

Start Time	8:02 AM
Stop Time	8:09 AM
Standard CFH	5,322,000
CO_2 %, wet	8.79
WAF applied	0.9900

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

8/7/2012
Test 1H Run 2
High Load (190 Klbs/Hr)

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.037	0.192	251	8:10 AM
2	A-2	0.049	0.221	251	
3	A-3	0.044	0.210	251	
4	A-4	0.040	0.200	251	
5	B-1	0.040	0.200	253	
6	B-2	0.052	0.228	253	
7	B-3	0.060	0.245	253	
8	B-4	0.048	0.219	253	
9	C-1	0.046	0.214	252	
10	C-2	0.059	0.243	252	
11	C-3	0.060	0.245	252	
12	C-4	0.044	0.210	252	
13	D-1	0.040	0.200	253	
14	D-2	0.030	0.173	253	
15	D-3	0.033	0.182	253	
16	D-4	0.021	0.145	253	8:16 AM
Average		0.044	0.208	252	

Moisture Content Data	
Dry Bulb (°F)	251
Wet Bulb (°F)	121.0
TRA	1.16
Vapor Pressure of Water	3.54
ZT	130.00
PM	215.98
Barometric Pressure	29.29
Standard Meter Volume	
Moisture Content	7.38
O_2 %	10.321
CO_2 %	9.471
Standard CFH	5,275,566
K Standard CFH	87.926

Flow Rate Data	
Static Pressure	-0.43
Pitot Coefficient	0.82
Duct Width (in.)	0.00
Duct Length (in.)	0.00
Duct Area (ft^2)	0.00
Stack Diameter (in.)	168.00
Stack Area (ft^2)	153.94
Molecular Weight (dry)	29.928
Molecular Weight (wet)	29.048
Stack Pressure	29.258
Feet per Second	13.132
Actual CFM	121290.74
DSCFM	81435.67

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	10.40	0.07	11.11	11.03	10.32	dry
CO_2 (wet)	8.82	0.06	8.59	8.54	8.77	wet

Moisture	7.38	Standard CFH	5,275,566
Fuel Factor C	1839	K Standard CFM	87.926
DSCFM	81436		

Results

Start Time	**8:10 AM**
Stop Time	**8:16 AM**
Standard CFH	**5,276,000**
CO_2 %, wet	**8.77**
WAF applied	**0.9900**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
8/7/2012
Run 1-3

Time	$\%O_2$, d	$\%\ CO_2$, w
8:02	10.36	8.851
8:03	10.44	8.799
8:04	10.4	8.865
8:05	10.39	8.839
8:06	10.31	8.904
8:07	10.47	8.738
8:08	10.47	8.717
8:09	10.44	8.781
8:10	10.4	8.833
8:11	10.41	8.849
8:12	10.4	8.878
8:13	10.38	8.878
8:14	10.35	8.91
8:15	10.39	8.834
8:16	10.38	8.846
8:17	10.31	8.836
8:18	10.31	8.873
8:19	10.39	8.866
8:20	10.45	8.779
8:21	10.43	8.799
8:22	10.46	8.761
8:23	10.54	8.668
8:24	10.33	8.783
Average	**10.400**	**8.821**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

8/7/2012
Test 1H Run 4
High Load (190 Klbs/Hr)

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.042	0.205	244	9:06 AM
2	A-2	0.046	0.214	244	
3	A-3	0.052	0.228	244	
4	A-4	0.049	0.221	244	
5	B-1	0.040	0.200	246	
6	B-2	0.053	0.230	246	
7	B-3	0.051	0.226	246	
8	B-4	0.049	0.221	246	
9	C-1	0.048	0.219	247	
10	C-2	0.059	0.243	247	
11	C-3	0.061	0.247	247	
12	C-4	0.058	0.241	247	
13	D-1	0.042	0.205	249	
14	D-2	0.040	0.200	249	
15	D-3	0.037	0.192	249	
16	D-4	0.021	0.145	249	9:13 AM
Average		0.047	0.215	247	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	244		
Wet Bulb (°F)	127.0	Static Pressure	-0.44
TRA	1.14	Pitot Coefficient	0.815
Vapor Pressure of Wate	4.18		
ZT	117.00	Duct Width (in.)	0
PM	293.05	Duct Length (in.)	0
Barometric Pressure	29.29	Duct Area (ft^2)	0
		Stack Diameter (in.)	168
Standard Meter Volume		Stack Area (ft^2)	153.93804
Moisture Content	10.02		
		Molecular Weight (dry)	30.023
O_2 %	10.111	Molecular Weight (wet)	28.818
CO_2 %	10.113	Stack Pressure	29.258
		Feet per Second	13.568
Standard CFH	5,495,063	Actual CFM	125320.41
K Standard CFH	91.584	DSCFM	82411.26

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	10.19	0.07	11.11	11.03	**10.11**	dry
CO_2 (wet)	9.12	0.06	8.56	8.54	**9.10**	wet

Moisture	10.02	**Standard CFH**	5,495,063
Fuel Factor C	1839	K Standard CFM	91.584
DSCFM	82411		

Results

Start Time	**9:06 AM**
Stop Time	**9:13 AM**
Standard CFH	**5,495,000**
CO_2 %, wet	**9.10**
WAF applied	**0.9900**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

8/7/2012
Test 1H Run 5
High Load (190 Klbs/Hr)

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.048	0.219	252	9:14 AM
2	A-2	0.054	0.232	252	
3	A-3	0.051	0.226	252	
4	A-4	0.050	0.224	252	
5	B-1	0.049	0.221	250	
6	B-2	0.051	0.226	250	
7	B-3	0.064	0.253	250	
8	B-4	0.057	0.239	250	
9	C-1	0.057	0.239	254	
10	C-2	0.052	0.228	254	
11	C-3	0.061	0.247	254	
12	C-4	0.049	0.221	254	
13	D-1	0.040	0.200	255	
14	D-2	0.039	0.197	255	
15	D-3	0.036	0.190	255	
16	D-4	0.030	0.173	255	9:20 AM
Average		0.049	0.221	253	

Moisture Content Data	
Dry Bulb (°F)	252
Wet Bulb (°F)	127.0
TRA	1.14
Vapor Pressure of Water	4.18
ZT	125.00
PM	284.52
Barometric Pressure	29.29
Standard Meter Volume	
Moisture Content	9.72
O_2 %	10.116
CO_2 %	10.116
Standard CFH	5,622,031
K Standard CFH	93.701

Flow Rate Data	
Static Pressure	-0.44
Pitot Coefficient	0.815
Duct Width (in.)	0
Duct Length (in.)	0
Duct Area (ft^2)	0
Stack Diameter (in.)	168
Stack Area (ft^2)	153.93804
Molecular Weight (dry)	30.023
Molecular Weight (wet)	28.854
Stack Pressure	29.258
Feet per Second	14.005
Actual CFM	129350.31
DSCFM	84588.37

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	10.19	0.06	11.10	11.03	**10.12**	dry
CO_2 (wet)	9.12	0.05	8.53	8.54	**9.13**	wet

Moisture	9.72	**Standard CFH**	**5,622,031**
Fuel Factor C	1839	K Standard CFM	93.701
DSCFM	84588		

Results

Start Time	**9:14 AM**
Stop Time	**9:20 AM**
Standard CFH	**5,622,000**
CO_2 %, wet	**9.13**
WAF applied	**0.9900**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

8/7/2012
Test 1H Run 6
High Load (190 Klbs/Hr)

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.047	0.217	255	9:21 AM
2	A-2	0.048	0.219	255	
3	A-3	0.053	0.230	255	
4	A-4	0.051	0.226	255	
5	B-1	0.058	0.241	256	
6	B-2	0.056	0.237	256	
7	B-3	0.062	0.249	256	
8	B-4	0.054	0.232	256	
9	C-1	0.053	0.230	256	
10	C-2	0.066	0.257	256	
11	C-3	0.067	0.259	256	
12	C-4	0.047	0.217	256	
13	D-1	0.039	0.197	257	
14	D-2	0.040	0.200	257	
15	D-3	0.041	0.202	257	
16	D-4	0.027	0.164	257	9:29 AM
Average		0.051	0.224	256	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	255		
Wet Bulb (°F)	127.0	Static Pressure	-0.44
TRA	1.14	Pitot Coefficient	0.815
Vapor Pressure of Water	4.18		
ZT	128.00	Duct Width (in.)	0.00
PM	281.33	Duct Length (in.)	0.00
Barometric Pressure	29.29	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	168.00
Standard Meter Volume		Stack Area (ft^2)	153.94
Moisture Content	9.62		
		Molecular Weight (dry)	30.021
O_2 %	10.116	Molecular Weight (wet)	28.865
CO_2 %	10.103	Stack Pressure	29.258
		Feet per Second	14.202
Standard CFH	5,675,499	Actual CFM	131175.91
K Standard CFH	94.592	DSCFM	85496.17

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration*	
O_2 (dry)	10.19	0.06	11.10	11.03	**10.12**	dry
CO_2 (wet)	9.12	0.05	8.53	8.54	**9.13**	wet

Moisture	9.62	**Standard CFH**	5,675,499
Fuel Factor C	1839	K Standard CFM	94.592
DSCFM	85496		

Results

Start Time	**9:21 AM**
Stop Time	**9:29 AM**
Standard CFH	**5,675,000**
CO_2 %, wet	**9.13**
WAF applied	**0.9900**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
8/7/2012
Run 4-6

Time	$\%O_2$, d	$\%\ CO_2$, w
9:06	9.641	9.677
9:07	9.548	9.803
9:08	9.563	9.786
9:09	9.634	9.786
9:10	9.689	9.692
9:11	9.882	9.519
9:12	9.956	9.421
9:13	9.996	9.393
9:14	10.11	9.421
9:15	10.12	9.238
9:16	10.17	9.095
9:17	10.31	8.97
9:18	10.45	8.877
9:19	10.53	8.808
9:20	10.63	8.677
9:21	10.61	8.645
9:22	10.65	8.612
9:23	10.55	8.709
9:24	10.47	8.709
9:25	10.42	8.781
9:26	10.37	8.799
9:27	10.32	8.824
9:28	10.4	8.794
9:29	10.43	8.788
Average	**10.185**	**9.118**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

8/7/2012
Test 1H Run 7
High Load (190 Klbs/Hr)

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.041	0.202	256	9:37 AM
2	A-2	0.050	0.224	256	
3	A-3	0.054	0.232	256	
4	A-4	0.051	0.226	256	
5	B-1	0.046	0.214	254	
6	B-2	0.062	0.249	254	
7	B-3	0.056	0.237	254	
8	B-4	0.052	0.228	254	
9	C-1	0.046	0.214	252	
10	C-2	0.063	0.251	252	
11	C-3	0.069	0.263	252	
12	C-4	0.049	0.221	252	
13	D-1	0.046	0.214	253	
14	D-2	0.038	0.195	253	
15	D-3	0.039	0.197	253	
16	D-4	0.040	0.200	253	9:45 AM
Average		0.050	0.223	254	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	256		
Wet Bulb (°F)	124.0	Static Pressure	-0.45
TRA	1.15	Pitot Coefficient	0.815
Vapor Pressure of Water	3.85		
ZT	132.00	Duct Width (in.)	0.00
PM	244.35	Duct Length (in.)	0.00
Barometric Pressure	29.29	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	168.00
Standard Meter Volume		Stack Area (ft^2)	153.94
Moisture Content	8.35		
		Molecular Weight (dry)	29.992
O_2 %	9.972	Molecular Weight (wet)	28.99
CO_2 %	9.957	Stack Pressure	29.257
		Feet per Second	14.114
Standard CFH	5,657,864	Actual CFM	130360.65
K Standard CFH	94.298	DSCFM	86422.08

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	10.05	0.07	11.11	11.0	**9.97**	dry
CO_2 (wet)	9.13	0.04	8.55	8.5	**9.13**	wet

Moisture	8.35	**Standard CFH**	5,657,864
Fuel Factor C	1839	K Standard CFM	94.298
DSCFM	86422		

Results

Start Time	**9:37 AM**
Stop Time	**9:45 AM**
Standard CFH	**5,658,000**
CO_2 %, wet	**9.13**
WAF applied	**0.9900**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

8/7/2012
Test 1H Run 8
High Load (190 Klbs/Hr)

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.051	0.226	252	9:46 AM
2	A-2	0.054	0.232	252	
3	A-3	0.056	0.237	252	
4	A-4	0.050	0.224	252	
5	B-1	0.046	0.214	252	
6	B-2	0.052	0.228	252	
7	B-3	0.061	0.247	252	
8	B-4	0.051	0.226	252	
9	C-1	0.053	0.230	250	
10	C-2	0.065	0.255	250	
11	C-3	0.064	0.253	250	
12	C-4	0.060	0.245	250	
13	D-1	0.045	0.212	251	
14	D-2	0.042	0.205	251	
15	D-3	0.047	0.217	251	
16	D-4	0.033	0.182	251	9:52 AM
Average		0.052	0.227	251	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	252		
Wet Bulb (°F)	124.0	Static Pressure	-0.44
TRA	1.15	Pitot Coefficient	0.815
Vapor Pressure of Water	3.85		
ZT	128.00	Duct Width (in.)	0.00
PM	248.61	Duct Length (in.)	0.00
Barometric Pressure	29.29	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	168.00
Standard Meter Volume		Stack Area (ft^2)	153.94
Moisture Content	8.50		
		Molecular Weight (dry)	29.99
O_2 %	9.962	Molecular Weight (wet)	28.971
CO_2 %	9.949	Stack Pressure	29.258
		Feet per Second	14.345
Standard CFH	5,770,687	Actual CFM	132491.13
K Standard CFH	96.178	DSCFM	88005.66

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	10.05	0.07	11.12	11.0	9.96	dry
CO_2 (wet)	9.13	0.02	8.57	8.5	9.10	wet

Moisture	8.50	Standard CFH	5,770,687
Fuel Factor C	1839	K Standard CFM	96.178
DSCFM	88006		

Results

Start Time	9:46 AM
Stop Time	9:52 AM
Standard CFH	5,771,000
CO_2 %, wet	9.10
WAF applied	0.9900

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

8/7/2012
Test 1H Run 9
High Load (190 Klbs/Hr)

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.043	0.207	253	9:53 AM
2	A-2	0.049	0.221	253	
3	A-3	0.055	0.235	253	
4	A-4	0.049	0.221	253	
5	B-1	0.048	0.219	251	
6	B-2	0.056	0.237	251	
7	B-3	0.066	0.257	251	
8	B-4	0.054	0.232	251	
9	C-1	0.057	0.239	252	
10	C-2	0.052	0.228	252	
11	C-3	0.067	0.259	252	
12	C-4	0.062	0.249	250	
13	D-1	0.041	0.202	250	
14	D-2	0.040	0.200	250	
15	D-3	0.040	0.200	250	
16	D-4	0.025	0.158	250	10:01 AM
Average		0.050	0.223	251	

Moisture Content Data		Flow Rate Data	
Dry Bulb (°F)	253		
Wet Bulb (°F)	124.0	Static Pressure	-0.45
TRA	1.15	Pitot Coefficient	0.815
Vapor Pressure of Water	3.85		
ZT	129.00	Duct Width (in.)	0.00
PM	247.55	Duct Length (in.)	0.00
Barometric Pressure	29.29	Duct Area (ft^2)	0.00
		Stack Diameter (in.)	168.00
Standard Meter Volume		Stack Area (ft^2)	153.94
Moisture Content	8.46		
		Molecular Weight (dry)	29.99
O_2 %	9.962	Molecular Weight (wet)	28.975
CO_2 %	9.945	Stack Pressure	29.257
		Feet per Second	14.078
Standard CFH	5,662,408	Actual CFM	130031.24
K Standard CFH	94.373	DSCFM	86388.41

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	10.05	0.07	11.12	11.0	**9.96**	dry
CO_2 (wet)	9.13	0.02	8.57	8.5	**9.10**	wet

Moisture	8.46	**Standard CFH**	5,662,408
Fuel Factor C	1839	K Standard CFM	94.373
DSCFM	86388		

Results

Start Time	**9:53 AM**
Stop Time	**10:01 AM**
Standard CFH	**5,662,000**
CO_2 %, wet	**9.10**
WAF applied	**0.9900**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
8/7/2012
Run 7-9

Time	$\%O_2$, d	$\%\ CO_2$, w
9:37	10.19	8.96
9:38	10.08	9.031
9:39	10.1	9.039
9:40	10.18	8.991
9:41	10.12	9.088
9:42	10.08	9.111
9:43	10.06	9.139
9:44	10.06	9.126
9:45	10.06	9.121
9:46	10.04	9.116
9:47	10.08	9.14
9:48	10.08	9.12
9:49	10.09	9.121
9:50	10.04	9.13
9:51	10.09	9.103
9:52	10.09	9.117
9:53	10.17	9.033
9:54	10.05	9.135
9:55	10.06	9.14
9:56	9.945	9.206
9:57	9.996	9.151
9:58	10.08	9.121
9:59	10.01	9.212
10:00	9.988	9.185
10:01	9.905	9.237
10:02	9.986	9.197
10:03	9.913	9.3
10:04	10.01	9.211
10:05	9.982	9.166
10:06	9.974	9.187
10:07	10.03	9.193
10:08	10.01	9.19
10:09	10.11	9.099
Average	**10.050**	**9.134**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack

8/7/2012
Test 1H Run 10
High Load (190 Klbs/Hr)

Volumetric Flow Rate Data

Number of Sample Points 16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.039	0.197	251	10:02 AM
2	A-2	0.049	0.221	251	
3	A-3	0.051	0.226	251	
4	A-4	0.049	0.221	251	
5	B-1	0.051	0.226	249	
6	B-2	0.051	0.226	249	
7	B-3	0.062	0.249	249	
8	B-4	0.048	0.219	249	
9	C-1	0.052	0.228	247	
10	C-2	0.054	0.232	247	
11	C-3	0.063	0.251	247	
12	C-4	0.052	0.228	247	
13	D-1	0.043	0.207	250	
14	D-2	0.041	0.202	250	
15	D-3	0.039	0.197	250	
16	D-4	0.039	0.197	250	10:09 AM
Average		0.049	0.221	249	

Moisture Content Data	
Dry Bulb (°F)	251
Wet Bulb (°F)	124.0
TRA	1.15
Vapor Pressure of Water	3.85
ZT	127.00
PM	249.67
Barometric Pressure	29.29
Standard Meter Volume	
Moisture Content	8.53
O_2 %	9.962
CO_2 %	9.952
Standard CFH	5,616,339
K Standard CFH	93.606

Flow Rate Data	
Static Pressure	-0.44
Pitot Coefficient	0.815
Duct Width (in.)	0.00
Duct Length (in.)	0.00
Duct Area (ft^2)	0.00
Stack Diameter (in.)	168.00
Stack Area (ft^2)	153.94
Molecular Weight (dry)	29.991
Molecular Weight (wet)	28.968
Stack Pressure	29.258
Feet per Second	13.922
Actual CFM	128584.82
DSCFM	85617.71

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration	
O_2 (dry)	10.05	0.07	11.12	11.0	**9.96**	dry
CO_2 (wet)	9.13	0.02	8.57	8.5	**9.10**	wet

Moisture	8.53	**Standard CFH**	5,616,339
Fuel Factor C	1839	K Standard CFM	93.606
DSCFM	85618		

Results

Start Time	**10:02 AM**
Stop Time	**10:09 AM**
Standard CFH	**5,616,000**
CO_2 %, wet	**9.10**
WAF applied	**0.9900**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
8/7/2012
Run 10-12

Time	$\%O_2$, d	$\% CO_2$, w
9:37	10.19	8.96
9:38	10.08	9.031
9:39	10.1	9.039
9:40	10.18	8.991
9:41	10.12	9.088
9:42	10.08	9.111
9:43	10.06	9.139
9:44	10.06	9.126
9:45	10.06	9.121
9:46	10.04	9.116
9:47	10.08	9.14
9:48	10.08	9.12
9:49	10.09	9.121
9:50	10.04	9.13
9:51	10.09	9.103
9:52	10.09	9.117
9:53	10.17	9.033
9:54	10.05	9.135
9:55	10.06	9.14
9:56	9.945	9.206
9:57	9.996	9.151
9:58	10.08	9.121
9:59	10.01	9.212
10:00	9.988	9.185
10:01	9.905	9.237
10:02	9.986	9.197
10:03	9.913	9.3
10:04	10.01	9.211
10:05	9.982	9.166
10:06	9.974	9.187
10:07	10.03	9.193
10:08	10.01	9.19
10:09	10.11	9.099
Average	**10.050**	**9.134**

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	1L	Run 1	Date	8/6/2012
Stack Diameter (in.)	168			
Dry Bulb (°F)	184	Wet Bulb (°F)	106	
Moisture Content (%)	5.02			
Monometer	Normal			
Barometric Pressure	29.31			
Static Pressure +/-	-0.35			
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:	11:10 PM
A-1	0.032	5.38	19.38	0.017	184
A-2	0.105	17.64	31.64	0.010	184
A-3	0.194	32.59	46.59	0.011	184
A-4	0.323	54.26	68.26	0.017	184
B-1				0.022	182
B-2				0.023	186
B-3				0.024	186
B-4				0.014	186
C-1				0.026	185
C-2				0.023	185
C-3				0.026	185
C-4				0.012	185
D-1				0.018	186
D-2				0.010	186
D-3				0.010	186
D-4				0.010	186
Digital Numbers Used:		85 / 138		End Time:	11:20 PM

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

Job	MSI / Manitowoc PU
Source	S20 Boiler Stack
Test	1L Run 2 Date 8/6/2012
Stack Diameter (in.)	168
Dry Bulb (°F)	191 Wet Bulb (°F) 107
Moisture Content (%)	5.09
Monometer	Normal
Barometric Pressure	29.31
Static Pressure +/-	-0.37
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:	11:40 PM
A-1	0.032	5.38	19.38	0.013	191
A-2	0.105	17.64	31.64	0.012	191
A-3	0.194	32.59	46.59	0.010	191
A-4	0.323	54.26	68.26	0.010	191
B-1				0.026	192
B-2				0.030	192
B-3				0.022	192
B-4				0.011	192
C-1				0.025	189
C-2				0.028	189
C-3				0.022	189
C-4				0.015	189
D-1				0.012	190
D-2				0.013	190
D-3				0.010	190
D-4				0.010	190
Digital Numbers Used:		85 / 138		End Time:	11:50 PM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU			
Source	S20 Boiler Stack			
Test	1L	Run 3	Date	8/7/2012
Stack Diameter (in.)	168			
Dry Bulb (°F)	191	Wet Bulb (°F)	105	
Moisture Content (%)	4.53			
Monometer	Normal			
Barometric Pressure	29.31			
Static Pressure +/-	-0.35			
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:	12:10 AM
A-1	0.032	5.38	19.38	0.018	191
A-2	0.105	17.64	31.64	0.019	191
A-3	0.194	32.59	46.59	0.014	191
A-4	0.323	54.26	68.26	0.012	191
B-1				0.027	190
B-2				0.028	190
B-3				0.025	190
B-4				0.018	190
C-1				0.026	190
C-2				0.027	191
C-3				0.020	191
C-4				0.019	191
D-1				0.014	192
D-2				0.011	192
D-3				0.010	192
D-4				0.010	192
Digital Numbers Used:		85 / 138		End Time:	12:20 AM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU			
Source	S20 Boiler Stack			
Test	1L	Run 4	Date	8/7/2012
Stack Diameter (in.)	168			
Dry Bulb (°F)	189	Wet Bulb (°F)	105	
Moisture Content (%)	4.55			
Monometer	Normal			
Barometric Pressure	29.31			
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:	12:40 AM
A-1	0.032	5.38	19.38	0.017	189
A-2	0.105	17.64	31.64	0.013	189
A-3	0.194	32.59	46.59	0.013	189
A-4	0.323	54.26	68.26	0.012	189
B-1				0.022	192
B-2				0.028	192
B-3				0.030	192
B-4				0.021	192
C-1				0.022	190
C-2				0.027	190
C-3				0.024	190
C-4				0.012	190
D-1				0.016	191
D-2				0.012	191
D-3				0.010	191
D-4				0.010	191
Digital Numbers Used:		85 / 138		End Time:	12:50 AM

Interpoll Laboratories
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EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	1L	Run 5	Date	8/7/2012	
Stack Diameter (in.)	168				
Dry Bulb (°F)	191	Wet Bulb (°F)	105		
Moisture Content (%)	4.55				
Monometer	Normal				
Barometric Pressure	29.31				
Static Pressure +/-	-0.37				
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:	1:10 AM
A-1	0.032	5.38	19.38	0.012	191
A-2	0.105	17.64	31.64	0.011	191
A-3	0.194	32.59	46.59	0.011	191
A-4	0.323	54.26	68.26	0.011	191
B-1				0.028	192
B-2				0.029	192
B-3				0.026	192
B-4				0.012	192
C-1				0.022	189
C-2				0.030	189
C-3				0.025	189
C-4				0.024	189
D-1				0.017	190
D-2				0.010	190
D-3				0.010	190
D-4				0.010	190
Digital Numbers Used:		85 / 138		End Time:	1:20 AM

Interpoll Laboratories
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EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU
Source	S20 Boiler Stack
Test	1L Run 6 Date 8/7/2012
Stack Diameter (in.)	168
Dry Bulb (°F)	189 Wet Bulb (°F) 107
Moisture Content (%)	5.11
Monometer	Normal
Barometric Pressure	29.31
Static Pressure +/-	-0.38
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:	1:40 AM
A-1	0.032	5.38	19.38	0.018	189
A-2	0.105	17.64	31.64	0.011	189
A-3	0.194	32.59	46.59	0.012	189
A-4	0.323	54.26	68.26	0.010	189
B-1				0.028	190
B-2				0.028	190
B-3				0.028	190
B-4				0.018	190
C-1				0.031	191
C-2				0.029	191
C-3				0.033	191
C-4				0.025	191
D-1				0.015	190
D-2				0.016	190
D-3				0.010	190
D-4				0.010	190
Digital Numbers Used:		85 / 138		End Time:	1:50 AM

Interpoll Laboratories
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EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU
Source	S20 Boiler Stack
Test	1L Run 7 Date 8/7/2012
Stack Diameter (in.)	168
Dry Bulb (°F)	191 Wet Bulb (°F) 105
Moisture Content (%)	4.53
Monometer	Normal
Barometric Pressure	29.31
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:	2:10 AM
A-1	0.032	5.38	19.38	0.016	191
A-2	0.105	17.64	31.64	0.014	191
A-3	0.194	32.59	46.59	0.011	191
A-4	0.323	54.26	68.26	0.010	191
B-1				0.028	192
B-2				0.029	192
B-3				0.025	192
B-4				0.018	192
C-1				0.027	192
C-2				0.019	192
C-3				0.022	192
C-4				0.020	192
D-1				0.013	189
D-2				0.013	189
D-3				0.010	189
D-4				0.010	189
Digital Numbers Used:		85 / 138		End Time:	2:20 AM

Interpoll Laboratories
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EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU
Source	S20 Boiler Stack
Test	1L Run 8 Date 8/7/2012
Stack Diameter (in.)	168
Dry Bulb (°F)	186 Wet Bulb (°F) 107
Moisture Content (%)	5.13
Monometer	Normal
Barometric Pressure	29.31
Static Pressure +/-	-0.37
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:	2:40 AM
A-1	0.032	5.38	19.38	0.020	186
A-2	0.105	17.64	31.64	0.011	186
A-3	0.194	32.59	46.59	0.012	186
A-4	0.323	54.26	68.26	0.010	186
B-1				0.022	190
B-2				0.027	190
B-3				0.027	190
B-4				0.015	190
C-1				0.026	191
C-2				0.027	191
C-3				0.029	191
C-4				0.021	191
D-1				0.016	190
D-2				0.011	190
D-3				0.010	190
D-4				0.012	190
Digital Numbers Used:		85 / 138		End Time:	2:50 AM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU
Source	S20 Boiler Stack
Test	1L Run 9 Date 8/7/2012
Stack Diameter (in.)	168
Dry Bulb (°F)	192 Wet Bulb (°F) 104
Moisture Content (%)	4.25
Monometer	Normal
Barometric Pressure	29.31
Static Pressure +/-	-0.37
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:	3:10 AM
A-1	0.032	5.38	19.38	0.018	192
A-2	0.105	17.64	31.64	0.013	192
A-3	0.194	32.59	46.59	0.010	192
A-4	0.323	54.26	68.26	0.010	192
B-1				0.028	193
B-2				0.027	193
B-3				0.027	193
B-4				0.016	193
C-1				0.028	191
C-2				0.028	191
C-3				0.027	191
C-4				0.021	191
D-1				0.012	191
D-2				0.011	191
D-3				0.010	191
D-4				0.010	191
Digital Numbers Used:		85 / 138		End Time:	3:20 AM

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EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU
Source	S20 Boiler Stack
Test	1L Run 10 Date 8/7/2012
Stack Diameter (in.)	168
Dry Bulb (°F)	189 Wet Bulb (°F) 105
Moisture Content (%)	4.55
Monometer	Normal
Barometric Pressure	29.31
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:	3:40 AM
A-1	0.032	5.38	19.38	0.015	189
A-2	0.105	17.64	31.64	0.016	189
A-3	0.194	32.59	46.59	0.014	189
A-4	0.323	54.26	68.26	0.010	189
B-1				0.022	191
B-2				0.027	191
B-3				0.027	191
B-4				0.017	191
C-1				0.026	192
C-2				0.028	192
C-3				0.023	192
C-4				0.020	192
D-1				0.015	190
D-2				0.011	190
D-3				0.011	190
D-4				0.010	190
Digital Numbers Used:		85 / 138		End Time:	3:50 AM

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

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	1M	Run 1	Date	8/7/2012	
Stack Diameter (in.)	168				
Dry Bulb (°F)	214	Wet Bulb (°F)	108		
Moisture Content (%)	4.51				
Monometer	Expanded				
Barometric Pressure	29.29				
Static Pressure +/-	-0.39				
Operators	Rory Eiynck / Andrew Strong				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150		

Cross-section View	Elevation View

Mid Load (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:	5:17 AM
A-1	0.032	5.38	19.38	0.022	214
A-2	0.105	17.64	31.64	0.028	214
A-3	0.194	32.59	46.59	0.027	214
A-4	0.323	54.26	68.26	0.018	214
B-1				0.037	211
B-2				0.040	211
B-3				0.038	211
B-4				0.036	211
C-1				0.029	213
C-2				0.038	213
C-3				0.027	213
C-4				0.038	213
D-1				0.017	214
D-2				0.017	214
D-3				0.013	214
D-4				0.013	214
Digital Numbers Used:		85 / 138		End Time:	5:25 AM

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

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	1M	Run 2	Date	8/7/2012	
Stack Diameter (in.)	168				
Dry Bulb (°F)	212	Wet Bulb (°F)	115		
Moisture Content (%)	6.71				
Monometer	Expanded				
Barometric Pressure	29.29				
Static Pressure +/-	-0.39				
Operators	Rory Elynck / Andrew Strong				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150		

Cross-section	Elevation
View	View

Mid Load (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:	5:26 AM
A-1	0.032	5.38	19.38	0.022	212
A-2	0.105	17.64	31.64	0.028	212
A-3	0.194	32.59	46.59	0.029	212
A-4	0.323	54.26	68.26	0.015	212
B-1				0.035	211
B-2				0.038	211
B-3				0.042	211
B-4				0.033	211
C-1				0.029	212
C-2				0.040	212
C-3				0.039	212
C-4				0.038	212
D-1				0.018	213
D-2				0.015	213
D-3				0.013	213
D-4				0.011	213
Digital Numbers Used:		85 / 138		End Time:	5:32 AM

Interpoil Laboratories
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EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU			
Source	S20 Boiler Stack			
Test	1M	Run 3	Date	8/7/2012
Stack Diameter (in.)	168			
Dry Bulb (°F)	211	Wet Bulb (°F)	115	
Moisture Content (%)	6.75			
Monometer	Expanded			
Barometric Pressure	29.29			
Static Pressure +/-	-0.40			
Operators	Rory Eiynck / Andrew Strong			
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150	

Cross-section View	Elevation View

Mid Load (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:	5:33 AM
A-1	0.032	5.38	19.38	0.020	211
A-2	0.105	17.64	31.64	0.028	211
A-3	0.194	32.59	46.59	0.027	211
A-4	0.323	54.26	68.26	0.018	211
B-1				0.032	211
B-2				0.042	211
B-3				0.045	211
B-4				0.034	211
C-1				0.032	213
C-2				0.037	213
C-3				0.043	213
C-4				0.040	213
D-1				0.016	214
D-2				0.011	214
D-3				0.010	214
D-4				0.010	214
Digital Numbers Used:		85 / 138		End Time:	5:42 AM

Interpoll Laboratories
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EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU
Source	S20 Boiler Stack
Test	1M Run 4 Date 8/7/2012
Stack Diameter (in.)	168
Dry Bulb (°F)	213 Wet Bulb (°F) 114
Moisture Content (%)	6.35
Monometer	Expanded
Barometric Pressure	29.29
Static Pressure +/-	-0.39
Operators	Rory Eiynck / Andrew Strong
Pitot No.	04-5+-P1 Pitot Coeff. 0.8150

Cross-section View	Elevation View

Mid Load (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:	6:00 AM
A-1	0.032	5.38	19.38	0.018	213
A-2	0.105	17.64	31.64	0.025	213
A-3	0.194	32.59	46.59	0.027	213
A-4	0.323	54.26	68.26	0.019	213
B-1				0.028	214
B-2				0.041	214
B-3				0.040	214
B-4				0.033	214
C-1				0.038	215
C-2				0.033	215
C-3				0.044	215
C-4				0.038	215
D-1				0.018	213
D-2				0.016	213
D-3				0.010	213
D-4				0.010	213
Digital Numbers Used:		85 / 138		End Time:	6:07 AM

Interpoll Laboratories
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EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	1M	Run 5	Date	8/7/2012	
Stack Diameter (in.)	168				
Dry Bulb (°F)	214	Wet Bulb (°F)	114		
Moisture Content (%)	6.31				
Monometer	Expanded				
Barometric Pressure	29.29				
Static Pressure +/-	-0.39				
Operators	Rory Eiynck / Andrew Strong				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150		

Cross-section View	Elevation View

Mid Load (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:	6:08 AM
A-1	0.032	5.38	19.38	0.020	214
A-2	0.105	17.64	31.64	0.026	214
A-3	0.194	32.59	46.59	0.023	214
A-4	0.323	54.26	68.26	0.020	214
B-1				0.030	215
B-2				0.032	215
B-3				0.044	215
B-4				0.028	215
C-1				0.030	215
C-2				0.037	215
C-3				0.042	215
C-4				0.040	215
D-1				0.015	213
D-2				0.010	213
D-3				0.010	213
D-4				0.010	213
Digital Numbers Used:		85 / 138		End Time:	6:15 AM

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EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	1M	Run 6	Date	8/7/2012	
Stack Diameter (in.)	168				
Dry Bulb (°F)	216	Wet Bulb (°F)	114		
Moisture Content (%)	6.24				
Monometer	Expanded				
Barometric Pressure	29.29				
Static Pressure +/-	-0.39				
Operators	Rory Eiynck / Andrew Strong				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150		

Cross-section View	Elevation View

Mid Load (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:	6:16 AM
A-1	0.032	5.38	19.38	0.020	216
A-2	0.105	17.64	31.64	0.026	216
A-3	0.194	32.59	46.59	0.028	216
A-4	0.323	54.26	68.26	0.022	216
B-1				0.030	217
B-2				0.036	217
B-3				0.039	217
B-4				0.028	217
C-1				0.027	215
C-2				0.041	215
C-3				0.039	215
C-4				0.041	215
D-1				0.021	216
D-2				0.016	216
D-3				0.013	216
D-4				0.010	216
Digital Numbers Used:		85 / 138		End Time:	6:23 AM

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EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	1M	Run 7	Date	8/7/2012	Cross-section View / Elevation View
Stack Diameter (in.)	168				
Dry Bulb (°F)	217	Wet Bulb (°F)	114		
Moisture Content (%)	6.20				
Monometer	Expanded				
Barometric Pressure	29.29				
Static Pressure +/-	-0.38				
Operators	Rory Eiynck / Andrew Strong				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150		

Mid Load (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:	6:24 AM
A-1	0.032	5.38	19.38	0.021	217
A-2	0.105	17.64	31.64	0.026	217
A-3	0.194	32.59	46.59	0.028	217
A-4	0.323	54.26	68.26	0.020	217
B-1				0.030	217
B-2				0.043	217
B-3				0.040	217
B-4				0.028	217
C-1				0.033	218
C-2				0.047	218
C-3				0.048	218
C-4				0.038	218
D-1				0.015	217
D-2				0.012	217
D-3				0.010	217
D-4				0.010	217
Digital Numbers Used:		85 / 138		End Time:	6:31 AM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	1M	Run 8	Date	8/7/2012	
Stack Diameter (in.)	168				
Dry Bulb (°F)	218	Wet Bulb (°F)	114		
Moisture Content (%)	6.17				
Monometer	Expanded				
Barometric Pressure	29.29				
Static Pressure +/-	-0.39				
Operators	Rory Elynck / Andrew Strong				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150		

Cross-section View	Elevation View

Mid Load (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:	6:32 AM
A-1	0.032	5.38	19.38	0.018	218
A-2	0.105	17.64	31.64	0.020	218
A-3	0.194	32.59	46.59	0.025	218
A-4	0.323	54.26	68.26	0.018	218
B-1				0.032	219
B-2				0.036	219
B-3				0.041	219
B-4				0.038	219
C-1				0.028	218
C-2				0.039	218
C-3				0.043	218
C-4				0.038	218
D-1				0.016	220
D-2				0.016	220
D-3				0.011	220
D-4				0.010	220
Digital Numbers Used:		85 / 138		End Time:	6:40 AM

MPU01058

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	1M	Run 9	Date	8/7/2012	
Stack Diameter (in.)	168				
Dry Bulb (°F)	218	Wet Bulb (°F)	114		
Moisture Content (%)	6.17				
Monometer	Expanded				
Barometric Pressure	29.29				
Static Pressure +/-	-0.39				
Operators	Rory Eiynck / Andrew Strong				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150		

Cross-section View	Elevation View

Mid Load (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:	6:41 AM
A-1	0.032	5.38	19.38	0.022	218
A-2	0.105	17.64	31.64	0.021	218
A-3	0.194	32.59	46.59	0.027	218
A-4	0.323	54.26	68.26	0.017	218
B-1				0.030	220
B-2				0.036	220
B-3				0.038	220
B-4				0.032	220
C-1				0.030	219
C-2				0.036	219
C-3				0.038	219
C-4				0.035	219
D-1				0.015	219
D-2				0.010	219
D-3				0.010	219
D-4				0.010	219
Digital Numbers Used:		85 / 138		End Time:	6:48 AM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	1M	Run 10	Date	8/7/2012	
Stack Diameter (in.)	168				
Dry Bulb (°F)	219	Wet Bulb (°F)	114		
Moisture Content (%)	6.13				
Monometer	Expanded				
Barometric Pressure	29.29				
Static Pressure +/-	-0.39				
Operators	Rory Eiynck / Andrew Strong				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150		

Cross-section View	Elevation View

Mid Load (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:	6:49 AM
A-1	0.032	5.38	19.38	0.023	219
A-2	0.105	17.64	31.64	0.024	219
A-3	0.194	32.59	46.59	0.023	219
A-4	0.323	54.26	68.26	0.020	219
B-1				0.030	220
B-2				0.040	220
B-3				0.043	220
B-4				0.039	220
C-1				0.028	220
C-2				0.037	220
C-3				0.038	220
C-4				0.038	220
D-1				0.020	219
D-2				0.016	219
D-3				0.011	219
D-4				0.010	219
Digital Numbers Used:		85 / 138		End Time:	6:56 AM

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

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	1H	Run	1	Date	8/7/2012
Stack Diameter (in.)	168				
Dry Bulb (°F)	248	Wet Bulb (°F)	121		
Moisture Content (%)	7.49				
Monometer	Expanded				
Barometric Pressure	29.29				
Static Pressure +/-	-0.44				
Operators	Rory Eiynck / Andrew Strong				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150		

Cross-section View	Elevation View

High Load (190 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:	8:02 AM
A-1	0.032	5.38	19.38	0.040	248
A-2	0.105	17.64	31.64	0.045	248
A-3	0.194	32.59	46.59	0.050	248
A-4	0.323	54.26	68.26	0.045	248
B-1				0.041	249
B-2				0.051	249
B-3				0.059	249
B-4				0.048	249
C-1				0.050	251
C-2				0.053	251
C-3				0.062	251
C-4				0.050	251
D-1				0.035	252
D-2				0.030	252
D-3				0.034	252
D-4				0.020	252
Digital Numbers Used:		85 / 138		End Time:	8:09 AM

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

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	1H	Run 2	Date	8/7/2012	
Stack Diameter (in.)	168				
Dry Bulb (°F)	251	Wet Bulb (°F)	121		
Moisture Content (%)	7.38				
Monometer	Expanded				
Barometric Pressure	29.29				
Static Pressure +/-	-0.43				
Operators	Rory Eiynck / Andrew Strong				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150		

Cross-section View	Elevation View

High Load (190 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:	8:10 AM
A-1	0.032	5.38	19.38	0.037	251
A-2	0.105	17.64	31.64	0.049	251
A-3	0.194	32.59	46.59	0.044	251
A-4	0.323	54.26	68.26	0.040	251
B-1				0.040	253
B-2				0.052	253
B-3				0.060	253
B-4				0.048	253
C-1				0.046	252
C-2				0.059	252
C-3				0.060	252
C-4				0.044	252
D-1				0.040	253
D-2				0.030	253
D-3				0.033	253
D-4				0.021	253
Digital Numbers Used:		85 / 138		End Time:	8:16 AM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	1H	Run 3	Date	8/7/2012	
Stack Diameter (in.)	168				
Dry Bulb (°F)	252	Wet Bulb (°F)	121		
Moisture Content (%)	7.35				
Monometer	Expanded				
Barometric Pressure	29.29				
Static Pressure +/-	-0.43				
Operators	Rory Eiynck / Andrew Strong				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150		

Cross-section View	Elevation View

High Load (190 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:	8:17 AM
A-1	0.032	5.38	19.38	0.041	252
A-2	0.105	17.64	31.64	0.049	252
A-3	0.194	32.59	46.59	0.050	252
A-4	0.323	54.26	68.26	0.042	252
B-1				0.038	251
B-2				0.051	251
B-3				0.062	251
B-4				0.049	251
C-1				0.050	251
C-2				0.056	251
C-3				0.058	251
C-4				0.049	251
D-1				0.038	253
D-2				0.037	253
D-3				0.035	253
D-4				0.021	253
Digital Numbers Used:		85 / 138		End Time:	8:24 AM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	1H	Run 4	Date	8/7/2012	
Stack Diameter (in.)	168				
Dry Bulb (°F)	244	Wet Bulb (°F)	127		
Moisture Content (%)	10.02				
Monometer	Expanded				
Barometric Pressure	29.29				
Static Pressure +/-	-0.44				
Operators	Rory Eiynck / Andrew Strong				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150		

Cross-section View	Elevation View

High Load (190 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:	9:06 AM
A-1	0.032	5.38	19.38	0.042	244
A-2	0.105	17.64	31.64	0.046	244
A-3	0.194	32.59	46.59	0.052	244
A-4	0.323	54.26	68.26	0.049	244
B-1				0.040	246
B-2				0.053	246
B-3				0.051	246
B-4				0.049	246
C-1				0.048	247
C-2				0.059	247
C-3				0.061	247
C-4				0.058	247
D-1				0.042	249
D-2				0.040	249
D-3				0.037	249
D-4				0.021	249
Digital Numbers Used:		85 / 138		End Time:	9:13 AM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	1H	Run	5	Date	8/7/2012
Stack Diameter (in.)	168				
Dry Bulb (°F)	252	Wet Bulb (°F)	127		
Moisture Content (%)	9.72				
Monometer	Expanded				
Barometric Pressure	29.29				
Static Pressure +/-	-0.44				
Operators	Rory Eiynck / Andrew Strong				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150		

Cross-section View	Elevation View

High Load (190 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:	9:14 AM
A-1	0.032	5.38	19.38	0.048	252
A-2	0.105	17.64	31.64	0.054	252
A-3	0.194	32.59	46.59	0.051	252
A-4	0.323	54.26	68.26	0.050	252
B-1				0.049	250
B-2				0.051	250
B-3				0.064	250
B-4				0.057	250
C-1				0.057	254
C-2				0.052	254
C-3				0.061	254
C-4				0.049	254
D-1				0.040	255
D-2				0.039	255
D-3				0.036	255
D-4				0.030	255
Digital Numbers Used:		85 / 138		End Time:	9:20 AM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	1H	Run 6	Date	8/7/2012	
Stack Diameter (in.)	168				
Dry Bulb (°F)	255	Wet Bulb (°F)	127		
Moisture Content (%)	9.62				
Monometer	Expanded				
Barometric Pressure	29.29				
Static Pressure +/-	-0.44				
Operators	Rory Eiynck / Andrew Strong				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150		

Cross-section View	Elevation View

High Load (190 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:	9:21 AM
A-1	0.032	5.38	19.38	0.047	255
A-2	0.105	17.64	31.64	0.048	255
A-3	0.194	32.59	46.59	0.053	255
A-4	0.323	54.26	68.26	0.051	255
B-1				0.058	256
B-2				0.056	256
B-3				0.062	256
B-4				0.054	256
C-1				0.053	256
C-2				0.066	256
C-3				0.067	256
C-4				0.047	256
D-1				0.039	257
D-2				0.040	257
D-3				0.041	257
D-4				0.027	257
Digital Numbers Used:		85 / 138		End Time:	9:29 AM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	1H	Run 7	Date	8/7/2012	
Stack Diameter (in.)	168				
Dry Bulb (°F)	256	Wet Bulb (°F)	124		
Moisture Content (%)	8.35				
Monometer	Expanded				
Barometric Pressure	29.29				
Static Pressure +/-	-0.45				
Operators	Rory Eiynck / Andrew Strong				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150		

Cross-section View	Elevation View

High Load (190 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:	9:37 AM
A-1	0.032	5.38	19.38	0.041	256
A-2	0.105	17.64	31.64	0.050	256
A-3	0.194	32.59	46.59	0.054	256
A-4	0.323	54.26	68.26	0.051	256
B-1				0.046	254
B-2				0.062	254
B-3				0.056	254
B-4				0.052	254
C-1				0.046	252
C-2				0.063	252
C-3				0.069	252
C-4				0.049	252
D-1				0.046	253
D-2				0.038	253
D-3				0.039	253
D-4				0.040	253
Digital Numbers Used:		85 / 138		End Time:	9:45 AM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	1H	Run 8	Date	8/7/2012	
Stack Diameter (in.)	168				
Dry Bulb (°F)	252	Wet Bulb (°F)	124		
Moisture Content (%)	8.50				
Monometer	Expanded				
Barometric Pressure	29.29				
Static Pressure +/-	-0.44				
Operators	Rory Elynck / Andrew Strong				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150		

Cross-section View	Elevation View

High Load (190 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:	9:46 AM
A-1	0.032	5.38	19.38	0.051	252
A-2	0.105	17.64	31.64	0.054	252
A-3	0.194	32.59	46.59	0.056	252
A-4	0.323	54.26	68.26	0.050	252
B-1				0.046	252
B-2				0.052	252
B-3				0.061	252
B-4				0.051	252
C-1				0.053	250
C-2				0.065	250
C-3				0.064	250
C-4				0.060	250
D-1				0.045	251
D-2				0.042	251
D-3				0.047	251
D-4				0.033	251
Digital Numbers Used:		85 / 138		End Time:	9:52 AM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	1H	Run 9	Date	8/7/2012	
Stack Diameter (in.)	168				
Dry Bulb (°F)	253		Wet Bulb (°F)	124	
Moisture Content (%)	8.46				
Monometer	Expanded				
Barometric Pressure	29.29				
Static Pressure +/-	-0.45				
Operators	Rory Eiynck / Andrew Strong				
Pitot No.	04-5+-P1		Pitot Coeff.	0.8150	

Cross-section View	Elevation View

High Load (190 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:	9:53 AM
A-1	0.032	5.38	19.38	0.043	253
A-2	0.105	17.64	31.64	0.049	253
A-3	0.194	32.59	46.59	0.055	253
A-4	0.323	54.26	68.26	0.049	253
B-1				0.048	251
B-2				0.056	251
B-3				0.066	251
B-4				0.054	251
C-1				0.057	252
C-2				0.052	252
C-3				0.067	252
C-4				0.062	250
D-1				0.041	250
D-2				0.040	250
D-3				0.040	250
D-4				0.025	250
Digital Numbers Used:		85 / 138		End Time:	10:01 AM

Interpoll Laboratories
(763) 786-6020

EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	S20 Boiler Stack				
Test	1H	Run 10	Date	8/7/2012	
Stack Diameter (in.)	168				
Dry Bulb (°F)	251	Wet Bulb (°F)	124		
Moisture Content (%)	8.53				
Monometer	Expanded				
Barometric Pressure	29.29				
Static Pressure +/-	-0.44				
Operators	Rory Eiynck / Andrew Strong				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150		

Cross-section View	Elevation View

High Load (190 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:	10:02 AM
A-1	0.032	5.38	19.38	0.039	251
A-2	0.105	17.64	31.64	0.049	251
A-3	0.194	32.59	46.59	0.051	251
A-4	0.323	54.26	68.26	0.049	251
B-1				0.051	249
B-2				0.051	249
B-3				0.062	249
B-4				0.048	249
C-1				0.052	247
C-2				0.054	247
C-3				0.063	247
C-4				0.052	247
D-1				0.043	250
D-2				0.041	250
D-3				0.039	250
D-4				0.039	250
Digital Numbers Used:		85 / 138		End Time:	10:09 AM

APPENDIX D

MEASUREMENT SYSTEM PERFORMANCE SPECIFICATIONS

Calibration Error

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
8/6-7/2012
Test 1L

SO_2(TEI Model 43i)

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	% of Span
Zero	0.00	0.37	0.37	251.00	0.15
Mid Level	117.80	117.70	0.10	251.00	0.04
High Level	251.00	250.90	0.10	251.00	0.04

NOx (TEI Model 42i)

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	% of Span
Zero	0.00	0.06	0.06	251.00	0.02
Mid Level	113.70	113.50	0.20	251.00	0.08
High Level	251.00	249.60	1.40	251.00	0.56

CO_2 (TEI Model 410i)

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (%)	% of Span
Zero	0.00	0.01	0.01	17.00	0.06
Mid Level	8.54	8.56	0.02	17.00	0.12
High Level	17.00	17.26	0.26	17.00	1.53

O_2 (Servomex Series 1400)

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (%)	% of Span
Zero	0.00	0.04	0.04	21.20	0.19
Mid Level	11.03	11.08	0.05	21.20	0.24
High Level	21.20	21.20	0.00	21.20	0.00

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

Calibration Drift

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
8/6-7/2012
Test 1L

O_2

		Initial	Pre-Cal Bias	Final	Post-cal Bias	Avg.	% Drift of Span
1	Zero	0.04	0.00%	0.06	0.09%	0.05	0.09%
	Upscale	11.08	0.00%	11.07	-0.05%	11.08	-0.05%
2	Zero	0.06	0.09%	0.06	0.09%	0.06	0.00%
	Upscale	11.07	-0.05%	11.12	0.19%	11.10	0.24%
3	Zero	0.06	0.09%	0.07	0.14%	0.07	0.05%
	Upscale	11.12	0.19%	11.15	0.33%	11.14	0.14%
4	Zero	0.07	0.14%	0.07	0.14%	0.07	0.00%
	Upscale	11.15	0.33%	11.19	0.52%	11.17	0.19%
5	Zero	0.07	0.14%	0.06	0.09%	0.07	-0.05%
	Upscale	11.19	0.52%	11.09	0.05%	11.14	-0.47%
6	Zero	0.06	0.09%	0.07	0.14%	0.07	0.05%
	Upscale	11.09	0.05%	11.06	-0.09%	11.08	-0.14%
7	Zero	0.07	0.14%	0.06	0.09%	0.07	-0.05%
	Upscale	11.06	-0.09%	11.07	-0.05%	11.07	0.05%
8	Zero	0.06	0.09%	0.07	0.14%	0.07	0.05%
	Upscale	11.07	-0.05%	11.06	-0.09%	11.07	-0.05%
9	Zero	0.07	0.14%	0.07	0.14%	0.07	0.00%
	Upscale	11.06	-0.09%	11.08	0.00%	11.07	0.09%
10	Zero	0.07	0.14%	0.06	0.09%	0.07	-0.05%
	Upscale	11.08	0.00%	11.07	-0.05%	11.08	-0.05%

	Cylinder Value	Analyzer Value
Zero	0.00 %	0.04 %
Upscale	11.03 %	11.08 %
Span	21.20 %	21.20 %

** 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
8/6-7/2012
Test 1L

CO_2

		Initial	Pre-Cal Bias	Final	Post-Cal Bias	Avg.	% Drift of Span
1	Zero	0.01	0.00%	0.03	0.12%	0.02	0.12%
	Upscale	8.56	0.00%	8.52	-0.24%	8.54	-0.24%
2	Zero	0.03	0.12%	0.01	0.00%	0.02	-0.12%
	Upscale	8.52	-0.24%	8.56	0.00%	8.54	0.24%
3	Zero	0.01	0.00%	0.02	0.06%	0.02	0.06%
	Upscale	8.56	0.00%	8.56	0.00%	8.56	0.00%
4	Zero	0.02	0.06%	0.02	0.06%	0.02	0.00%
	Upscale	8.56	0.00%	8.58	0.12%	8.57	0.12%
5	Zero	0.02	0.06%	0.01	0.00%	0.02	-0.06%
	Upscale	8.58	0.12%	8.53	-0.18%	8.56	-0.29%
6	Zero	0.01	0.00%	0.01	0.00%	0.01	0.00%
	Upscale	8.53	-0.18%	8.52	-0.24%	8.53	-0.06%
7	Zero	0.01	0.00%	0.01	0.00%	0.01	0.00%
	Upscale	8.52	-0.24%	8.50	-0.35%	8.51	-0.12%
8	Zero	0.01	0.00%	-0.04	-0.29%	-0.02	-0.29%
	Upscale	8.50	-0.35%	8.48	-0.47%	8.49	-0.12%
9	Zero	-0.04	-0.29%	-0.02	-0.18%	-0.03	0.12%
	Upscale	8.48	-0.47%	8.49	-0.41%	8.49	0.06%
10	Zero	-0.02	-0.18%	0.01	0.00%	-0.01	0.18%
	Upscale	8.49	-0.41%	8.56	0.00%	8.53	0.41%

	Cylinder Value		Analyzer Response	
Zero	0.00	ppm	0.01	ppm
Upscale	8.54	ppm	8.56	ppm
Span	17.00	ppm	17.00	ppm

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

Calibration Drift

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
8/6-7/2012
Test 1L

Nox

		Initial	Pre-Cal Bias	Final	Post-Cal Bias	Avg.	% Drift of Span
1	Zero	0.06	0.00%	0.21	0.06%	0.14	0.06%
	Upscale	113.50	0.00%	113.80	0.12%	113.65	0.12%
2	Zero	0.21	0.06%	0.24	0.07%	0.23	0.01%
	Upscale	113.80	0.12%	114.40	0.36%	114.10	0.24%
3	Zero	0.24	0.07%	0.09	0.01%	0.17	-0.06%
	Upscale	114.40	0.36%	113.80	0.12%	114.10	-0.24%
4	Zero	0.09	0.01%	0.21	0.06%	0.15	0.05%
	Upscale	113.80	0.12%	113.30	-0.08%	113.55	-0.20%
5	Zero	0.21	0.06%	0.22	0.06%	0.22	0.00%
	Upscale	113.30	-0.08%	114.40	0.36%	113.85	0.44%
6	Zero	0.22	0.06%	0.21	0.06%	0.22	0.00%
	Upscale	114.40	0.36%	114.10	0.24%	114.25	-0.12%
7	Zero	0.21	0.06%	0.18	0.05%	0.20	-0.01%
	Upscale	114.10	0.24%	113.40	-0.04%	113.75	-0.28%
8	Zero	0.18	0.05%	0.21	0.06%	0.20	0.01%
	Upscale	113.40	-0.04%	113.50	0.00%	113.45	0.04%
9	Zero	0.21	0.06%	-0.09	-0.06%	0.06	-0.12%
	Upscale	113.50	0.00%	113.80	0.12%	113.65	0.12%
10	Zero	-0.09	-0.06%	-0.06	-0.05%	-0.08	0.01%
	Upscale	113.80	0.12%	114.10	0.24%	113.95	0.12%

	Cylinder Value	Analyzer Response
Zero	0.00 ppm	0.06 ppm
Upscale	113.70 ppm	113.50 ppm
Span	251.00 ppm	251.00 ppm

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

Calibration Drift

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
8/6-7/2012
Test 1L

SO_2

		Initial	Pre-Cal Bias	Final	Post-Cal Bias	Avg.	% Drift of Span
1	Zero	0.37	0.00%	0.46	0.04%	0.42	0.04%
	Upscale	117.70	0.00%	118.20	0.20%	117.95	0.20%
2	Zero	0.46	0.04%	0.17	-0.08%	0.32	-0.12%
	Upscale	118.20	0.20%	117.70	0.00%	117.95	-0.20%
3	Zero	0.17	-0.08%	0.33	-0.02%	0.25	0.06%
	Upscale	117.70	0.00%	117.90	0.08%	117.80	0.08%
4	Zero	0.33	-0.02%	0.27	-0.04%	0.30	-0.02%
	Upscale	117.90	0.08%	117.90	0.08%	117.90	0.00%
5	Zero	0.27	-0.04%	0.46	0.04%	0.37	0.08%
	Upscale	117.90	0.08%	118.20	0.20%	118.05	0.12%
6	Zero	0.46	0.04%	0.19	-0.07%	0.33	-0.11%
	Upscale	118.20	0.20%	118.80	0.44%	118.50	0.24%
7	Zero	0.19	-0.07%	0.37	0.00%	0.28	0.07%
	Upscale	118.80	0.44%	119.30	0.64%	119.05	0.20%
8	Zero	0.37	0.00%	0.30	-0.03%	0.34	-0.03%
	Upscale	119.30	0.64%	119.40	0.68%	119.35	0.04%
9	Zero	0.30	-0.03%	0.25	-0.05%	0.28	-0.02%
	Upscale	119.40	0.68%	118.80	0.44%	119.10	-0.24%
10	Zero	0.25	-0.05%	0.33	-0.02%	0.29	0.03%
	Upscale	118.80	0.44%	119.10	0.56%	118.95	0.12%

	Cylinder Value	Analyzer Response
Zero	0.00 ppm	0.37 ppm
Upscale	117.80 ppm	117.70 ppm
Span	251.00 ppm	251.00 ppm

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

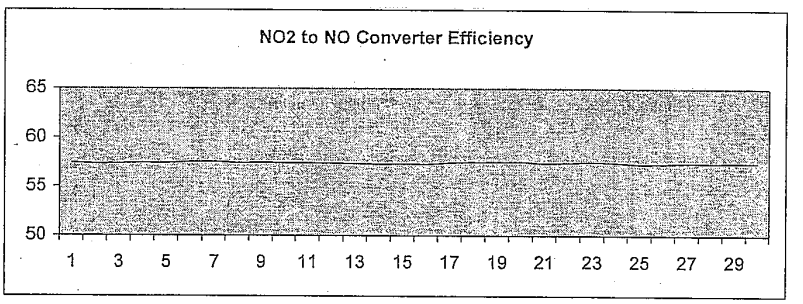
Interpoll Laboratories
(763) 786-6020

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

Job	MSI / Manitowoc PU
Source	S20 Boiler Stack
Date	8/6-7/2012
Operator	Rory Eiynck / Andrew Strong
Analyzer	TECO Model 42i-LS (NOx)
Analyzer S/N	615216893

Time (min)	NOx Response
10:30 PM	57.415
10:31 PM	57.328
10:32 PM	57.377
10:33 PM	57.434
10:34 PM	57.403
10:35 PM	57.520
10:36 PM	57.534
10:37 PM	57.440
10:38 PM	57.469
10:39 PM	57.422
10:40 PM	57.438
10:41 PM	57.404
10:42 PM	57.375
10:43 PM	57.320
10:44 PM	57.329
10:45 PM	57.314
10:46 PM	57.469
10:47 PM	57.521
10:48 PM	57.545
10:49 PM	57.544
10:50 PM	57.384
10:51 PM	57.454
10:52 PM	57.535
10:53 PM	57.448
10:54 PM	57.321
10:55 PM	57.328
10:56 PM	57.411
10:57 PM	57.382
10:58 PM	57.413
10:59 PM	57.437
Highest Peak Value	57.54
Percent Drift	0.2%
System Pass of Fail	PASS

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



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INTERPOLL LABORATORIES, INC.
(763) 786-6020

EPA Appendix A Stratification Test

Job:	MSI / Manitowoc PU	Date:	8/6-7/2012
Source:	S20 Boiler Stack	Personnel:	Rory Elynck / Andrew Strong
Test	1L	Bar. Press. (in. Hg)	29.31
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**	23:10	84.40	40.02	14.03	5.97
2	0.50	84.00	**98.00**	23:17	71.14	42.44	14.09	5.93
3	0.83	140.00	**154.00**	23:24	86.02	42.36	14.05	6.06
Average					**80.52**	**41.61**	**14.06**	**5.98**
			Largest Value		86.02	42.44	14.09	6.06
			Smallest Value		71.14	40.02	14.03	5.93
			%Deviation		**20.93%**	**6.04%**	**0.42%**	**2.20%**

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

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
8/6-7/2012
Stratification Test Data

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	% CO_2, w
23:10:00	94.89	39.23	13.71	6.19
23:11:00	95.38	40.69	13.75	6.16
23:12:00	96.20	41.38	13.76	6.23
23:13:00	89.51	41.42	13.69	6.30
23:14:00	87.19	40.01	13.77	6.21
23:15:00	67.31	37.74	14.95	5.21
23:16:00	60.32	39.70	14.60	5.47
Average	**84.40**	**40.02**	**14.03**	**5.97**

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	% CO_2, w
23:17:00	59.94	38.66	14.69	5.42
23:18:00	63.67	37.53	14.20	5.82
23:19:00	68.41	44.69	13.81	6.16
23:20:00	73.63	44.88	13.89	6.06
23:21:00	74.05	43.41	13.96	6.01
23:22:00	77.77	45.08	13.91	6.05
23:23:00	80.48	42.84	14.18	5.98
Average	**71.14**	**42.44**	**14.09**	**5.93**

Time	SO_2 ppm, w	Nox ppm, w	$\%O_2$, d	% CO_2, w
23:24:00	87.61	42.38	14.34	6.11
23:25:00	97.17	41.71	14.17	6.07
23:26:00	94.21	42.94	14.08	5.98
23:27:00	88.76	44.86	14.16	5.99
23:28:00	82.00	40.50	14.26	5.80
23:29:00	85.15	42.52	13.98	5.99
23:30:00	67.26	41.61	13.39	6.46
Average	**86.02**	**42.36**	**14.05**	**6.06**

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
8/7/2012
Test 1M

CO_2 (TEI Model 410i)

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	% of Span
Zero	0.00	0.03	0.03	17.00	0.18
Mid Level	8.54	8.56	0.02	17.00	0.12
High Level	17.00	17.22	0.22	17.00	1.29

O_2 (Servomex Series 1400)

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	% of Span
Zero	0.00	0.06	0.06	21.20	0.28
Mid Level	11.03	11.07	0.04	21.20	0.19
High Level	21.20	21.21	0.01	21.20	0.05

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

Calibration Drift

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
8/7/2012
Test 1M

O_2

		Initial	Pre-Cal Bias	Final	Post-cal Bias	Avg.	% Drift of Span
1	Zero	0.06	0.00%	0.07	0.05%	0.07	0.05%
	Upscale	11.07	0.00%	11.13	0.28%	11.10	0.28%
2	Zero	0.07	0.05%	0.07	0.05%	0.07	0.00%
	Upscale	11.13	0.28%	11.13	0.28%	11.13	0.00%
3	Zero	0.07	0.05%	0.07	0.05%	0.07	0.00%
	Upscale	11.13	0.28%	11.13	0.28%	11.13	0.00%
4	Zero	0.07	0.05%	0.06	0.00%	0.07	-0.05%
	Upscale	11.13	0.28%	11.11	0.19%	11.12	-0.09%
5	Zero	0.06	0.00%	0.06	0.00%	0.06	0.00%
	Upscale	11.11	0.19%	11.11	0.19%	11.11	0.00%
6	Zero	0.06	0.00%	0.06	0.00%	0.06	0.00%
	Upscale	11.11	0.19%	11.11	0.19%	11.11	0.00%
7	Zero	0.06	0.00%	0.06	0.00%	0.06	0.00%
	Upscale	11.11	0.19%	11.11	0.19%	11.11	0.00%
8	Zero	0.06	0.00%	0.06	0.00%	0.06	0.00%
	Upscale	11.11	0.19%	11.11	0.19%	11.11	0.00%
9	Zero	0.06	0.00%	0.06	0.00%	0.06	0.00%
	Upscale	11.11	0.19%	11.11	0.19%	11.11	0.00%
10	Zero	0.06	0.00%	0.06	0.00%	0.06	0.00%
	Upscale	11.11	0.19%	11.11	0.19%	11.11	0.00%

	Cylinder Value	Analyzer Value
Zero	0.00 %	0.06 %
Upscale	11.03 %	11.07 %
Span	21.20 %	21.2 %

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

Calibration Drift

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
8/7/2012
Test 1M

CO_2

		Initial	Pre-Cal Bias	Final	Post-Cal Bias	Avg.	% Drift of Span
1	Zero	0.03	0.00%	0.05	0.12%	0.04	0.12%
	Upscale	8.56	0.00%	8.61	0.29%	8.59	0.29%
2	Zero	0.05	0.12%	0.05	0.12%	0.05	0.00%
	Upscale	8.61	0.29%	8.61	0.29%	8.61	0.00%
3	Zero	0.05	0.12%	0.05	0.12%	0.05	0.00%
	Upscale	8.61	0.29%	8.61	0.29%	8.61	0.00%
4	Zero	0.05	0.12%	0.05	0.12%	0.05	0.00%
	Upscale	8.61	0.29%	8.56	0.00%	8.59	-0.29%
5	Zero	0.05	0.12%	0.05	0.12%	0.05	0.00%
	Upscale	8.56	0.00%	8.56	0.00%	8.56	0.00%
6	Zero	0.05	0.12%	0.05	0.12%	0.05	0.00%
	Upscale	8.56	0.00%	8.56	0.00%	8.56	0.00%
7	Zero	0.05	0.12%	0.05	0.12%	0.05	0.00%
	Upscale	8.56	0.00%	8.56	0.00%	8.56	0.00%
8	Zero	0.05	0.12%	0.05	0.12%	0.05	0.00%
	Upscale	8.56	0.00%	8.56	0.00%	8.56	0.00%
9	Zero	0.05	0.12%	0.05	0.12%	0.05	0.00%
	Upscale	8.56	0.00%	8.56	0.00%	8.56	0.00%
10	Zero	0.05	0.12%	0.05	0.12%	0.05	0.00%
	Upscale	8.56	0.00%	8.56	0.00%	8.56	0.00%

	Cylinder Value	Analyzer Response
Zero	0.00 ppm	0.03 ppm
Upscale	8.54 ppm	8.56 ppm
Span	17.00 ppm	17.00 ppm

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

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
8/7/2012
Test 1H

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	17.00	0.29
Mid Level	8.54	8.56	0.02	17.00	0.12
High Level	17.00	17.22	0.22	17.00	1.29

O_2 (Servomex Series 1400)

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	% of Span
Zero	0.00	0.06	0.06	21.20	0.28
Mid Level	11.03	11.11	0.08	21.20	0.38
High Level	21.20	21.32	0.12	21.20	0.57

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

Calibration Drift

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
8/7/2012
Test 1H

O_2

		Initial	Pre-Cal Bias	Final	Post-cal Bias	Avg.	% Drift of Span
1	Zero	0.06	0.00%	0.07	0.05%	0.07	0.05%
	Upscale	11.11	0.00%	11.11	0.00%	11.11	0.00%
2	Zero	0.07	0.05%	0.07	0.05%	0.07	0.00%
	Upscale	11.11	0.00%	11.11	0.00%	11.11	0.00%
3	Zero	0.07	0.05%	0.07	0.05%	0.07	0.00%
	Upscale	11.11	0.00%	11.11	0.00%	11.11	0.00%
4	Zero	0.07	0.05%	0.06	0.00%	0.07	-0.05%
	Upscale	11.11	0.00%	11.10	-0.05%	11.11	-0.05%
5	Zero	0.06	0.00%	0.06	0.00%	0.06	0.00%
	Upscale	11.10	-0.05%	11.10	-0.05%	11.10	0.00%
6	Zero	0.06	0.00%	0.06	0.00%	0.06	0.00%
	Upscale	11.10	-0.05%	11.10	-0.05%	11.10	0.00%
7	Zero	0.06	0.00%	0.07	0.05%	0.07	0.05%
	Upscale	11.10	-0.05%	11.12	0.05%	11.11	0.09%
8	Zero	0.07	0.05%	0.07	0.05%	0.07	0.00%
	Upscale	11.12	0.05%	11.12	0.05%	11.12	0.00%
9	Zero	0.07	0.05%	0.07	0.05%	0.07	0.00%
	Upscale	11.12	0.05%	11.12	0.05%	11.12	0.00%
10	Zero	0.07	0.05%	0.07	0.05%	0.07	0.00%
	Upscale	11.12	0.05%	11.12	0.05%	11.12	0.00%

	Cylinder Value	Analyzer Value
Zero	0.00 %	0.06 %
Upscale	11.03 %	11.11 %
Span	21.20 %	21.2 %

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

Calibration Drift

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
8/7/2012
Test 1H

CO_2

		Initial	Pre-Cal Bias	Final	Post-Cal Bias	Avg.	% Drift of Span
1	Zero	0.05	0.00%	0.06	0.06%	0.06	0.06%
	Upscale	8.56	0.00%	8.59	0.18%	8.58	0.18%
2	Zero	0.06	0.06%	0.06	0.06%	0.06	0.00%
	Upscale	8.59	0.18%	8.59	0.18%	8.59	0.00%
3	Zero	0.06	0.06%	0.06	0.06%	0.06	0.00%
	Upscale	8.59	0.18%	8.59	0.18%	8.59	0.00%
4	Zero	0.06	0.06%	0.05	0.00%	0.06	-0.06%
	Upscale	8.59	0.18%	8.53	-0.18%	8.56	-0.35%
5	Zero	0.05	0.00%	0.05	0.00%	0.05	0.00%
	Upscale	8.53	-0.18%	8.53	-0.18%	8.53	0.00%
6	Zero	0.05	0.00%	0.05	0.00%	0.05	0.00%
	Upscale	8.53	-0.18%	8.53	-0.18%	8.53	0.00%
7	Zero	0.05	0.00%	0.02	-0.18%	0.04	-0.18%
	Upscale	8.53	-0.18%	8.57	0.06%	8.55	0.24%
8	Zero	0.02	-0.18%	0.02	-0.18%	0.02	0.00%
	Upscale	8.57	0.06%	8.57	0.06%	8.57	0.00%
9	Zero	0.02	-0.18%	0.02	-0.18%	0.02	0.00%
	Upscale	8.57	0.06%	8.57	0.06%	8.57	0.00%
10	Zero	0.02	-0.18%	0.02	-0.18%	0.02	0.00%
	Upscale	8.57	0.06%	8.57	0.06%	8.57	0.00%

	Cylinder Value	Analyzer Response
Zero	0.00 ppm	0.05 ppm
Upscale	8.54 ppm	8.56 ppm
Span	17.00 ppm	17.00 ppm

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

MSI / Manitowoc PU
Manitowoc, WI
S20 Boiler Stack
8/7/2012
Run 1-3

Time	$\%O_2$, d	$\% CO_2$, w
8:02	10.36	8.851
8:03	10.44	8.799
8:04	10.4	8.865
8:05	10.39	8.839
8:06	10.31	8.904
8:07	10.47	8.738
8:08	10.47	8.717
8:09	10.44	8.781
8:10	10.4	8.833
8:11	10.41	8.849
8:12	10.4	8.878
8:13	10.38	8.878
8:14	10.35	8.91
8:15	10.39	8.834
8:16	10.38	8.846
8:17	10.31	8.836
8:18	10.31	8.873
8:19	10.39	8.866
8:20	10.45	8.779
8:21	10.43	8.799
8:22	10.46	8.761
8:23	10.54	8.668
8:24	10.33	8.783
Average	**10.400**	**8.821**

APPENDIX E

CALIBRATION GAS CERTIFICATION SHEETS

THE LINDE GROUP

CERTIFICATE OF ANALYSIS

EPA PROTOCOL MIXTURE

PROCEDURE # : G1

PGVP ID#:	I12012	GAS CODE:	SNC
CUSTOMER:	HAMMOND	CYLINDER # :	CC-127409
SALES#:	501103829	CYLINDER PRES:	2000 PSIG
PROD#:	1218583	CYLINDER VALVE:	CGA 660
P.O.# :	4501103829	CYLINDER SIZE:	2A
MATERIAL#:	24086350	CYLINDER MATERIAL:	Aluminum
CERTIFICATION DATE:	11-Jun-2012	GAS VOLUME:	4000 Liter
EXPIRATION DATE:	11-Jun-2014	BLEND TOLERANCE:	5% Relative
		PAGE:	1 of 1

CERTIFICATION HISTORY

COMPONENT	DATE OF ASSAY	MEAN CONCENTRATION	CERTIFIED CONCENTRATION	ANALYTICAL ACCURACY
Carbon Monoxide	31-May-2012 11-Jun-2012	111.3 ppm 112.0 ppm	111.6 ppm	+/- 1%
Nitric Oxide	04-Jun-2012 11-Jun-2012	113.8 ppm 113.5 ppm	113.7 ppm	+/- 1%
NOx			113.7 ppm	Reference Value Only
Sulfur Dioxide	04-Jun-2012 11-Jun-2012	117.6 ppm 118.0 ppm	117.8 ppm	+/- 1%

BALANCE Nitrogen

PREVIOUS CERTIFICATION DATES: None

REFERENCE STANDARDS

COMPONENT	SRM/NTRM#	CYLINDER#	CONCENTRATION
Carbon Monoxide	GMIS-1	cc-279053	500 ppm
Nitric Oxide	GMIS-1	CC-143752	254 ppm
Sulfur Dioxide	GMIS-1	CC-118364	355 ppm

INSTRUMENTATION

COMPONENT	MAKE/MODEL	SERIAL #	DETECTOR	CALIBRATION DATE(S)
Carbon Monoxide	Horiba VIA-510	570423011	NDIR	01-Jun-2012
Nitric Oxide	CAI 400-CLD	6L09004	Chemi	24-May-2012
Sulfur Dioxide	Horiba VIA-510	851221093	NDIR	04-Jun-2012

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: 11-Jun-2012

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

CERTIFICATE OF ANALYSIS

EPA PROTOCOL MIXTURE

PROCEDURE # : G1

PGVP ID#:	I12012	GAS CODE:	OC2
CUSTOMER:	HAMMOND	CYLINDER # :	CC-106969
SALES#:	501117489	CYLINDER PRES:	2000 PSIG
PROD#:	1222894	CYLINDER VALVE:	CGA 590
P.O.# :	4501117489	CYLINDER SIZE:	2A
MATERIAL#:	24086339	CYLINDER MATERIAL:	Aluminum
CERTIFICATION DATE:	12-Jul-2012	GAS VOLUME:	4000 Liter
EXPIRATION DATE:	12-Jul-2015	BLEND TOLERANCE:	5% Relative
		PAGE:	1 of 1

CERTIFICATION HISTORY

COMPONENT	DATE OF ASSAY	MEAN CONCENTRATION	CERTIFIED CONCENTRATION	ANALYTICAL ACCURACY
Carbon Dioxide	12-Jul-2012	8.54 %	8.54 %	+/- 1%
Oxygen	12-Jul-2012	11.03 %	11.03 %	+/- 1%

BALANCE Nitrogen

PREVIOUS CERTIFICATION DATES: None

REFERENCE STANDARDS

COMPONENT	SRM/NTRM#	CYLINDER#	CONCENTRATION
Carbon Dioxide	GMIS-1	CC-109878	9.98 %
Oxygen	NTRM-82659Y	cc-237244	24.52 %

INSTRUMENTATION

COMPONENT	MAKE/MODEL	SERIAL #	DETECTOR	CALIBRATION DATE(S)
Carbon Dioxide	CAI-300	S03001	NDIR	10-Jul-2012
Oxygen	CAI-300	S03001	PM	28-Jun-2012

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: 12-Jul-2012

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

THE LINDE GROUP

Linde

CERTIFICATE OF ANALYSIS

EPA PROTOCOL MIXTURE

PROCEDURE # : G1

PGVP ID#:	I12011	GAS CODE:	OC2
CUSTOMER:	Linde Hammond Plant	CYLINDER # :	CC-75412
SALES#:	108158693	CYLINDER PRES:	2000 PSIG
PROD#:	1180101	CYLINDER VALVE:	CGA 590
P.O.# :	4501778098	CYLINDER SIZE:	2A
MATERIAL#:	24090596	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	17.00 %	17.00 %	+/- 1%
Oxygen	03-Jun-2011	21.2 %	21.2 %	+/- 1%

BALANCE Nitrogen

PREVIOUS CERTIFICATION DATES: None

REFERENCE STANDARDS

COMPONENT	SRM/NTRM#	CYLINDER#	CONCENTRATION
Carbon Dioxide	NTRM-981004	CC-79852	20.00 %
Oxygen	NTRM-82659X	CC-83903	22.80 %

INSTRUMENTATION

COMPONENT	MAKE/MODEL	SERIAL #	DETECTOR	CALIBRATION DATE(S)
Carbon Dioxide	CAI-300	S03001	NDIR	12-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

20503

MPU01090

ISO 9001:2008

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:	SNC
CUSTOMER:	LINDE GAS NORTH AMERICA	CYLINDER # :	CC-131154
SALES#:	108553301	CYLINDER PRES:	2000 PSIG
PROD#:	1199023	CYLINDER VALVE:	CGA 660
P.O.# :	4501795868	CYLINDER SIZE:	2A
MATERIAL#:	24089260	CYLINDER MATERIAL:	Aluminum
CERTIFICATION DATE:	05-Dec-2011	GAS VOLUME:	4000 Liter
EXPIRATION DATE:	05-Dec-2013	BLEND TOLERANCE:	5% Relative
		PAGE:	1 of 1

CERTIFICATION HISTORY

COMPONENT	DATE OF ASSAY	MEAN CONCENTRATION	CERTIFIED CONCENTRATION	ANALYTICAL ACCURACY
Nitric Oxide	28-Nov-2011 05-Dec-2011	250.7 ppm 251.0 ppm	251 ppm	+/- 1%
NOx			251 ppm	Reference Value Only
Sulfur Dioxide	28-Nov-2011 05-Dec-2011	251.2 ppm 251.2 ppm	251 ppm	+/- 1%
Carbon Monoxide	28-Nov-2011 05-Dec-2011	252.9 ppm 252.5 ppm	253 ppm	+/- 1%

BALANCE Nitrogen

PREVIOUS CERTIFICATION DATES: None

REFERENCE STANDARDS

COMPONENT	SRM/NTRM#	CYLINDER#	CONCENTRATION
Nitric Oxide	GMIS-1	CC-143752	254 ppm
Sulfur Dioxide	GMIS-1	CC-197153	493 ppm
Carbon Monoxide	GMIS-1	CC-118482	502 ppm

INSTRUMENTATION

COMPONENT	MAKE/MODEL	SERIAL #	DETECTOR	CALIBRATION DATE(S)
Nitric Oxide	CAI 400-CLD	6L09004	Cheml	14-Nov-2011
Sulfur Dioxide	Horiba VIA-510	851221093	NDIR	15-Nov-2011
Carbon Monoxide	Horiba VIA-510	570423011	NDIR	07-Nov-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: 05-Dec-2011

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

MPU01091

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.

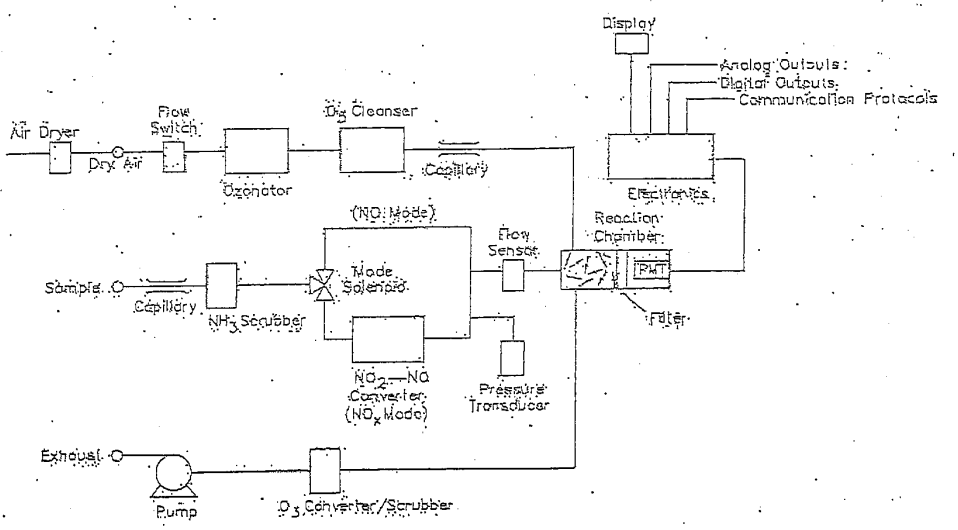

Figure 1-1. Model 42*i* Low Source Flow Schematic

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)

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.

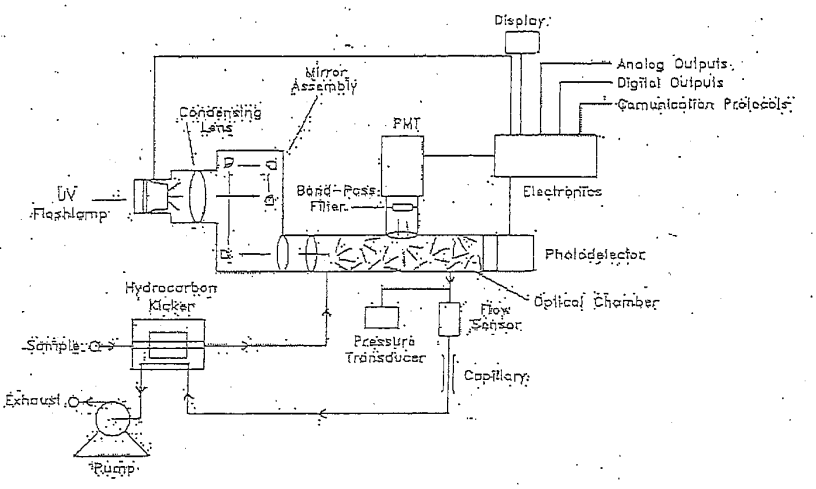

Figure 1-1. Model 43i Flow Schematic

Specifications

Table 1-1. Model 43i 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

MPU01095

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	Approximately 5 lbs. (in addition to the standard Model 43*i*)

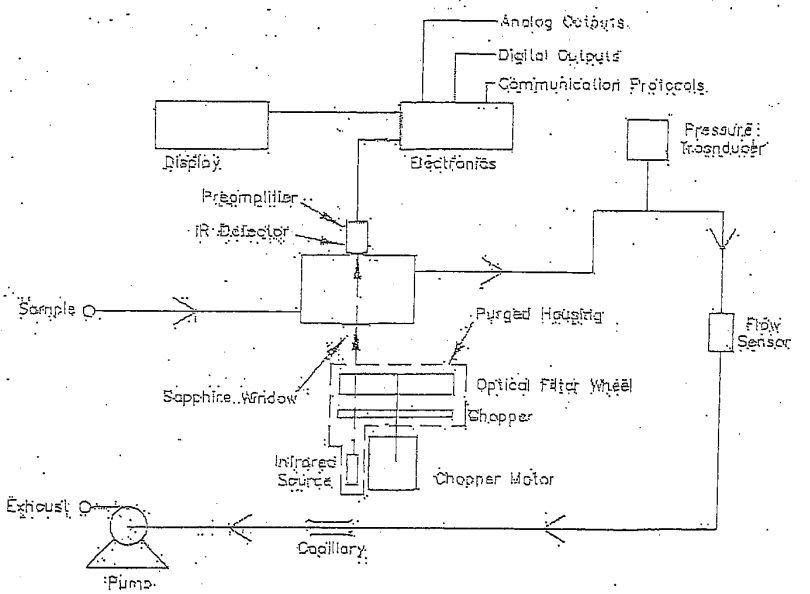

Figure 1-1. Model 410i Flow Schematic

Specifications

Table 1-1. Model 410i 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

MPU01097

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: G-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

MPU01099

Materials exposed to the sample	Stainless steel, Pyrex glass, brass, platinum, epoxy resin, viton, polypropylene and glass fibre filter
<u>Physical Characteristics</u>	
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
<u>Electrical</u>	
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: 431 S/N 0908635559

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	5.15
High	17.21

9-18-09

Date

1

MPU01102

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

MPU01103

APPENDIX H

CEM DATA

Run # 1

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/06/2012 23:10 Through 08/06/2012 23:20
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
08/06/12 23:10	3,525,904.0	1,839.0	58.8	4.573	88	188.2
08/06/12 23:11	3,502,986.0	1,839.0	58.4	4.572	82	187.9
08/06/12 23:12	3,395,628.0	1,839.0	56.6	4.572	83	188.0
08/06/12 23:13	3,389,983.0	1,839.0	56.5	4.571	86	188.4
08/06/12 23:14	3,571,544.0	1,839.0	59.5	4.571	80	189.7
08/06/12 23:15	3,334,749.0	1,839.0	55.6	4.573	88	190.2
08/06/12 23:16	3,436,061.0	1,839.0	57.3	4.575	80	189.7
08/06/12 23:17	3,519,882.0	1,839.0	58.7	4.575	88	189.0
08/06/12 23:18	3,541,891.0	1,839.0	59.0	4.575	80	188.5
08/06/12 23:19	3,526,758.0	1,839.0	58.8	4.575	83	188.6
08/06/12 23:20	3,537,596.0	1,839.0	59.0	4.574	81	188.9
Average	3,480,271.1	1,839.0	58.0	4.573	84	188.8
Minimum	3,334,749.0	1,839.0	55.6	4.571	80	187.9
Maximum	3,571,544.0	1,839.0	59.5	4.575	88	190.2
Summation	38,282,982.0	20,229.0	638.2	50.306	919	2,077.1
Included Data Points	11	11	11	11	11	11
Total number of Data Points	11	11	11	11	11	11

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

Report Generated: 08/06/12 23:38 Report Version 3.1.1130 STACKVISION- 1 of 1

MPU01105

Run # 2

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/06/2012 23:40 Through 08/06/2012 23:50
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
08/06/12 23:40	3,441,795.0	1,839.0	57.4	4.575	87	188.6
08/06/12 23:41	3,492,106.0	1,839.0	58.2	4.575	78	188.4
08/06/12 23:42	3,352,559.0	1,839.0	55.9	4.575	83	188.4
08/06/12 23:43	3,239,069.0	1,839.0	54.0	4.575	82	187.8
08/06/12 23:44	3,444,489.0	1,839.0	57.4	4.574	81	188.5
08/06/12 23:45	3,372,506.0	1,839.0	56.2	4.575	84	189.2
08/06/12 23:46	3,404,595.0	1,839.0	56.7	4.574	80	189.1
08/06/12 23:47	3,387,414.0	1,839.0	56.5	4.574	86	188.1
08/06/12 23:48	3,377,073.0	1,839.0	56.3	4.574	78	188.1
08/06/12 23:49	3,515,829.0	1,839.0	58.6	4.574	86	188.4
08/06/12 23:50	3,492,867.0	1,839.0	58.2	4.575	78	188.5
Average	3,410,936.5	1,839.0	56.9	4.575	82	188.5
Minimum	3,239,069.0	1,839.0	54.0	4.574	78	187.8
Maximum	3,515,829.0	1,839.0	58.6	4.575	87	189.2
Summation	37,520,302.0	20,229.0	625.4	50.320	903	2,073.1
Included Data Points	11	11	11	11	11	11
Total number of Data Points	11	11	11	11	11	11

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

Report Generated: 08/07/12 00:12 Report Version 3.1.1130 STACKVISION- 1 of 1

MPU01106

Run # 3

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 00:10 Through 08/07/2012 00:20
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
08/07/12 00:10	3,484,476.0	1,839.0	58.1	4.575	79	186.9
08/07/12 00:11	3,498,004.0	1,839.0	58.3	4.574	81	187.0
08/07/12 00:12	3,481,264.0	1,839.0	58.0	4.574	83	187.1
08/07/12 00:13	3,441,105.0	1,839.0	57.4	4.573	77	187.1
08/07/12 00:14	3,456,246.0	1,839.0	57.6	4.572	86	187.2
08/07/12 00:15	3,421,388.0	1,839.0	57.0	4.574	79	187.4
08/07/12 00:16	3,410,115.0	1,839.0	56.8	4.576	83	188.3
08/07/12 00:17	3,523,950.0	1,839.0	58.7	4.576	82	189.0
08/07/12 00:18	3,541,375.0	1,839.0	59.0	4.576	79	188.4
08/07/12 00:19	3,433,427.0	1,839.0	57.2	4.576	85	188.3
08/07/12 00:20	3,675,970.0	1,839.0	61.3	4.576	80	187.6
Average	3,487,938.2	1,839.0	58.1	4.575	81	187.7
Minimum	3,410,115.0	1,839.0	56.8	4.572	77	186.9
Maximum	3,675,970.0	1,839.0	61.3	4.576	86	189.0
Summation	38,367,320.0	20,229.0	639.4	50.322	894	2,064.3
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 U - Startup
I = Invalid M = Maintenance T = Out Of Control * = Suspect D - Shutdown

Run # 4

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 00:40 Through 08/07/2012 00:50
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
08/07/12 00:40	3,315,482.0	1,839.0	55.3	4.577	77	187.5
08/07/12 00:41	3,216,923.0	1,839.0	53.6	4.575	83	187.4
08/07/12 00:42	3,260,141.0	1,839.0	54.3	4.574	83	187.7
08/07/12 00:43	3,385,128.0	1,839.0	56.4	4.573	79	188.1
08/07/12 00:44	3,518,441.0	1,839.0	58.6	4.572	84	189.0
08/07/12 00:45	3,279,623.0	1,839.0	54.7	4.571	77	188.9
08/07/12 00:46	2,974,220.0	1,839.0	49.6	4.570	86	187.3
08/07/12 00:47	3,456,514.0	1,839.0	57.6	4.569	78	187.9
08/07/12 00:48	3,485,686.0	1,839.0	58.1	4.568	81	187.7
08/07/12 00:49	3,577,731.0	1,839.0	59.6	4.569	84	188.1
08/07/12 00:50	3,605,642.0	1,839.0	60.1	4.572	78	188.4
Average	3,370,502.8	1,839.0	56.2	4.572	81	188.0
Minimum	2,974,220.0	1,839.0	49.6	4.568	77	187.3
Maximum	3,605,642.0	1,839.0	60.1	4.577	86	189.0
Summation	37,075,531.0	20,229.0	617.9	50.290	890	2,068.0
Included Data Points	11	11	11	11	11	11
Total number of Data Points	11	11	11	11	11	11

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

Report Generated: 08/07/12 00:59 Report Version 3.1.1130 STACKVISION-

Run # 5

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 01:10 Through 08/07/2012 01:20
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
08/07/12 01:10	3,689,832.0	1,839.0	61.5	4.568	86	188.3
08/07/12 01:11	3,683,439.0	1,839.0	61.4	4.567	77	188.0
08/07/12 01:12	3,398,552.0	1,839.0	56.6	4.570	87	187.8
08/07/12 01:13	3,455,204.0	1,839.0	57.6	4.572	81	187.7
08/07/12 01:14	3,499,207.0	1,839.0	58.3	4.572	82	187.7
08/07/12 01:15	3,505,235.0	1,839.0	58.4	4.571	84	187.4
08/07/12 01:16	3,491,881.0	1,839.0	58.2	4.570	80	187.5
08/07/12 01:17	3,500,812.0	1,839.0	58.3	4.570	86	187.3
08/07/12 01:18	3,392,352.0	1,839.0	56.5	4.569	78	186.8
08/07/12 01:19	3,354,114.0	1,839.0	55.9	4.568	84	188.3
08/07/12 01:20	3,371,786.0	1,839.0	56.2	4.567	81	188.5
Average	3,485,674.0	1,839.0	58.1	4.569	82	187.8
Minimum	3,354,114.0	1,839.0	55.9	4.567	77	186.8
Maximum	3,689,832.0	1,839.0	61.5	4.572	87	188.5
Summation	38,342,414.0	20,229.0	638.9	50.264	906	2,065.3
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 U - Startup
I = Invalid M = Maintenance T = Out Of Control * = Suspect D - Shutdown

Report Generated: 08/07/12 01:29 Report Version 3.1.1130 STACKVISION-

Run #6

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 01:40 Through 08/07/2012 01:50
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
08/07/12 01:40	3,116,783.0	1,839.0	51.9	4.567	82	186.9
08/07/12 01:41	3,311,376.0	1,839.0	55.2	4.566	85	185.9
08/07/12 01:42	3,294,526.0	1,839.0	54.9	4.566	78	186.5
08/07/12 01:43	3,392,704.0	1,839.0	56.5	4.566	87	186.7
08/07/12 01:44	3,633,537.0	1,839.0	60.6	4.565	78	187.7
08/07/12 01:45	3,401,385.0	1,839.0	56.7	4.565	83	188.3
08/07/12 01:46	3,430,381.0	1,839.0	57.2	4.565	84	185.3
08/07/12 01:47	3,406,820.0	1,839.0	56.8	4.569	79	186.2
08/07/12 01:48	3,314,259.0	1,839.0	55.2	4.570	85	186.3
08/07/12 01:49	3,450,166.0	1,839.0	57.5	4.570	83	186.4
08/07/12 01:50	3,346,459.0	1,839.0	55.8	4.570	80	186.6
Average	3,372,581.5	1,839.0	56.2	4.567	82	186.6
Minimum	3,116,783.0	1,839.0	51.9	4.565	78	185.3
Maximum	3,633,537.0	1,839.0	60.6	4.570	87	188.3
Summation	37,098,396.0	20,229.0	618.3	50.239	904	2,052.8
Included Data Points	11	11	11	11	11	11
Total number of Data Points	11	11	11	11	11	11

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

Report Generated: 08/07/12 01:57 Report Version 3.1.1130 STACKVISION-

Run #7

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 02:10 Through 08/07/2012 02:20
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
08/07/12 02:10	3,561,945.0	1,839.0	59.4	4.575	84	187.6
08/07/12 02:11	3,518,534.0	1,839.0	58.6	4.574	78	187.4
08/07/12 02:12	3,431,850.0	1,839.0	57.2	4.573	87	187.6
08/07/12 02:13	3,345,712.0	1,839.0	55.8	4.573	80	187.9
08/07/12 02:14	3,410,907.0	1,839.0	56.8	4.572	83	188.0
08/07/12 02:15	3,462,886.0	1,839.0	57.7	4.571	85	188.0
08/07/12 02:16	3,481,933.0	1,839.0	58.0	4.575	78	187.9
08/07/12 02:17	3,546,676.0	1,839.0	59.1	4.576	87	187.7
08/07/12 02:18	3,540,372.0	1,839.0	59.0	4.576	79	187.8
08/07/12 02:19	3,413,186.0	1,839.0	56.9	4.576	86	188.1
08/07/12 02:20	3,364,639.0	1,839.0	56.1	4.576	79	186.8
Average	3,461,694.5	1,839.0	57.7	4.574	82	187.7
Minimum	3,345,712.0	1,839.0	55.8	4.571	78	186.8
Maximum	3,561,945.0	1,839.0	59.4	4.576	87	188.1
Summation	38,078,640.0	20,229.0	634.6	50.317	906	2,064.8
Included Data Points	11	11	11	11	11	11
Total number of Data Points	11	11	11	11	11	11

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

Report Generated: 08/07/12 02:22 Report Version 3.1.1130 STACKVISION- 1 of 1

MPU01111

Run #8

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 02:40 Through 08/07/2012 02:50
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
08/07/12 02:40	3,478,896.0	1,839.0	58.0	4.580	87	187.9
08/07/12 02:41	3,491,276.0	1,839.0	58.2	4.580	78	187.8
08/07/12 02:42	3,484,242.0	1,839.0	58.1	4.581	84	187.8
08/07/12 02:43	3,503,087.0	1,839.0	58.4	4.584	80	188.1
08/07/12 02:44	3,347,706.0	1,839.0	55.8	4.584	83	188.8
08/07/12 02:45	3,275,748.0	1,839.0	54.6	4.584	81	188.2
08/07/12 02:46	3,571,252.0	1,839.0	59.5	4.583	82	187.3
08/07/12 02:47	3,400,651.0	1,839.0	56.7	4.582	85	187.6
08/07/12 02:48	3,357,834.0	1,839.0	56.0	4.582	76	187.8
08/07/12 02:49	3,377,868.0	1,839.0	56.3	4.581	86	187.9
08/07/12 02:50	3,485,939.0	1,839.0	58.1	4.580	78	187.8
Average	3,434,045.4	1,839.0	57.2	4.582	82	187.9
Minimum	3,275,748.0	1,839.0	54.6	4.580	76	187.3
Maximum	3,571,252.0	1,839.0	59.5	4.584	87	188.8
Summation	37,774,499.0	20,229.0	629.7	50.401	900	2,067.0
Included Data Points	11	11	11	11	11	11
Total number of Data Points	11	11	11	11	11	11

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

Report Generated: 08/07/12 02:52 Report Version 3.1.1130 STACKVISION-

Run # 9

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 03:10 Through 08/07/2012 03:20
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
08/07/12 03:10	3,485,211.0	1,839.0	58.1	4.583	80	187.5
08/07/12 03:11	3,457,946.0	1,839.0	57.6	4.587	81	187.5
08/07/12 03:12	3,182,475.0	1,839.0	53.0	4.588	84	187.0
08/07/12 03:13	3,290,451.0	1,839.0	54.8	4.588	79	187.0
08/07/12 03:14	3,420,940.0	1,839.0	57.0	4.588	86	187.2
08/07/12 03:15	3,467,459.0	1,839.0	57.8	4.588	77	187.8
08/07/12 03:16	3,140,078.0	1,839.0	52.3	4.587	87	187.2
08/07/12 03:17	3,277,830.0	1,839.0	54.6	4.587	79	186.8
08/07/12 03:18	3,315,758.0	1,839.0	55.3	4.586	85	186.2
08/07/12 03:19	3,392,063.0	1,839.0	56.5	4.585	82	186.2
08/07/12 03:20	3,285,772.0	1,839.0	54.8	4.586	78	186.1
Average	3,337,816.6	1,839.0	55.6	4.587	82	187.0
Minimum	3,140,078.0	1,839.0	52.3	4.583	77	186.1
Maximum	3,485,211.0	1,839.0	58.1	4.588	87	187.8
Summation	36,715,983.0	20,229.0	611.8	50.453	898	2,056.5
Included Data Points	11	11	11	11	11	11
Total number of Data Points	11	11	11	11	11	11

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

Run #10

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 03:40 Through 08/07/2012 03:50
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
08/07/12 03:40	3,334,566.0	1,839.0	55.6	4.584	82	184.8
08/07/12 03:41	3,342,280.0	1,839.0	55.7	4.586	76	184.9
08/07/12 03:42	3,422,746.0	1,839.0	57.0	4.588	85	185.4
08/07/12 03:43	3,470,232.0	1,839.0	57.8	4.588	80	186.8
08/07/12 03:44	3,399,580.0	1,839.0	56.7	4.588	83	187.2
08/07/12 03:45	3,288,346.0	1,839.0	54.8	4.587	82	186.1
08/07/12 03:46	3,306,754.0	1,839.0	55.1	4.587	78	185.4
08/07/12 03:47	3,280,032.0	1,839.0	54.7	4.586	85	185.5
08/07/12 03:48	3,345,417.0	1,839.0	55.8	4.586	82	186.0
08/07/12 03:49	3,437,442.0	1,839.0	57.3	4.585	79	186.2
08/07/12 03:50	3,464,079.0	1,839.0	57.7	4.586	87	186.2
Average	3,371,952.2	1,839.0	56.2	4.586	82	185.9
Minimum	3,280,032.0	1,839.0	54.7	4.584	76	184.8
Maximum	3,470,232.0	1,839.0	57.8	4.588	87	187.2
Summation	37,091,474.0	20,229.0	618.2	50.451	899	2,044.5
Included Data Points	11	11	11	11	11	11
Total number of Data Points	11	11	11	11	11	11

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

Report Generated: 08/07/12 03:51 Report Version 3.1.1130 STACKVISION-

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/06/2012 23:10 Through 08/06/2012 23:30
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)
08/06/12 23:10	6.0	33.9	89.3	1,839.0	0.124	0.454	88
08/06/12 23:11	6.2	32.9	97.5	1,839.0	0.117	0.480	82
08/06/12 23:12	6.2	34.4	92.0	1,839.0	0.122	0.453	83
08/06/12 23:13	6.0	35.7	87.3	1,839.0	0.131	0.444	86
08/06/12 23:14	6.1	36.6	90.4	1,839.0	0.132	0.452	80
08/06/12 23:15	6.1	36.6	87.4	1,839.0	0.132	0.437	88
08/06/12 23:16	6.0	35.7	82.0	1,839.0	0.131	0.417	80
08/06/12 23:17	6.0	38.6	77.4	1,839.0	0.141	0.394	88
08/06/12 23:18	6.1	40.3	67.7	1,839.0	0.145	0.339	80
08/06/12 23:19	6.0	39.3	62.1	1,839.0	0.144	0.316	83
08/06/12 23:20	5.9	37.1	63.6	1,839.0	0.138	0.329	81
08/06/12 23:21	6.0	39.9	61.2	1,839.0	0.146	0.311	82
08/06/12 23:22	5.9	39.2	67.4	1,839.0	0.146	0.349	82
08/06/12 23:23	5.9	38.7	68.5	1,839.0	0.144	0.354	81
08/06/12 23:24	5.8	38.9	71.3	1,839.0	0.147	0.375	84
08/06/12 23:25	5.9	38.9	72.0	1,839.0	0.145	0.373	79
08/06/12 23:26	5.9	37.5	78.6	1,839.0	0.140	0.407	86
08/06/12 23:27	5.9	37.0	85.9	1,839.0	0.138	0.444	77
08/06/12 23:28	5.9	38.3	89.7	1,839.0	0.143	0.464	87
08/06/12 23:29	5.8	39.5	83.9	1,839.0	0.150	0.442	79
08/06/12 23:30	5.9	38.4	82.3	1,839.0	0.143	0.426	84
Average	6.0	37.5	78.9	1,839.0	0.138	0.403	83
Minimum	5.8	32.9	61.2	1,839.0	0.117	0.311	77
Maximum	6.2	40.3	97.5	1,839.0	0.150	0.480	88
Summation	125.5	787.4	1,657.5	38,619.0	2.899	8.460	1,740
Included Data	21	21	21	21	21	21	21
Total number of	21	21	21	21	21	21	21

F = Unit Offline E = Exceedance
I = Invalid M = Maintenance
Report Generated: 08/06/12 23:39

C = Calibration S = Substituted
T = Out Of Control * = Suspect
Report Version 3.1.1130 STAC

MPU01115

Run # 2

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/06/2012 23:40 Through 08/07/2012 00:00
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)
08/06/12 23:40	5.9	41.1	69.1	1,839.0	0.153	0.358	87
08/06/12 23:41	5.9	37.0	75.9	1,839.0	0.138	0.393	78
08/06/12 23:42	6.0	34.8	90.5	1,839.0	0.127	0.460	83
08/06/12 23:43	5.7	41.6	72.4	1,839.0	0.160	0.388	82
08/06/12 23:44	5.8	40.8	78.9	1,839.0	0.154	0.415	81
08/06/12 23:45	5.8	39.6	81.8	1,839.0	0.150	0.431	84
08/06/12 23:46	5.9	37.3	82.4	1,839.0	0.139	0.426	80
08/06/12 23:47	5.8	39.5	77.6	1,839.0	0.150	0.408	86
08/06/12 23:48	5.8	40.1	77.6	1,839.0	0.152	0.408	78
08/06/12 23:49	5.8	39.6	72.3	1,839.0	0.150	0.381	86
08/06/12 23:50	5.8	40.4	72.3	1,839.0	0.153	0.381	78
08/06/12 23:51	5.9	41.5	70.4	1,839.0	0.154	0.364	84
08/06/12 23:52	5.9	38.3	79.8	1,839.0	0.143	0.413	81
08/06/12 23:53	5.9	38.7	77.1	1,839.0	0.144	0.399	82
08/06/12 23:54	5.9	40.0	77.6	1,839.0	0.149	0.402	81
08/06/12 23:55	5.8	37.7	88.8	1,839.0	0.143	0.467	79
08/06/12 23:56	5.9	38.2	87.5	1,839.0	0.142	0.453	84
08/06/12 23:57	5.9	37.8	88.1	1,839.0	0.141	0.456	79
08/06/12 23:58	5.8	36.8	86.2	1,839.0	0.139	0.454	86
08/06/12 23:59	6.0	35.6	101.3	1,839.0	0.130	0.515	77
08/07/12 00:00	5.9	36.3	109.0	1,839.0	0.135	0.564	87
Average	5.9	38.7	81.7	1,839.0	0.145	0.426	82
Minimum	5.7	34.8	69.1	1,839.0	0.127	0.358	77
Maximum	6.0	41.6	109.0	1,839.0	0.160	0.564	87
Summation	123.1	812.7	1,716.6	38,619.0	3.046	8.936	1,723
Included Data	21	21	21	21	21	21	21
Total number of	21	21	21	21	21	21	21

12

F = Unit Offline E = Exceedance
I = Invalid M = Maintenance
Report Generated: 08/07/12 00:13

C = Calibration S = Substituted
T = Out Of Control * = Suspect
Report Version 3.1.1130 STAC

MPU01116

Run # 5

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 00:10 Through 08/07/2012 00:30
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)
08/07/12 00:10	5.9	36.8	63.1	1,839.0	0.137	0.326	79
08/07/12 00:11	5.8	35.8	68.8	1,839.0	0.136	0.362	81
08/07/12 00:12	5.9	36.3	75.5	1,839.0	0.135	0.391	83
08/07/12 00:13	5.9	36.9	74.0	1,839.0	0.137	0.383	77
08/07/12 00:14	5.9	36.4	76.8	1,839.0	0.135	0.397	86
08/07/12 00:15	5.9	35.7	83.2	1,839.0	0.133	0.430	79
08/07/12 00:16	5.9	37.9	73.0	1,839.0	0.141	0.378	83
08/07/12 00:17	5.8	37.8	71.8	1,839.0	0.143	0.378	82
08/07/12 00:18	5.8	37.6	77.3	1,839.0	0.142	0.407	79
08/07/12 00:19	5.8	38.6	80.0	1,839.0	0.146	0.421	85
08/07/12 00:20	5.9	39.4	82.5	1,839.0	0.147	0.427	80
08/07/12 00:21	5.9	40.1	82.3	1,839.0	0.149	0.426	81
08/07/12 00:22	5.9	39.4	83.2	1,839.0	0.147	0.430	84
08/07/12 00:23	5.9	39.3	80.7	1,839.0	0.146	0.418	78
08/07/12 00:24	5.8	41.1	78.1	1,839.0	0.156	0.411	85
08/07/12 00:25	5.9	40.2	79.9	1,839.0	0.150	0.413	83
08/07/12 00:26	5.9	38.2	85.8	1,839.0	0.142	0.444	78
08/07/12 00:27	5.9	39.0	80.3	1,839.0	0.145	0.415	87
08/07/12 00:28	5.9	38.9	81.7	1,839.0	0.145	0.423	78
08/07/12 00:29	5.9	36.7	92.1	1,839.0	0.137	0.477	85
08/07/12 00:30	5.9	38.6	88.8	1,839.0	0.144	0.459	81
Average	5.9	38.1	79.0	1,839.0	0.143	0.410	82
Minimum	5.8	35.7	63.1	1,839.0	0.133	0.326	77
Maximum	5.9	41.1	92.1	1,839.0	0.156	0.477	87
Summation	123.4	800.7	1,658.9	38,619.0	2.993	8.616	1,714
Included Data	21	21	21	21	21	21	21
Total number of	21	21	21	21	21	21	21

13

F = Unit Offline E = Exceedance
I = Invalid M = Maintenance
Report Generated: 08/07/12 00:49

C = Calibration S = Substituted
T = Out Of Control * = Suspect
Report Version 3.1.1130 STAC

MPU01117

Run #4

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 00:40 Through 08/07/2012 01:00
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)
08/07/12 00:40	5.7	41.5	71.2	1,839.0	0.160	0.381	77
08/07/12 00:41	5.7	40.2	73.0	1,839.0	0.155	0.391	83
08/07/12 00:42	5.7	41.3	72.3	1,839.0	0.159	0.387	83
08/07/12 00:43	5.7	41.2	68.1	1,839.0	0.159	0.365	79
08/07/12 00:44	5.7	40.5	68.1	1,839.0	0.156	0.365	84
08/07/12 00:45	5.7	39.2	72.8	1,839.0	0.151	0.390	77
08/07/12 00:46	5.8	40.9	74.0	1,839.0	0.155	0.389	86
08/07/12 00:47	5.7	39.2	79.7	1,839.0	0.151	0.427	78
08/07/12 00:48	5.7	40.6	81.0	1,839.0	0.156	0.434	81
08/07/12 00:49	5.7	41.1	80.4	1,839.0	0.158	0.431	84
08/07/12 00:50	5.7	41.0	76.5	1,839.0	0.158	0.410	78
08/07/12 00:51	5.7	39.5	78.1	1,839.0	0.152	0.418	84
08/07/12 00:52	5.8	38.5	76.7	1,839.0	0.146	0.404	82
08/07/12 00:53	5.8	39.8	72.8	1,839.0	0.151	0.383	79
08/07/12 00:54	5.7	39.2	73.8	1,839.0	0.151	0.395	86
08/07/12 00:55	5.8	39.4	80.9	1,839.0	0.149	0.426	78
08/07/12 00:56	5.9	37.6	90.7	1,839.0	0.140	0.469	84
08/07/12 00:57	5.8	37.7	91.1	1,839.0	0.143	0.479	81
08/07/12 00:58	5.8	39.6	87.2	1,839.0	0.150	0.459	81
08/07/12 00:59	5.8	39.5	89.5	1,839.0	0.150	0.471	86
08/07/12 01:00	5.8	40.1	89.9	1,839.0	0.152	0.473	76
Average	5.7	39.9	78.5	1,839.0	0.152	0.417	81
Minimum	5.7	37.6	68.1	1,839.0	0.140	0.365	76
Maximum	5.9	41.5	91.1	1,839.0	0.160	0.479	86
Summation	120.7	837.6	1,647.8	38,619.0	3.202	8.747	1,707
Included Data	21	21	21	21	21	21	21
Total number of	21	21	21	21	21	21	21

F = Unit Offline E = Exceedance
I = Invalid M = Maintenance
Report Generated: 08/07/12 01:02

C = Calibration S = Substituted
T = Out Of Control * = Suspect
Report Version 3.1.1130 STAC

MPU01118

Run # 2

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 01:10 Through 08/07/2012 01:30
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)
08/07/12 01:10	5.8	38.9	89.3	1,839.0	0.147	0.470	86
08/07/12 01:11	5.8	38.8	93.1	1,839.0	0.147	0.490	77
08/07/12 01:12	5.8	40.2	90.7	1,839.0	0.152	0.477	87
08/07/12 01:13	5.8	38.5	90.6	1,839.0	0.146	0.477	81
08/07/12 01:14	5.8	35.7	91.6	1,839.0	0.135	0.482	82
08/07/12 01:15	5.9	38.9	82.0	1,839.0	0.145	0.424	84
08/07/12 01:16	5.8	38.1	78.2	1,839.0	0.144	0.412	80
08/07/12 01:17	5.9	37.3	76.0	1,839.0	0.139	0.393	86
08/07/12 01:18	5.9	39.2	83.4	1,839.0	0.146	0.432	78
08/07/12 01:19	5.8	40.1	79.7	1,839.0	0.152	0.419	84
08/07/12 01:20	5.9	40.6	78.5	1,839.0	0.151	0.406	81
08/07/12 01:21	5.9	39.7	76.0	1,839.0	0.148	0.393	83
08/07/12 01:22	5.8	39.7	78.5	1,839.0	0.150	0.413	83
08/07/12 01:23	5.8	39.7	73.1	1,839.0	0.150	0.385	78
08/07/12 01:24	5.9	38.7	75.9	1,839.0	0.144	0.393	86
08/07/12 01:25	5.9	38.4	83.0	1,839.0	0.143	0.429	80
08/07/12 01:26	5.9	39.1	85.0	1,839.0	0.146	0.440	83
08/07/12 01:27	5.8	39.5	82.4	1,839.0	0.150	0.434	83
08/07/12 01:28	5.9	38.5	80.7	1,839.0	0.143	0.418	81
08/07/12 01:29	5.9	39.2	83.6	1,839.0	0.146	0.433	86
08/07/12 01:30	5.8	40.5	79.7	1,839.0	0.153	0.419	77
Average	5.8	39.0	82.4	1,839.0	0.147	0.430	82
Minimum	5.8	35.7	73.1	1,839.0	0.135	0.385	77
Maximum	5.9	40.6	93.1	1,839.0	0.153	0.490	87
Summation	122.8	819.3	1,731.0	38,619.0	3.077	9.039	1,726
Included Data	21	21	21	21	21	21	21
Total number of	21	21	21	21	21	21	21

F = Unit Offline E = Exceedance
I = Invalid M = Maintenance
Report Generated: 08/07/12 01:32

C = Calibration S = Substituted
T = Out Of Control * = Suspect
Report Version 3.1.1130 STAC

MPU01119

Run #6

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 01:40 Through 08/07/2012 02:00
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)
08/07/12 01:40	5.9	38.1	83.3	1,839.0	0.142	0.431	82
08/07/12 01:41	5.8	40.4	82.8	1,839.0	0.153	0.436	85
08/07/12 01:42	5.9	39.1	84.8	1,839.0	0.146	0.439	78
08/07/12 01:43	5.9	39.0	87.8	1,839.0	0.145	0.454	87
08/07/12 01:44	5.9	39.6	82.6	1,839.0	0.147	0.427	78
08/07/12 01:45	5.9	38.7	80.6	1,839.0	0.144	0.417	83
08/07/12 01:46	5.8	37.9	79.3	1,839.0	0.143	0.417	84
08/07/12 01:47	5.9	36.9	86.1	1,839.0	0.137	0.445	79
08/07/12 01:48	6.0	37.3	88.5	1,839.0	0.137	0.450	85
08/07/12 01:49	6.0	37.0	83.1	1,839.0	0.135	0.423	83
08/07/12 01:50	6.0	37.4	82.4	1,839.0	0.137	0.419	80
08/07/12 01:51	6.0	35.6	80.1	1,839.0	0.130	0.408	85
08/07/12 01:52	5.9	37.1	74.8	1,839.0	0.138	0.387	78
08/07/12 01:53	6.0	36.7	74.7	1,839.0	0.134	0.380	85
08/07/12 01:54	6.1	36.6	69.2	1,839.0	0.132	0.346	81
08/07/12 01:55	6.0	36.4	68.2	1,839.0	0.133	0.347	80
08/07/12 01:56	6.0	36.8	69.2	1,839.0	0.135	0.352	85
08/07/12 01:57	6.0	36.4	75.9	1,839.0	0.133	0.386	78
08/07/12 01:58	6.0	34.5	83.9	1,839.0	0.126	0.427	86
08/07/12 01:59	6.0	34.3	83.2	1,839.0	0.126	0.423	78
08/07/12 02:00	5.9	35.7	76.5	1,839.0	0.133	0.396	87
Average	5.9	37.2	79.9	1,839.0	0.137	0.410	82
Minimum	5.8	34.3	68.2	1,839.0	0.126	0.346	78
Maximum	6.1	40.4	88.5	1,839.0	0.153	0.454	87
Summation	124.9	781.5	1,677.0	38,619.0	2.886	8.610	1,727
Included Data	21	21	21	21	21	21	21
Total number of	21	21	21	21	21	21	21

F = Unit Offline E = Exceedance
I = Invalid M = Maintenance
Report Generated: 08/07/12 02:01

C = Calibration S = Substituted
T = Out Of Control * = Suspect
Report Version 3.1.1130 STAC

MPU01120

Run

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 02:10 Through 08/07/2012 02:30
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)
08/07/12 02:10	5.8	37.6	85.2	1,839.0	0.142	0.448	84
08/07/12 02:11	5.8	38.4	78.0	1,839.0	0.145	0.411	78
08/07/12 02:12	5.9	37.9	81.3	1,839.0	0.141	0.421	87
08/07/12 02:13	5.9	37.7	82.2	1,839.0	0.140	0.425	80
08/07/12 02:14	5.9	39.2	84.9	1,839.0	0.146	0.439	83
08/07/12 02:15	5.9	39.3	83.8	1,839.0	0.146	0.434	85
08/07/12 02:16	5.9	38.0	85.5	1,839.0	0.141	0.442	78
08/07/12 02:17	5.9	38.2	86.5	1,839.0	0.142	0.448	87
08/07/12 02:18	5.9	38.8	86.8	1,839.0	0.144	0.449	79
08/07/12 02:19	5.9	39.4	81.8	1,839.0	0.147	0.423	86
08/07/12 02:20	6.0	38.3	82.6	1,839.0	0.140	0.420	79
08/07/12 02:21	5.9	39.0	79.8	1,839.0	0.145	0.413	84
08/07/12 02:22	5.9	41.3	70.5	1,839.0	0.154	0.365	86
08/07/12 02:23	6.0	40.8	72.2	1,839.0	0.149	0.367	78
08/07/12 02:24	5.9	39.4	70.5	1,839.0	0.147	0.365	86
08/07/12 02:25	5.9	40.5	63.5	1,839.0	0.151	0.329	80
08/07/12 02:26	5.9	39.8	70.2	1,839.0	0.148	0.363	83
08/07/12 02:27	5.8	39.2	66.0	1,839.0	0.148	0.347	81
08/07/12 02:28	5.8	39.1	67.0	1,839.0	0.148	0.353	83
08/07/12 02:29	5.8	40.6	68.5	1,839.0	0.154	0.361	83
08/07/12 02:30	5.9	39.5	74.8	1,839.0	0.147	0.387	78
Average	5.9	39.1	77.2	1,839.0	0.146	0.400	82
Minimum	5.8	37.6	63.5	1,839.0	0.140	0.329	78
Maximum	6.0	41.3	86.8	1,839.0	0.154	0.449	87
Summation	123.6	822.0	1,621.6	38,619.0	3.065	8.410	1,728
Included Data	21	21	21	21	21	21	21
Total number of	21	21	21	21	21	21	21

F = Unit Offline E = Exceedance
I = Invalid M = Maintenance
Report Generated: 08/07/12 02:32

C = Calibration S = Substituted
T = Out Of Control * = Suspect
Report Version 3.1.1130 STAC

MPU01121

Run #8

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 02:40 Through 08/07/2012 03:00
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)
08/07/12 02:40	5.8	38.8	85.0	1,839.0	0.147	0.447	87
08/07/12 02:41	5.8	39.3	81.8	1,839.0	0.149	0.431	78
08/07/12 02:42	5.9	37.3	92.5	1,839.0	0.139	0.479	84
08/07/12 02:43	5.8	40.6	88.9	1,839.0	0.154	0.468	80
08/07/12 02:44	5.8	39.9	88.7	1,839.0	0.151	0.467	83
08/07/12 02:45	5.8	39.5	87.0	1,839.0	0.150	0.458	81
08/07/12 02:46	5.8	40.7	79.4	1,839.0	0.154	0.418	82
08/07/12 02:47	5.8	40.0	81.9	1,839.0	0.151	0.431	85
08/07/12 02:48	5.9	36.8	90.0	1,839.0	0.137	0.466	76
08/07/12 02:49	5.9	38.3	88.7	1,839.0	0.143	0.459	86
08/07/12 02:50	5.8	40.3	77.3	1,839.0	0.153	0.407	78
08/07/12 02:51	5.8	41.1	74.3	1,839.0	0.156	0.391	85
08/07/12 02:52	5.9	41.0	77.8	1,839.0	0.153	0.403	78
08/07/12 02:53	5.8	39.5	76.6	1,839.0	0.150	0.403	83
08/07/12 02:54	5.9	40.8	71.2	1,839.0	0.152	0.368	82
08/07/12 02:55	5.8	39.8	72.3	1,839.0	0.151	0.381	80
08/07/12 02:56	5.9	39.4	73.3	1,839.0	0.147	0.379	85
08/07/12 02:57	5.8	40.1	71.6	1,839.0	0.152	0.377	78
08/07/12 02:58	5.8	40.1	70.8	1,839.0	0.152	0.373	84
08/07/12 02:59	5.8	39.8	71.2	1,839.0	0.151	0.375	81
08/07/12 03:00	5.8	41.1	74.4	1,839.0	0.156	0.392	82
Average	5.8	39.7	79.7	1,839.0	0.150	0.418	82
Minimum	5.8	36.8	70.8	1,839.0	0.137	0.368	76
Maximum	5.9	41.1	92.5	1,839.0	0.156	0.479	87
Summation	122.4	834.2	1,674.7	38,619.0	3.148	8.773	1,718
Included Data	21	21	21	21	21	21	21
Total number of	21	21	21	21	21	21	21

F = Unit Offline E = Exceedance
I = Invalid M = Maintenance
Report Generated: 08/07/12 03:05

C = Calibration S = Substituted
T = Out Of Control * = Suspect
Report Version 3.1.1130 STAC

MPU01122

Run 7

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 03:10 Through 08/07/2012 03:30
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)
08/07/12 03:10	5.9	39.0	83.5	1,839.0	0.145	0.432	80
08/07/12 03:11	5.8	39.3	78.8	1,839.0	0.149	0.415	81
08/07/12 03:12	5.8	39.0	82.8	1,839.0	0.148	0.436	84
08/07/12 03:13	5.8	35.6	86.7	1,839.0	0.135	0.456	79
08/07/12 03:14	6.0	38.1	92.4	1,839.0	0.139	0.470	86
08/07/12 03:15	5.9	40.4	89.7	1,839.0	0.150	0.464	77
08/07/12 03:16	5.8	40.6	85.6	1,839.0	0.154	0.451	87
08/07/12 03:17	5.8	39.3	76.8	1,839.0	0.149	0.404	79
08/07/12 03:18	5.9	35.9	81.1	1,839.0	0.134	0.420	85
08/07/12 03:19	6.0	35.0	84.8	1,839.0	0.128	0.431	82
08/07/12 03:20	5.8	37.4	74.6	1,839.0	0.142	0.393	78
08/07/12 03:21	5.9	36.8	76.7	1,839.0	0.137	0.397	83
08/07/12 03:22	5.8	40.2	65.9	1,839.0	0.152	0.347	81
08/07/12 03:23	5.7	42.3	53.0	1,839.0	0.163	0.284	78
08/07/12 03:24	5.7	44.6	50.6	1,839.0	0.172	0.271	85
08/07/12 03:25	5.7	44.3	48.8	1,839.0	0.171	0.261	75
08/07/12 03:26	5.6	43.4	47.4	1,839.0	0.170	0.258	85
08/07/12 03:27	5.6	45.1	47.4	1,839.0	0.177	0.258	76
08/07/12 03:28	5.6	41.1	54.3	1,839.0	0.161	0.296	86
08/07/12 03:29	5.6	38.6	61.2	1,839.0	0.151	0.334	76
08/07/12 03:30	5.6	37.7	67.2	1,839.0	0.148	0.366	82
Average	5.8	39.7	70.9	1,839.0	0.151	0.374	81
Minimum	5.6	35.0	47.4	1,839.0	0.128	0.258	75
Maximum	6.0	45.1	92.4	1,839.0	0.177	0.470	87
Summation	121.3	833.7	1,489.3	38,619.0	3.175	7.844	1,705
Included Data	21	21	21	21	21	21	21
Total number of	21	21	21	21	21	21	21

F = Unit Offline E = Exceedance
I = Invalid M = Maintenance
Report Generated: 08/07/12 03:31

C = Calibration S = Substituted
T = Out Of Control * = Suspect
Report Version 3.1.1130 STAC

MPU01123

Run # 10

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 03:40 Through 08/07/2012 04:00
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)
08/07/12 03:40	5.8	34.9	82.8	1,839.0	0.132	0.436	82
08/07/12 03:41	5.8	35.4	81.5	1,839.0	0.134	0.429	76
08/07/12 03:42	5.8	35.9	77.7	1,839.0	0.136	0.409	85
08/07/12 03:43	5.8	35.8	77.7	1,839.0	0.136	0.409	80
08/07/12 03:44	5.8	37.3	73.4	1,839.0	0.141	0.386	83
08/07/12 03:45	5.8	37.8	66.1	1,839.0	0.143	0.348	82
08/07/12 03:46	5.7	39.1	65.8	1,839.0	0.151	0.352	78
08/07/12 03:47	5.8	37.8	69.5	1,839.0	0.143	0.366	85
08/07/12 03:48	5.7	38.2	70.0	1,839.0	0.147	0.375	82
08/07/12 03:49	5.7	36.0	80.4	1,839.0	0.139	0.431	79
08/07/12 03:50	5.8	35.1	93.2	1,839.0	0.133	0.491	87
08/07/12 03:51	5.8	34.1	104.7	1,839.0	0.129	0.551	81
08/07/12 03:52	5.9	33.2	111.7	1,839.0	0.124	0.578	84
08/07/12 03:53	5.9	33.7	106.9	1,839.0	0.125	0.553	85
08/07/12 03:54	6.0	31.9	112.5	1,839.0	0.117	0.572	78
08/07/12 03:55	5.9	35.6	99.6	1,839.0	0.132	0.515	87
08/07/12 03:56	5.8	36.8	85.4	1,839.0	0.139	0.449	79
08/07/12 03:57	5.9	37.2	80.7	1,839.0	0.138	0.418	84
08/07/12 03:58	5.8	38.0	74.1	1,839.0	0.144	0.390	81
08/07/12 03:59	5.8	38.4	63.4	1,839.0	0.145	0.334	84
08/07/12 04:00	5.9	38.5	63.6	1,839.0	0.143	0.329	82
Average	5.8	36.2	82.9	1,839.0	0.137	0.434	82
Minimum	5.7	31.9	63.4	1,839.0	0.117	0.329	76
Maximum	6.0	39.1	112.5	1,839.0	0.151	0.578	87
Summation	122.2	760.7	1,740.7	38,619.0	2.871	9.121	1,724
Included Data	21	21	21	21	21	21	21
Total number of	21	21	21	21	21	21	21

F = Unit Offline E = Exceedance
I = Invalid M = Maintenance
Report Generated: 08/07/12 04:01

C = Calibration S = Substituted
T = Out Of Control * = Suspect
Report Version 3.1.1130 STAC

MPU01124

Run # 1

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 05:17 Through 08/07/2012 05:25
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
08/07/12 05:17	4,128,247.0	1,839.0	68.8	4.575	142	207.9
08/07/12 05:18	4,045,709.0	1,839.0	67.4	4.575	146	207.8
08/07/12 05:19	4,003,738.0	1,839.0	66.7	4.574	146	207.8
08/07/12 05:20	4,060,386.0	1,839.0	67.7	4.573	144	208.0
08/07/12 05:21	4,100,367.0	1,839.0	68.3	4.572	141	208.4
08/07/12 05:22	4,070,592.0	1,839.0	67.8	4.571	141	209.1
08/07/12 05:23	4,011,332.0	1,839.0	66.9	4.571	146	208.9
08/07/12 05:24	4,082,824.0	1,839.0	68.0	4.571	147	208.1
08/07/12 05:25	4,050,779.0	1,839.0	67.5	4.574	143	207.9
Average	4,061,552.7	1,839.0	67.7	4.573	144	208.2
Minimum	4,003,738.0	1,839.0	66.7	4.571	141	207.8
Maximum	4,128,247.0	1,839.0	68.8	4.575	147	209.1
Summation	36,553,974.0	16,551.0	609.1	41.156	1,296	1,873.9
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 U - Startup
I = Invalid M = Maintenance T = Out Of Control * = Suspect D - Shutdown

Report Generated: 08/07/12 05:48 Report Version 3.1.1130 STACKVISION- 1 of 1

MPU01125

Run #2

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 05:26 Through 08/07/2012 05:32
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
08/07/12 05:26	4,089,269.0	1,839.0	68.2	4.575	141	208.0
08/07/12 05:27	4,114,307.0	1,839.0	68.6	4.575	141	208.5
08/07/12 05:28	4,060,224.0	1,839.0	67.7	4.574	141	210.0
08/07/12 05:29	4,276,295.0	1,839.0	71.3	4.574	146	210.3
08/07/12 05:30	3,757,761.0	1,839.0	62.6	4.574	146	208.8
08/07/12 05:31	4,020,490.0	1,839.0	67.0	4.574	142	208.7
08/07/12 05:32	4,057,744.0	1,839.0	67.6	4.574	141	208.5
Average	4,053,727.1	1,839.0	67.6	4.574	143	209.0
Minimum	3,757,761.0	1,839.0	62.6	4.574	141	208.0
Maximum	4,276,295.0	1,839.0	71.3	4.575	146	210.3
Summation	28,376,090.0	12,873.0	473.0	32.020	998	1,462.8
Included Data Points	7	7	7	7	7	7
Total number of Data Points	7	7	7	7	7	7

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

Report Generated: 08/07/12 05:48 Report Version 3.1.1130 STACKVISION- 1 of 1

MPU01126

Run #3

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 05:33 Through 08/07/2012 05:42
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
08/07/12 05:33	4,056,931.0	1,839.0	67.6	4.574	141	208.8
08/07/12 05:34	4,077,739.0	1,839.0	68.0	4.573	143	209.0
08/07/12 05:35	4,097,703.1	1,839.0	68.3	4.573	146	209.2
08/07/12 05:36	4,085,353.0	1,839.0	68.1	4.572	143	209.2
08/07/12 05:37	3,993,059.0	1,839.0	66.6	4.575	141	208.9
08/07/12 05:38	3,891,240.0	1,839.0	64.9	4.576	141	209.9
08/07/12 05:39	3,969,137.0	1,839.0	66.2	4.575	141	210.7
08/07/12 05:40	3,991,769.0	1,839.0	66.5	4.575	141	209.9
08/07/12 05:41	4,008,415.0	1,839.0	66.8	4.574	143	209.6
08/07/12 05:42	3,940,069.0	1,839.0	65.7	4.574	145	209.7
Average	4,011,141.5	1,839.0	66.9	4.574	143	209.5
Minimum	3,891,240.0	1,839.0	64.9	4.572	141	208.8
Maximum	4,097,703.1	1,839.0	68.3	4.576	146	210.7
Summation	40,111,415.1	18,390.0	668.7	45.741	1,425	2,094.9
Included Data Points	10	10	10	10	10	10
Total number of Data Points	10	10	10	10	10	10

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

Report Generated: 08/07/12 05:49 Report Version 3.1.1130 STACKVISION- 1 of 1

MPU01127

Run #4

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 06:00 Through 08/07/2012 06:07
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
08/07/12 06:00	4,000,420.0	1,839.0	66.7	4.571	141	211.0
08/07/12 06:01	4,004,073.0	1,839.0	66.7	4.571	142	211.0
08/07/12 06:02	3,911,688.0	1,839.0	65.2	4.571	144	211.8
08/07/12 06:03	4,058,609.0	1,839.0	67.6	4.575	144	211.9
08/07/12 06:04	4,030,359.0	1,839.0	67.2	4.576	143	211.5
08/07/12 06:05	4,014,898.0	1,839.0	66.9	4.576	139	210.8
08/07/12 06:06	3,941,095.0	1,839.0	65.7	4.576	139	210.6
08/07/12 06:07	3,924,509.0	1,839.0	65.4	4.575	140	210.8
Average	3,985,706.4	1,839.0	66.4	4.574	142	211.2
Minimum	3,911,688.0	1,839.0	65.2	4.571	139	210.6
Maximum	4,058,609.0	1,839.0	67.6	4.576	144	211.9
Summation	31,885,651.0	14,712.0	531.4	36.591	1,132	1,689.4
Included Data Points	8	8	8	8	8	8
Total number of Data Points	8	8	8	8	8	8

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

Report Generated: 08/07/12 06:26 Report Version 3.1.1130 STACKVISION- 1 of 1

MPU01128

Run #5

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 06:08 Through 08/07/2012 06:15
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
08/07/12 06:08	4,056,381.0	1,839.0	67.6	4.575	142	211.1
08/07/12 06:09	4,097,998.0	1,839.0	68.3	4.574	143	211.5
08/07/12 06:10	4,055,884.0	1,839.0	67.6	4.573	143	211.4
08/07/12 06:11	4,053,822.0	1,839.0	67.6	4.573	143	211.1
08/07/12 06:12	3,588,066.0	1,839.0	59.8	4.572	143	212.0
08/07/12 06:13	3,923,212.0	1,839.0	65.4	4.572	143	213.5
08/07/12 06:14	3,640,193.0	1,839.0	60.7	4.573	141	212.6
08/07/12 06:15	3,929,675.0	1,839.0	65.5	4.576	139	211.8
Average	3,918,153.9	1,839.0	65.3	4.574	142	211.9
Minimum	3,588,066.0	1,839.0	59.8	4.572	139	211.1
Maximum	4,097,998.0	1,839.0	68.3	4.576	143	213.5
Summation	31,345,231.0	14,712.0	522.5	36.588	1,137	1,695.0
Included Data Points	8	8	8	8	8	8
Total number of Data Points	8	8	8	8	8	8

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

Report Generated: 08/07/12 06:27 Report Version 3.1.1130 STACKVISION- 1 of 1

MPU01129

Run #6

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 06:16 Through 08/07/2012 06:23
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
08/07/12 06:16	3,964,111.0	1,839.0	66.1	4.576	140	211.5
08/07/12 06:17	3,985,363.0	1,839.0	66.4	4.576	145	211.8
08/07/12 06:18	4,058,007.0	1,839.0	67.6	4.575	145	212.4
08/07/12 06:19	4,049,314.0	1,839.0	67.5	4.574	139	213.2
08/07/12 06:20	3,964,081.0	1,839.0	66.1	4.574	139	213.4
08/07/12 06:21	3,904,885.0	1,839.0	65.1	4.574	140	212.7
08/07/12 06:22	3,947,729.0	1,839.0	65.8	4.574	143	212.0
08/07/12 06:23	4,013,765.0	1,839.0	66.9	4.574	143	212.3
Average	3,985,906.9	1,839.0	66.4	4.575	142	212.4
Minimum	3,904,885.0	1,839.0	65.1	4.574	139	211.5
Maximum	4,058,007.0	1,839.0	67.6	4.576	145	213.4
Summation	31,887,255.0	14,712.0	531.5	36.597	1,134	1,699.3
Included Data Points	8	8	8	8	8	8
Total number of Data Points	8	8	8	8	8	8

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

Report Generated: 08/07/12 06:27 Report Version 3.1.1130 STACKVISION- 1 of 1

MPU01130

Run # 7

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 06:24 Through 08/07/2012 06:31
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
08/07/12 06:24	4,026,849.0	1,839.0	67.1	4.574	142	212.5
08/07/12 06:25	4,068,216.0	1,839.0	67.8	4.574	139	212.3
08/07/12 06:26	4,126,183.0	1,839.0	68.8	4.573	139	212.6
08/07/12 06:27	4,113,258.0	1,839.0	68.6	4.576	145	212.8
08/07/12 06:28	3,719,154.0	1,839.0	62.0	4.577	145	213.2
08/07/12 06:29	3,755,928.0	1,839.0	62.6	4.577	140	214.5
08/07/12 06:30	3,956,591.0	1,839.0	65.9	4.576	139	215.0
08/07/12 06:31	4,037,417.0	1,839.0	67.3	4.575	140	214.2
Average	3,975,449.5	1,839.0	66.3	4.575	141	213.4
Minimum	3,719,154.0	1,839.0	62.0	4.573	139	212.3
Maximum	4,126,183.0	1,839.0	68.8	4.577	145	215.0
Summation	31,803,596.0	14,712.0	530.1	36.602	1,129	1,707.1
Included Data Points	8	8	8	8	8	8
Total number of Data Points	8	8	8	8	8	8

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

Report Generated: 08/07/12 06:36 Report Version 3.1.1130 STACKVISION- 1 of 1

MPU01131

Run # 8

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 06:32 Through 08/07/2012 06:40
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
08/07/12 06:32	4,030,026.0	1,839.0	67.2	4.575	140	213.1
08/07/12 06:33	3,984,628.0	1,839.0	66.4	4.574	142	212.9
08/07/12 06:34	4,145,320.0	1,839.0	69.1	4.574	142	213.2
08/07/12 06:35	4,292,388.0	1,839.0	71.5	4.573	142	214.4
08/07/12 06:36	4,011,857.0	1,839.0	66.9	4.573	142	215.0
08/07/12 06:37	3,997,469.0	1,839.0	66.6	4.572	142	214.3
08/07/12 06:38	4,055,982.0	1,839.0	67.6	4.573	138	213.6
08/07/12 06:39	4,111,946.0	1,839.0	68.5	4.574	138	213.5
08/07/12 06:40	4,144,772.0	1,839.0	69.1	4.578	139	213.6
Average	4,086,043.1	1,839.0	68.1	4.574	141	213.7
Minimum	3,984,628.0	1,839.0	66.4	4.572	138	212.9
Maximum	4,292,388.0	1,839.0	71.5	4.578	142	215.0
Summation	36,774,388.0	16,551.0	612.9	41.166	1,265	1,923.6
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 U - Startup
I = Invalid M = Maintenance T = Out Of Control * = Suspect D - Shutdown

Report Generated: 08/07/12 06:42 Report Version 3.1.1130 STACKVISION-

Run # 9

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 06:41 Through 08/07/2012 06:48
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
08/07/12 06:41	4,100,940.0	1,839.0	68.3	4.579	141	213.4
08/07/12 06:42	3,845,470.0	1,839.0	64.1	4.580	145	213.0
08/07/12 06:43	3,995,530.0	1,839.0	66.6	4.580	144	213.0
08/07/12 06:44	4,157,890.0	1,839.0	69.3	4.579	140	213.4
08/07/12 06:45	4,047,083.0	1,839.0	67.5	4.578	140	214.2
08/07/12 06:46	4,062,390.0	1,839.0	67.7	4.577	142	214.8
08/07/12 06:47	4,009,697.0	1,839.0	66.8	4.577	145	214.2
08/07/12 06:48	3,978,469.0	1,839.0	66.3	4.576	143	213.6
Average	4,024,683.6	1,839.0	67.1	4.578	143	213.7
Minimum	3,845,470.0	1,839.0	64.1	4.576	140	213.0
Maximum	4,157,890.0	1,839.0	69.3	4.580	145	214.8
Summation	32,197,469.0	14,712.0	536.6	36.626	1,140	1,709.6
Included Data Points	8	8	8	8	8	8
Total number of Data Points	8	8	8	8	8	8

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

Report Generated: 08/07/12 06:50 Report Version 3.1.1130 STACKVISION- 1 of 1

MPU01133

RUN # 10

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 06:49 Through 08/07/2012 06:56
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
08/07/12 06:49	4,025,264.0	1,839.0	67.1	4.575	139	213.6
08/07/12 06:50	4,127,213.0	1,839.0	68.8	4.576	139	213.8
08/07/12 06:51	4,224,599.0	1,839.0	70.4	4.579	143	214.3
08/07/12 06:52	4,135,011.0	1,839.0	68.9	4.579	143	215.0
08/07/12 06:53	4,070,482.0	1,839.0	67.8	4.579	143	215.3
08/07/12 06:54	4,049,273.0	1,839.0	67.5	4.579	142	214.4
08/07/12 06:55	4,013,928.0	1,839.0	66.9	4.579	139	214.1
08/07/12 06:56	4,040,339.0	1,839.0	67.3	4.578	139	214.4
Average	4,085,763.6	1,839.0	68.1	4.578	141	214.4
Minimum	4,013,928.0	1,839.0	66.9	4.575	139	213.6
Maximum	4,224,599.0	1,839.0	70.4	4.579	143	215.3
Summation	32,686,109.0	14,712.0	544.7	36.624	1,127	1,714.9
Included Data Points	8	8	8	8	8	8
Total number of Data Points	8	8	8	8	8	8

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

Report Generated: 08/07/12 06:57 Report Version 3.1.1130 STACKVISION-

RUN #1

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 08:02 Through 08/07/2012 08:09
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
08/07/12 08:02	5,140,584.0	1,839.0	85.7	4.582	189	241.6
08/07/12 08:03	5,087,375.0	1,839.0	84.8	4.583	195	241.5
08/07/12 08:04	5,061,870.0	1,839.0	84.4	4.583	195	241.5
08/07/12 08:05	5,144,224.0	1,839.0	85.7	4.583	191	242.1
08/07/12 08:06	5,290,347.0	1,839.0	88.2	4.584	189	243.4
08/07/12 08:07	5,150,480.0	1,839.0	85.8	4.583	193	243.6
08/07/12 08:08	5,126,827.0	1,839.0	85.4	4.583	194	243.2
08/07/12 08:09	5,099,528.0	1,839.0	85.0	4.583	194	242.5
Average	5,137,654.4	1,839.0	85.6	4.583	193	242.4
Minimum	5,061,870.0	1,839.0	84.4	4.582	189	241.5
Maximum	5,290,347.0	1,839.0	88.2	4.584	195	243.6
Summation	41,101,235.0	14,712.0	685.0	36.664	1,540	1,939.4
Included Data Points	8	8	8	8	8	8
Total number of Data Points	8	8	8	8	8	8

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

Report Generated: 08/07/12 08:11 Report Version 3.1.1130 STACKVISION- 1 of 1

MPU01135

Run #2

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 08:10 Through 08/07/2012 08:16
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
08/07/12 08:10	5,072,689.0	1,839.0	84.5	4.582	194	242.6
08/07/12 08:11	5,059,226.0	1,839.0	84.3	4.582	194	243.0
08/07/12 08:12	5,129,164.0	1,839.0	85.5	4.581	194	243.5
08/07/12 08:13	5,164,020.0	1,839.0	86.1	4.580	193	244.4
08/07/12 08:14	5,116,017.0	1,839.0	85.3	4.582	194	244.4
08/07/12 08:15	5,066,135.0	1,839.0	84.4	4.584	196	243.7
08/07/12 08:16	5,084,745.0	1,839.0	84.7	4.584	196	243.5
Average	5,098,856.6	1,839.0	85.0	4.582	194	243.6
Minimum	5,059,226.0	1,839.0	84.3	4.580	193	242.6
Maximum	5,164,020.0	1,839.0	86.1	4.584	196	244.4
Summation	35,691,996.0	12,873.0	594.8	32.075	1,361	1,705.1
Included Data Points	7	7	7	7	7	7
Total number of Data Points	7	7	7	7	7	7

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

Report Generated: 08/07/12 08:17 Report Version 3.1.1130 STACKVISION- 1 of 1

MPU01136

RUN # 3

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 08:17 Through 08/07/2012 08:24
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
08/07/12 08:17	5,179,832.0	1,839.0	86.3	4.585	198	244.1
08/07/12 08:18	5,245,546.0	1,839.0	87.4	4.585	199	244.7
08/07/12 08:19	5,234,212.0	1,839.0	87.2	4.584	194	244.7
08/07/12 08:20	5,211,874.0	1,839.0	86.9	4.583	193	244.6
08/07/12 08:21	5,524,931.0	1,839.0	92.1	4.583	193	245.2
08/07/12 08:22	5,462,801.0	1,839.0	91.0	4.583	195	246.4
08/07/12 08:23	5,252,335.0	1,839.0	87.5	4.583	197	246.1
08/07/12 08:24	5,190,243.0	1,839.0	86.5	4.584	191	245.2
Average	5,287,721.8	1,839.0	88.1	4.584	195	245.1
Minimum	5,179,832.0	1,839.0	86.3	4.583	191	244.1
Maximum	5,524,931.0	1,839.0	92.1	4.585	199	246.4
Summation	42,301,774.0	14,712.0	704.9	36.670	1,560	1,961.0
Included Data Points	8	8	8	8	8	8
Total number of Data Points	8	8	8	8	8	8

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

Run #4

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 09:06 Through 08/07/2012 09:13
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
08/07/12 09:06	5,416,437.0	1,839.0	90.3	4.588	203	235.6
08/07/12 09:07	5,392,962.0	1,839.0	89.9	4.588	204	236.1
08/07/12 09:08	5,378,324.0	1,839.0	89.6	4.587	206	236.8
08/07/12 09:09	5,378,414.0	1,839.0	89.6	4.587	205	237.4
08/07/12 09:10	5,386,814.0	1,839.0	89.8	4.586	202	238.2
08/07/12 09:11	5,395,560.0	1,839.0	89.9	4.589	198	238.9
08/07/12 09:12	5,381,898.0	1,839.0	89.7	4.591	202	239.3
08/07/12 09:13	5,360,434.0	1,839.0	89.3	4.591	199	239.5
Average	5,386,355.4	1,839.0	89.8	4.588	202	237.7
Minimum	5,360,434.0	1,839.0	89.3	4.586	198	235.6
Maximum	5,416,437.0	1,839.0	90.3	4.591	206	239.5
Summation	43,090,843.0	14,712.0	718.1	36.707	1,619	1,901.8
Included Data Points	8	8	8	8	8	8
Total number of Data Points	8	8	8	8	8	8

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

Report Generated: 08/07/12 09:21 Report Version 3.1.1130 STACKVISION-

RUN # 5

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 09:14 Through 08/07/2012 09:20
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
08/07/12 09:14	5,361,384.0	1,839.0	89.4	4.591	195	240.1
08/07/12 09:15	5,380,995.0	1,839.0	89.7	4.590	196	240.6
08/07/12 09:16	5,218,388.0	1,839.0	87.0	4.591	199	241.2
08/07/12 09:17	5,384,556.0	1,839.0	89.7	4.590	196	241.8
08/07/12 09:18	5,426,670.0	1,839.0	90.4	4.590	191	242.6
08/07/12 09:19	5,426,164.0	1,839.0	90.4	4.590	189	243.1
08/07/12 09:20	5,303,713.0	1,839.0	88.4	4.589	188	243.4
Average	5,357,410.0	1,839.0	89.3	4.590	193	241.8
Minimum	5,218,388.0	1,839.0	87.0	4.589	188	240.1
Maximum	5,426,670.0	1,839.0	90.4	4.591	199	243.4
Summation	37,501,870.0	12,873.0	625.0	32.131	1,354	1,692.8
Included Data Points	7	7	7	7	7	7
Total number of Data Points	7	7	7	7	7	7

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

RUN #6

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 09:21 Through 08/07/2012 09:29
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
08/07/12 09:21	5,394,396.0	1,839.0	89.9	4.590	188	243.3
08/07/12 09:22	5,426,419.0	1,839.0	90.4	4.593	190	243.9
08/07/12 09:23	5,406,369.0	1,839.0	90.1	4.593	194	244.6
08/07/12 09:24	5,393,337.0	1,839.0	89.9	4.592	194	245.2
08/07/12 09:25	5,633,277.0	1,839.0	93.9	4.592	193	245.4
08/07/12 09:26	5,565,020.0	1,839.0	92.8	4.591	191	245.0
08/07/12 09:27	5,531,999.0	1,839.0	92.2	4.590	195	244.8
08/07/12 09:28	5,472,098.0	1,839.0	91.2	4.590	196	244.5
08/07/12 09:29	5,442,792.0	1,839.0	90.7	4.589	192	244.3
Average	5,473,967.4	1,839.0	91.2	4.591	193	244.6
Minimum	5,393,337.0	1,839.0	89.9	4.589	188	243.3
Maximum	5,633,277.0	1,839.0	93.9	4.593	196	245.4
Summation	49,265,707.0	16,551.0	821.1	41.320	1,733	2,201.0
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 U - Startup
I = Invalid M = Maintenance T = Out Of Control * = Suspect D - Shutdown

Report Generated: 08/07/12 09:30 Report Version 3.1.1130 STACKVISION-

Run 7
S20 High Flow

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 09:37 Through 08/07/2012 09:45
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
08/07/12 09:37	5,411,163.0	1,839.0	90.2	4.595	196	245.0
08/07/12 09:38	5,413,293.0	1,839.0	90.2	4.594	196	245.0
08/07/12 09:39	5,394,719.0	1,839.0	89.9	4.594	195	245.0
08/07/12 09:40	5,371,436.0	1,839.0	89.5	4.593	193	245.0
08/07/12 09:41	5,396,777.0	1,839.0	89.9	4.592	195	245.0
08/07/12 09:42	5,384,091.0	1,839.0	89.7	4.591	197	245.2
08/07/12 09:43	5,426,600.0	1,839.0	90.4	4.591	197	245.8
08/07/12 09:44	5,597,564.0	1,839.0	93.3	4.591	197	245.6
08/07/12 09:45	5,604,040.0	1,839.0	93.4	4.595	196	245.0
Average	5,444,409.2	1,839.0	90.7	4.593	196	245.2
Minimum	5,371,436.0	1,839.0	89.5	4.591	193	245.0
Maximum	5,604,040.0	1,839.0	93.4	4.595	197	245.8
Summation	48,999,683.0	16,551.0	816.5	41.336	1,762	2,206.6
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 U - Startup
I = Invalid M = Maintenance T = Out Of Control * = Suspect D - Shutdown

Run #8

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 09:46 Through 08/07/2012 09:52
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
08/07/12 09:46	5,499,192.0	1,839.0	91.7	4.595	195	244.5
08/07/12 09:47	5,416,624.0	1,839.0	90.3	4.594	195	244.1
08/07/12 09:48	5,651,069.0	1,839.0	94.2	4.594	196	245.4
08/07/12 09:49	5,441,491.0	1,839.0	90.7	4.594	196	245.6
08/07/12 09:50	5,337,404.0	1,839.0	89.0	4.593	196	244.7
08/07/12 09:51	5,421,850.0	1,839.0	90.4	4.593	197	244.1
08/07/12 09:52	5,394,403.0	1,839.0	89.9	4.594	196	244.1
Average	5,451,719.0	1,839.0	90.9	4.594	196	244.6
Minimum	5,337,404.0	1,839.0	89.0	4.593	195	244.1
Maximum	5,651,069.0	1,839.0	94.2	4.595	197	245.6
Summation	38,162,033.0	12,873.0	636.2	32.157	1,371	1,712.5
Included Data Points	7	7	7	7	7	7
Total number of Data Points	7	7	7	7	7	7

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

Report Generated: 08/07/12 09:53 Report Version 3.1.1130 STACKVISION-

RUN # 9

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 09:53 Through 08/07/2012 10:01
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
08/07/12 09:53	5,433,950.0	1,839.0	90.6	4.594	196	244.4
08/07/12 09:54	5,459,262.0	1,839.0	91.0	4.594	197	245.0
08/07/12 09:55	5,359,362.0	1,839.0	89.3	4.595	197	245.0
08/07/12 09:56	5,312,103.0	1,839.0	88.5	4.599	196	244.7
08/07/12 09:57	5,354,345.0	1,839.0	89.2	4.599	196	244.5
08/07/12 09:58	5,422,892.0	1,839.0	90.4	4.599	196	244.7
08/07/12 09:59	5,412,961.0	1,839.0	90.2	4.598	197	245.0
08/07/12 10:00	5,384,020.0	1,839.0	89.7	4.597	196	244.9
08/07/12 10:01	5,402,139.0	1,839.0	90.0	4.597	194	244.5
Average	5,393,448.2	1,839.0	89.9	4.597	196	244.7
Minimum	5,312,103.0	1,839.0	88.5	4.594	194	244.4
Maximum	5,459,262.0	1,839.0	91.0	4.599	197	245.0
Summation	48,541,034.0	16,551.0	808.9	41.372	1,765	2,202.7
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 U - Startup
I = Invalid M = Maintenance T = Out Of Control * = Suspect D - Shutdown

Report Generated: 08/07/12 10:08 Report Version 3.1.1130 STACKVISION- 1 of 1

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Run # 10

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 08/07/2012 10:02 Through 08/07/2012 10:09
Time Online Criteria: 1 minute(s)

Source	S20					
Parameter (Unit)	S20CPFLO (SCFH)	S20FFACT (MMBTU/CF)	S20PFLOW (KSCFM)	S20PVAC (PSIA)	S20STEAM (KLBS/HR)	S20STEMP (DEGFAHRE)
08/07/12 10:02	5,483,018.0	1,839.0	91.4	4.596	194	244.6
08/07/12 10:03	5,505,840.0	1,839.0	91.8	4.596	194	244.6
08/07/12 10:04	5,150,510.0	1,839.0	85.8	4.595	197	245.4
08/07/12 10:05	5,249,791.0	1,839.0	87.5	4.595	201	246.2
08/07/12 10:06	5,352,856.0	1,839.0	89.2	4.594	194	245.9
08/07/12 10:07	5,363,796.0	1,839.0	89.4	4.594	194	245.1
08/07/12 10:08	5,378,461.0	1,839.0	89.6	4.598	196	244.5
08/07/12 10:09	5,358,288.0	1,839.0	89.3	4.599	198	244.4
Average	5,355,320.0	1,839.0	89.3	4.596	196	245.1
Minimum	5,150,510.0	1,839.0	85.8	4.594	194	244.4
Maximum	5,505,840.0	1,839.0	91.8	4.599	201	246.2
Summation	42,842,560.0	14,712.0	714.0	36.767	1,568	1,960.7
Included Data Points	8	8	8	8	8	8
Total number of Data Points	8	8	8	8	8	8

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

Report Generated: 08/07/12 10:10 Report Version 3.1.1130 STACKVISION-

RATA Test - Part 75

Plant: MPU Source: S20

Parameter:	S20CPCO2	Unit of Measure:	PERCENT
Effective Date/Time:	08/07/2012 05:00	Test Number:	XML (X09-Q3-2012-001) / EDR (1)
Monitoring System ID:	X09	Frequency:	4QTRS
Test Reason:	QA-Periodic Quality Assurance	Test Result:	**Passed**
Overall RA:	4.40	Overall BAF:	1.000
CEMS Time Offset :			
Test Comment:			

Operating Level:	Low	Level BAF:	1.000	APS Indicator:	False	Report in EDR:	Y
Mean CEMS:	5.856	Relative Accuracy:	4.40	tValue:	2.306	Use BAF:	Y
Mean Reference:	6.056	Standard Deviation:	0.087	Avg Load:	82	Reference Method:	3A
Mean Difference:	0.200	Confidence Coefficient:	0.067				

Run	Started	Ended	Reference Value	CEMS Value	Difference	Load	Use
1	08/06/2012 23:10	08/06/2012 23:30	6.0	6.0	0.0	83	Y
2	08/06/2012 23:40	08/07/2012 00:00	6.1	5.9	0.2	82	Y
3	08/07/2012 00:10	08/07/2012 00:30	6.1	5.9	0.2	82	Y
4	08/07/2012 00:40	08/07/2012 01:00	5.9	5.7	0.2	81	Y
5	08/07/2012 01:10	08/07/2012 01:30	6.1	5.8	0.3	82	Y
6	08/07/2012 01:40	08/07/2012 02:00	6.2	5.9	0.3	82	Y
7	08/07/2012 02:10	08/07/2012 02:30	6.1	5.9	0.2	82	Y
8	08/07/2012 02:40	08/07/2012 03:00	6.0	5.8	0.2	82	Y
9	08/07/2012 03:10	08/07/2012 03:30	6.0	5.8	0.2	81	Y
10	08/07/2012 03:40	08/07/2012 04:00	6.1	5.8	0.3	82	

RATA Test - Part 75

Plant: MPU Source: S20

Parameter:	S20CPFLO	Unit of Measure:	SCFH
Effective Date/Time:	08/07/2012 11:09	Test Number:	XML (X03-Q3-2012-001) / EDR (1)
Monitoring System ID:	X03	Frequency:	4QTRS
Test Reason:	QA-Periodic Quality Assurance	Test Result:	**Passed**
Overall RA:	5.35	Overall BAF:	1.038
CEMS Time Offset :			
Test Comment:			

Operating Level:	Low	Level BAF:	1.020	APS Indicator:	False	Report in EDR:	Y
Mean CEMS:	3,426,888.889	Relative Accuracy:	3.96	tValue:	2.306	Use BAF:	Y
Mean Reference:	3,496,555.556	Standard Deviation:	89,314.053	Avg Load:	82	Reference Method:	2
Mean Difference:	69,666.667	Confidence Coefficient:	68,652.735				
Flow/Load Ratio:	0.43	CO/O2 RM Used:		Stack Dia:		Default WAF:	
Heat/Load Ratio:	1359	Reference Heat:		Stack Area:		Calculated WAF:	

Run	Started	Ended	Reference Value	CEMS Value	Difference	Load	Use
1	08/06/2012 23:10	08/06/2012 23:20	3,432,000.0	3,480,000.0	-48,000.0	84	Y
2	08/06/2012 23:40	08/06/2012 23:50	3,374,000.0	3,411,000.0	-37,000.0	82	Y
3	08/07/2012 00:10	08/07/2012 00:20	3,570,000.0	3,488,000.0	82,000.0	81	Y
4	08/07/2012 00:40	08/07/2012 00:50	3,511,000.0	3,371,000.0	140,000.0	81	Y
5	08/07/2012 01:10	08/07/2012 01:20	3,482,000.0	3,486,000.0	-4,000.0	82	Y
6	08/07/2012 01:40	08/07/2012 01:50	3,689,000.0	3,373,000.0	316,000.0	82	
7	08/07/2012 02:10	08/07/2012 02:20	3,483,000.0	3,462,000.0	21,000.0	82	Y
8	08/07/2012 02:40	08/07/2012 02:50	3,555,000.0	3,434,000.0	121,000.0	82	Y
9	08/07/2012 03:10	08/07/2012 03:20	3,529,000.0	3,338,000.0	191,000.0	82	Y
10	08/07/2012 03:40	08/07/2012 03:50	3,533,000.0	3,372,000.0	161,000.0	82	Y

RATA Test - Part 75

Plant: MPU Source: S20

Parameter: S20CPFLO
Effective Date/Time: 08/07/2012 11:09
Monitoring System ID: X03
Test Reason: QA-Periodic Quality Assurance
Overall RA: 5.35
CEMS Time Offset :
Test Comment:

Unit of Measure: SCFH
Test Number: XML (X03-Q3-2012-001) / EDR (1)
Frequency: 4QTRS
Test Result: **Passed**
Overall BAF: 1.038

Operating Level: Mid
Mean CEMS: 4,023,777.778
Mean Reference: 4,175,222.222
Mean Difference: 151,444.444

Level BAF: 1.038
Relative Accuracy: 5.35
Standard Deviation: 93,566.969
Confidence Coefficient: 71,921.811

APS Indicator: False
tValue: 2.306
Avg Load: 142

Report in EDR: Y
Use BAF: Y
Reference Method: 2

Flow/Load Ratio: 0.29
Heat/Load Ratio: 1231

CO/O2 RM Used:
Reference Heat:

Stack Dia:
Stack Area:

Default WAF:
Calculated WAF:

Run	Started	Ended	Reference Value	CEMS Value	Difference	Load	Use
1	08/07/2012 05:17	08/07/2012 05:25	4,232,000.0	4,062,000.0	170,000.0	144	Y
2	08/07/2012 05:26	08/07/2012 05:32	4,270,000.0	4,054,000.0	216,000.0	143	Y
3	08/07/2012 05:33	08/07/2012 05:42	4,241,000.0	4,011,000.0	230,000.0	143	Y
4	08/07/2012 06:00	08/07/2012 06:07	4,216,000.0	3,986,000.0	230,000.0	142	Y
5	08/07/2012 06:08	08/07/2012 06:15	4,100,000.0	3,918,000.0	182,000.0	142	Y
6	08/07/2012 06:16	08/07/2012 06:23	4,225,000.0	3,986,000.0	239,000.0	142	Y
7	08/07/2012 06:24	08/07/2012 06:31	4,236,000.0	3,975,000.0	261,000.0	141	
8	08/07/2012 06:32	08/07/2012 06:40	4,152,000.0	4,086,000.0	66,000.0	141	Y
9	08/07/2012 06:41	08/07/2012 06:48	4,045,000.0	4,025,000.0	20,000.0	143	Y
10	08/07/2012 06:49	08/07/2012 06:56	4,096,000.0	4,086,000.0	10,000.0	141	Y

RATA Test - Part 75

Plant: MPU Source: S20

Parameter: S20CPFLO
Effective Date/Time: 08/07/2012 11:09
Monitoring System ID: X03
Test Reason: QA-Periodic Quality Assurance
Overall RA: 5.35
CEMS Time Offset :
Test Comment:

Unit of Measure: SCFH
Test Number: XML (X03-Q3-2012-001) / EDR (1)
Frequency: 4QTRS
Test Result: **Passed**
Overall BAF: 1.038

Operating Level: High
Mean CEMS: 5,326,000.000
Mean Reference: 5,521,666.667
Mean Difference: 195,666.667

Level BAF: 1.037
Relative Accuracy: 4.48
Standard Deviation: 67,046.626
Confidence Coefficient: 51,536.506

APS Indicator: False
tValue: 2.306
Avg Load: 195

Report in EDR: Y
Use BAF: Y
Reference Method: 2

Flow/Load Ratio: 0.28
Heat/Load Ratio: 1293

CO/O2 RM Used:
Reference Heat:

Stack Dia:
Stack Area:

Default WAF:
Calculated WAF:

Run	Started	Ended	Reference Value	CEMS Value	Difference	Load	Use
1	08/07/2012 08:02	08/07/2012 08:09	5,322,000.0	5,138,000.0	184,000.0	193	Y
2	08/07/2012 08:10	08/07/2012 08:16	5,276,000.0	5,099,000.0	177,000.0	194	Y
3	08/07/2012 08:17	08/07/2012 08:24	5,369,000.0	5,288,000.0	81,000.0	195	Y
4	08/07/2012 09:06	08/07/2012 09:13	5,495,000.0	5,386,000.0	109,000.0	202	Y
5	08/07/2012 09:14	08/07/2012 09:20	5,622,000.0	5,357,000.0	265,000.0	193	Y
6	08/07/2012 09:21	08/07/2012 09:29	5,675,000.0	5,474,000.0	201,000.0	193	Y
7	08/07/2012 09:37	08/07/2012 09:45	5,658,000.0	5,444,000.0	214,000.0	196	Y
8	08/07/2012 09:46	08/07/2012 09:52	5,771,000.0	5,452,000.0	319,000.0	196	
9	08/07/2012 09:53	08/07/2012 10:01	5,662,000.0	5,393,000.0	269,000.0	196	Y
10	08/07/2012 10:02	08/07/2012 10:09	5,616,000.0	5,355,000.0	261,000.0	196	Y

RATA Test - Part 75

Plant: MPU Source: S20

Parameter: S20CPNOX
Effective Date/Time: 08/07/2012 05:00
Monitoring System ID: X06
Test Reason: QA-Periodic Quality Assurance
Overall RA: 8.58
CEMS Time Offset :
Test Comment:

Unit of Measure: PPM
Test Number: XML (X06-Q3-2012-001) / EDR (1)
Frequency: 4QTRS
Test Result: **PassAPS**
Overall BAF: 1.078

Operating Level: Low
Mean CEMS: 38.489
Mean Reference: 41.500
Mean Difference: 3.011

Level BAF: 1.078
Relative Accuracy: 8.58
Standard Deviation: 0.715
Confidence Coefficient: 0.550

APS Indicator: True
tValue: 2.306
Avg Load: 82

Report in EDR: Y
Use BAF: Y
Reference Method: 7E

Run	Started	Ended	Reference Value	CEMS Value	Difference	Load	Use
1	08/06/2012 23:10	08/06/2012 23:30	41.5	37.5	4.0	83	Y
2	08/06/2012 23:40	08/07/2012 00:00	43.2	38.7	4.5	82	
3	08/07/2012 00:10	08/07/2012 00:30	42.0	38.1	3.9	82	Y
4	08/07/2012 00:40	08/07/2012 01:00	43.5	39.9	3.6	81	Y
5	08/07/2012 01:10	08/07/2012 01:30	41.7	39.0	2.7	82	Y
6	08/07/2012 01:40	08/07/2012 02:00	39.7	37.2	2.5	82	Y
7	08/07/2012 02:10	08/07/2012 02:30	41.2	39.1	2.1	82	Y
8	08/07/2012 02:40	08/07/2012 03:00	41.9	39.7	2.2	82	Y
9	08/07/2012 03:10	08/07/2012 03:30	42.5	39.7	2.8	81	Y
10	08/07/2012 03:40	08/07/2012 04:00	39.5	36.2	3.3	82	Y

RATA Test - Part 75

Plant: MPU Source: S20

Parameter: S20CPSO2
Effective Date/Time: 08/07/2012 05:00
Monitoring System ID: X01
Test Reason: QA-Periodic Quality Assurance
Overall RA: 8.37
CEMS Time Offset :
Test Comment:

Unit of Measure: PPM
Test Number: XML (X01-Q3-2012-001) / EDR (1)
Frequency: 4QTRS
Test Result: **PassAPS**
Overall BAF: 1.073

Operating Level: Low
Mean CEMS: 79.189
Mean Reference: 84.967
Mean Difference: 5.778

Level BAF: 1.073
Relative Accuracy: 8.37
Standard Deviation: 1.733
Confidence Coefficient: 1.332

APS Indicator: True
tValue: 2.306
Avg Load: 82

Report in EDR: Y
Use BAF: Y
Reference Method: 6C

Run	Started	Ended	Reference Value	CEMS Value	Difference	Load	Use
1	08/06/2012 23:10	08/06/2012 23:30	80.3	78.9	1.4	83	Y
2	08/06/2012 23:40	08/07/2012 00:00	88.5	81.8	6.7	82	Y
3	08/07/2012 00:10	08/07/2012 00:30	85.6	79.0	6.6	82	Y
4	08/07/2012 00:40	08/07/2012 01:00	85.5	78.5	7.0	81	
5	08/07/2012 01:10	08/07/2012 01:30	89.1	82.4	6.7	82	Y
6	08/07/2012 01:40	08/07/2012 02:00	86.3	79.9	6.4	82	Y
7	08/07/2012 02:10	08/07/2012 02:30	82.7	77.2	5.5	82	Y
8	08/07/2012 02:40	08/07/2012 03:00	85.4	79.7	5.7	82	Y
9	08/07/2012 03:10	08/07/2012 03:30	76.7	70.9	5.8	81	Y
10	08/07/2012 03:40	08/07/2012 04:00	90.1	82.9	7.2	82	Y

RATA Test - Part 75

Plant: MPU Source: S20

Parameter:	S20NOX#M	Unit of Measure:	LB/MMBTU
Effective Date/Time:	08/07/2012 05:00	Test Number:	XML (X05-Q3-2012-001) / EDR (1)
Monitoring System ID:	X05	Frequency:	4QTRS
Test Reason:	QA-Periodic Quality Assurance	Test Result:	**Passed**
Overall RA:	6.29	Overall BAF:	1.044
CEMS Time Offset :			
Test Comment:			

Operating Level:	Low	Level BAF:	1.044	APS Indicator:	False	Report in EDR:	Y
Mean CEMS:	0.144	Relative Accuracy:	6.29	tValue:	2.306	Use BAF:	Y
Mean Reference:	0.151	Standard Deviation:	0.004	Avg Load:	82	Reference Method:	7E,3A
Mean Difference:	0.006	Confidence Coefficient:	0.003				

Run	Started	Ended	Reference Value	CEMS Value	Difference	Load	Use
1	08/06/2012 23:10	08/06/2012 23:30	0.153	0.138	0.015	83	Y
2	08/06/2012 23:40	08/07/2012 00:00	0.157	0.145	0.012	82	
3	08/07/2012 00:10	08/07/2012 00:30	0.152	0.142	0.010	82	Y
4	08/07/2012 00:40	08/07/2012 01:00	0.160	0.152	0.008	81	Y
5	08/07/2012 01:10	08/07/2012 01:30	0.151	0.147	0.004	82	Y
6	08/07/2012 01:40	08/07/2012 02:00	0.141	0.137	0.004	82	Y
7	08/07/2012 02:10	08/07/2012 02:30	0.148	0.146	0.002	82	Y
8	08/07/2012 02:40	08/07/2012 03:00	0.153	0.150	0.003	82	Y
9	08/07/2012 03:10	08/07/2012 03:30	0.156	0.151	0.005	81	Y
10	08/07/2012 03:40	08/07/2012 04:00	0.143	0.137	0.006	82	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.

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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:

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

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 1L Run 1
Sample Calculations

LB/mmBtu

Calculator		Equations - CFR 40, Part 60,Method 19
SO2 : Calculator		**SO2 : Equations**
SO2 ppm,w =	80.3	*19-7* Using the wet SO2 and CO2 numbers.
CO2 %,w =	5.98	Fc * 0.000000002595 * 64 *100 * SO2 ppm (wet) /CO2 % (wet)
F-factor (Fc) =	1839	
lb/million Btu =	0.41012234	
NOx : Calculator		**NOx : Equations**
NOx ppm,w =	41.5	*19-7* Using wet NOx and CO2 numbers:
CO2 %,w =	5.98	Fc * 0.000000002595 * 46 * 100 * NOx ppm (wet)/ CO2 % (wet)
F-factor (Fc) =	1839	
lb/million Btu =	0.152343467	

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APPENDIX K

AETB REQUIREMENTS

Interpoll Laboratories, Inc.
4500 Ball Road NE
Circle Pines, MN 55014-1819
Tel: 763-786-6020
Fax: 763-786-7854
www.interpoll-labs.com

September 11, 2012

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

Re: Part 75 Air Emission Testing Body Requirements

Mr. Reed

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

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

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

Regards,

Daniel Despen
President
Interpoll Laboratories, Inc.

AN EQUAL OPPORTUNITY EMPLOYER

Stack Vision Entry Requirements

Required AETB Data Per Part 75

Field	Entry	Description
QI Last Name	Eiynck	Required-Qualified Individual's last name
QI First Name	Rory	Required-Qualified Individual's first name
QI Middle Initial	R.	Required-Qualified Individual's middle initial
AETB Name	Interpoll Laboratories, Inc.	Required-The AETB company whom the Qualified Individual represents.
AETB Phone Number	763-786-6020	Required-AETB company phone number.
AETB Email	stack@interpoll-labs.com	Required-AETB company email address or the email address of the qualified individual.
Exam Date	2/22/2012	Required-Date the Qualified Individual completed the AETB exam that certifies this person to conduct RATA tests.
Exam Provider Name	Source Evaluation Society	Required-Name of the agency who provided the exam
Exam Provider Email	qstiprogram@gmail.com	Required-Email address for the agency who provided the exam.
Comment		Optional field for additional comments.

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

MPU01160

SOURCE EVALUATION SOCIETY

Qualified Source Testing Individual

LET IT BE KNOWN THAT

RORY R. EIYNCK

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

GASEOUS POLLUTANTS INSTRUMENTAL SAMPLING METHODS

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

Peter R. Westlin, QSTI/QSTO Review Board

C. David Bagwell, QSTI/QSTO Review Board

Peter S. Pakalnis, QSTI/QSTO Review Board

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

LeRoy Owens, QSTI/QSTO Review Board

Glenn C. England, QSTI/QSTO Review Board

APPLICATION NO. 2012-646

MPU01161

SOURCE EVALUATION SOCIETY

Qualified Source Testing Individual

LET IT BE KNOWN THAT

RORY R. EIYNCK

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

MANUAL GAS VOLUME MEASUREMENTS AND ISOKINETIC PARTICULATE SAMPLING METHODS

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

Peter R. Westlin, QSTI/QSTO Review Board

C. David Bagwell, QSTI/QSTO Review Board

Peter S. Pakalnis, QSTI/QSTO Review Board

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

LeRoy Owens, QSTI/QSTO Review Board

Glenn C. England, QSTI/QSTO Review Board

APPLICATION NO. 2012-646

MPU01162