LOKEE TESTING Laboratory

United States
Environmental Protection Agency
Wood Heater Certification Test Report

Jotul North America

F 50 TL

Volume 1 of 1

13235 Prairie Circle East, Bonney Lake, Washington 98391-7250
Telephone: 360-897-9685

United States
Environmental Protection Agency
Wood Heater Certification Test Report

Jotul North America
55 Hutcherson Drive
Gorham, ME 04038
F 50 TL
Volume 1 of 1

Report By:

Chip Wadington

CONFIDENTIAL

RELEASED ONLY BY
AUTHORIZED PERSONNEL

09/13/2010

TABLE OF CONTENTS

PAGE NUMBER INDEX

M-5H INDIVIDUAL TEST RUN PAGE INDEX

The data sheets in the individual test runs are organized in the following sequence:

A. Computer Printouts

Table 1	Field Data
Table 2	Field Data
Table 3	Field Data Averages
Table 4	Calculations
Table 5	Proportional Rate Variation

B. Raw Data Sheets

		No. of Pages
Data Sheet # 1	Computer Input Data	1
Data Sheet # 2	Meter box Data Sheets	variable
Data Sheet # 3	Moisture /Pariculate Catch Processing Sheet (Front Half, Back Half)	1
Data Sheet # 4-1	Initial Filter Weights	variable
# 4-2	Initial Beaker Weights	variable
# 4-3	Constant Weights	variable
# 4-4	Scale QA Checks	variable
Data Sheet # 5	Blank Catch	1
Data Sheet # 6	Net Particulate Catch Calc Sheet	1
Data Sheet # 7	Particulate Calc Sheet	1
Data Sheet # 8	Miscellaneous Test Data	1
Data Sheet # 9	Stove Operating Data	1
Data Sheet # 10	Fuel Moisture	1
Data Sheet # 11	Wood Density	1
Data Sheet # 12	Burn Rate And Flue Gas Data	variable
Data Sheet # 13	Pre Burn Data	variable
Data Sheet # 14	Temperature Data	variable
Data Sheet # 15	Pre and Post test Zero/Span Audits	1
# 15-1	CO_2	1
# 15-2	O_2	1
# 15-3	CO	1
# 15-4	SO_2	1
Data Sheet # 16	Quality Checks	1

TEST SERIES INFORMATION

Unit name and model number: F 50 TL

Type of unit: Wood Heater

Manufacturer: Jotul North America
Address: 55 Hutcherson Drive
Gorham, ME 04038

Contact: Roger Purinton
Phone Number: 1-207-591-6621
Fax Number: 1-207-772-0523

Observers: None

Date Received: 5-2010 Aged:7/5/2010 Dates Tested: 8/26-31/2010

Tested by: LoKee Testing Lab using EPA Methods 28, 28A and 5H where applicable.

Test Location: 13235 Prairie Circle East
Bonney Lake, WA 98391
Test Site Elevation: 627 feet above sea level

LoKee's Field Team

Team Members: Chip Wadington
Armando Vedoy

The following pages contain (1) test unit storage information, (2) a diagram showing the height and location of the stack components and sampling ports, and (3) copies of the certification test notices and cancellations sent to the EPA.

STOVE STORAGE INFORMATION

1. **Temporary Storage at LoKee**

   A single, steel, banding strap is place around the unit, preventing opening of the loading door.

2. **Permanent Storage**

   After certification is granted, additional banding is placed both horizontally and vertically around the unit to prevent access to the interior of the unit. An address label is then taped over the intersecting bands to act as a seal. Warning labels are affixed on the unit. The unit is then shipped via common carrier to the manufacturer's designated storage facility unless otherwise noted. A sample of the warning label follows.

WARNING

SEALED EPA TEST UNIT

DO NOT TAMPER WITH SEALS
TO DO SO WILL VOID CERTIFICATION

JOTUL NORTH AMERICA
F 50 TL

LOKEE TESTING Laboratory

13235 PRAIRIE CIRCLE EAST, BONNEY LAKE, WA 98391
TELEPHONE: 360-897-9685

August 26, 2010

Mr. John Dupree
Federal Programs Section
U.S. EPA
Stationary Source Compliance Division
Mail Code 2223A Room #7124
1200 Pennsylvania Avenue NW
Washington, DC 20460

Mr. Dupree:

This is a request to waive the 30 notification for testing in order run certification tests on the:

Jotul North America:
Model:F 50 TL

If you have any questions please feel free to call.

Sincerely,

Chip Wadington
Owner

LOKEE TESTING Laboratory

13235 Prairie Circle East, Bonney Lake, WA 98391
Telephone: 360-897-9685

August 26, 2010

Mr. John Dupree
Federal Programs Section
U.S. EPA
Stationary Source Compliance Division
Mail Code 2223A Room #7138
1200 Pennsylvania Avenue NW
Washington, DC 20460

Mr. Dupree:

On August 26, 2010 at 10:00 am PST, John Dupree waived the 30 day intent to certify notice at the request of LoKee Testing Laboratory in order to run certification tests on the:

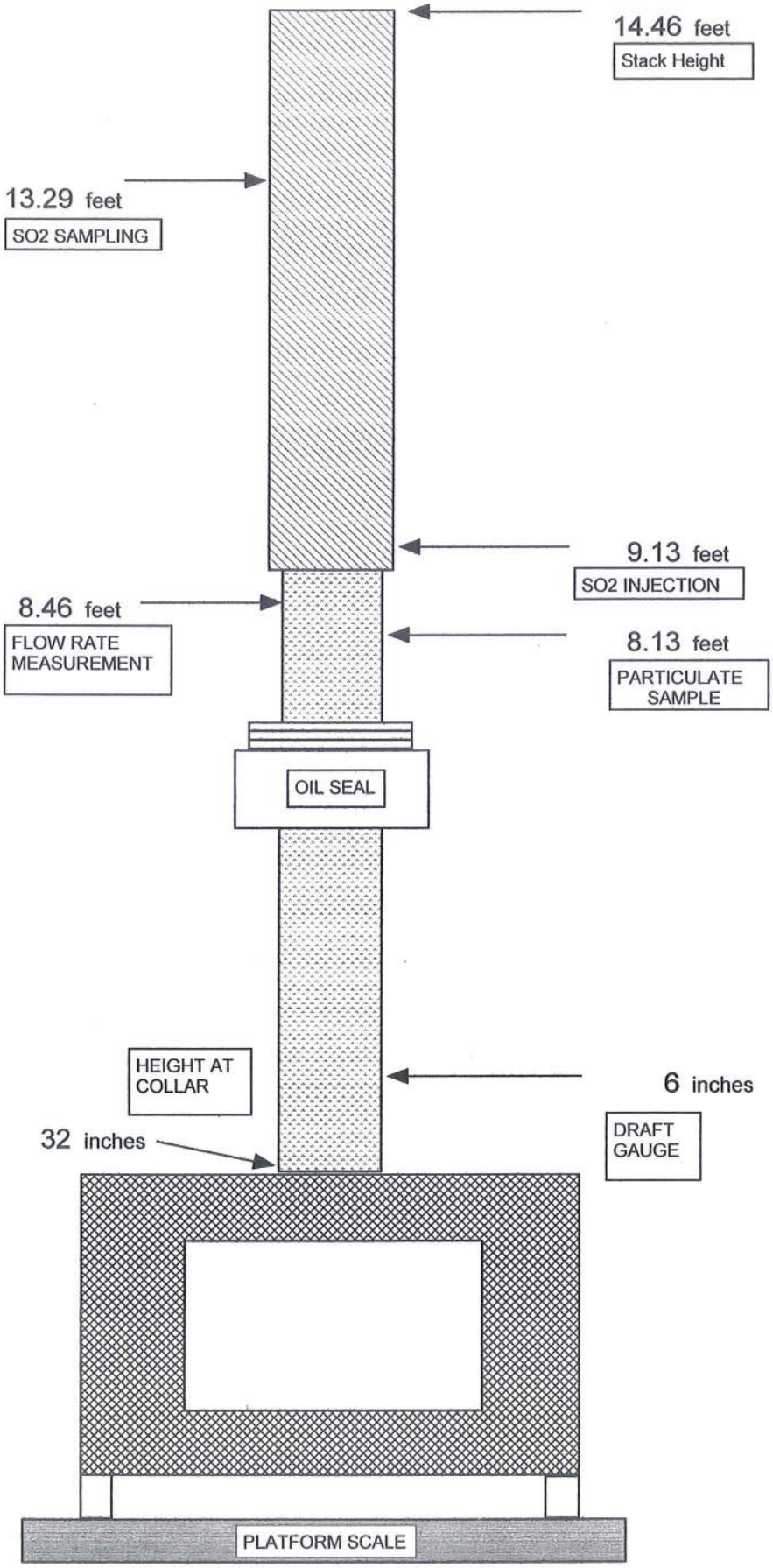
Jotul North America :
Model: F 50 TL

If you have any questions please feel free to call.

Sincerely,

Chip Wadington
Owner

Model: Jotul F 50 TL **Date:** 08/26/10



AGING DATA SHEET

UNIT : Jotul DATE: 7-5-10

Hr #	DATE	TIME	TEMP Stuck 1	TEMP Top 2
1	7-5-10	1000	608	634
2	"	1100	331	502
3	"	1200	184	303
4	"	1300	314	535
5	"	1400	243	434
6	"	1500	188	321
7	"	1600	174	291
8	"	1700	162	251
9	7-6-10	1000	379	429
10	"	1100	514	619
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				

Hr #	DATE	TIME	TEMP 1	TEMP 2
26				
27				
28				
29				
30				
31				
32				
33				
34				
35				
36				
37				
38				
39				
40				
41				
42				
43				
44				
45				
46				
47				
48				
49				
50				

COMMENTS:

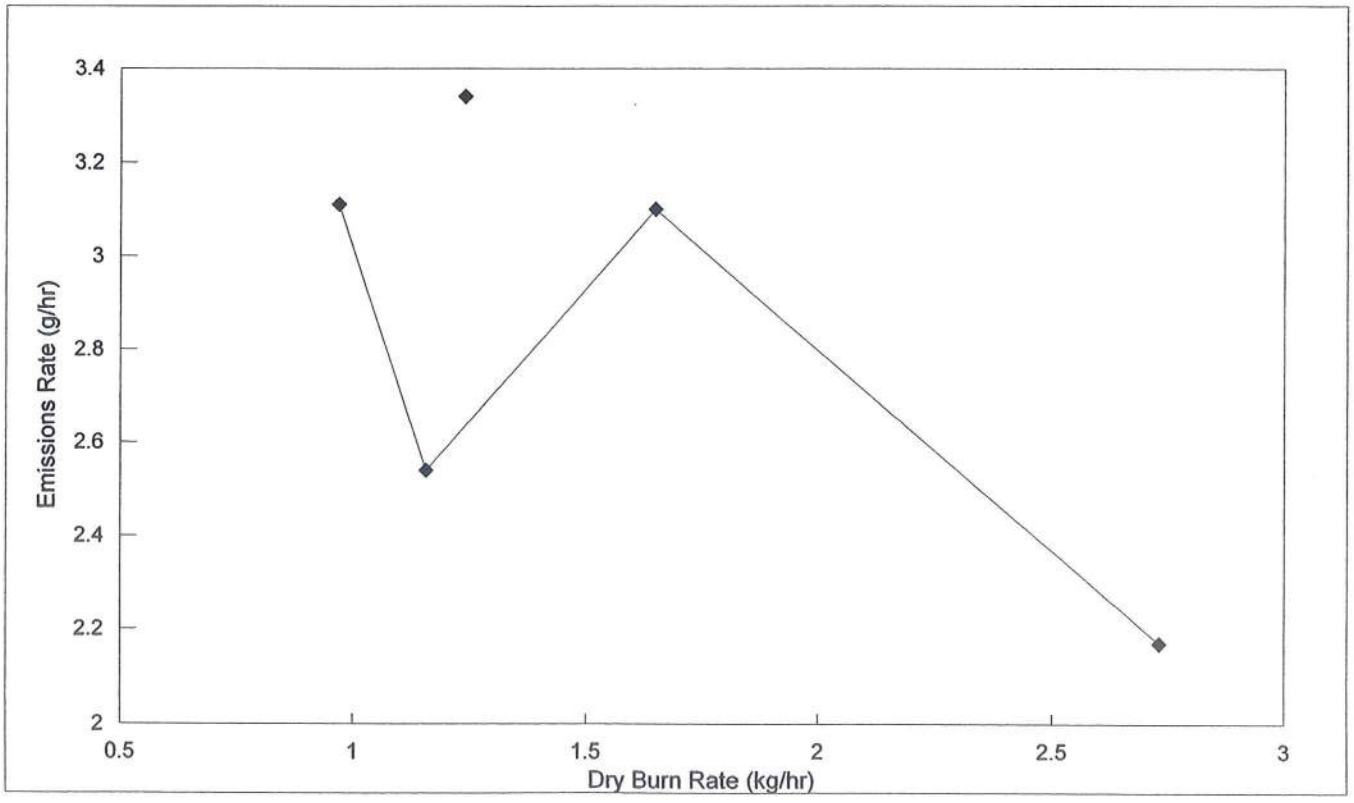
Data Summary

Wood Heater Emission Test Summary

Laboratory/Wood Heater Information

Stove Manufacturer:	**Jotul**
Model Identification:	**F 50 TL**
Stove Type> 1=cat, 2=noncat, 3=pellet:	**2**
Laboratory Name:	**LoKee Testing**
Laboratory Contact:	**CHIP WADINGTON**
Telephone no.:	**360-897-9685**
Test Dates:	**8/26-31/2010**
Test Methods Used	
Method 28/Other:	**28**
Sampling Method:	**5H**

Run no.	Burn Rate (kg/hr)	Emission Rate (g/hr)	Heat Output (Btu/hr)	Wtd Avg (g/hr) 2.84
2	0.970	3.11	11696	
4	1.157	2.54	13951	
3	1.649	3.10	19884	
1	2.730	2.17	32919	
			NA	
			NA	
			NA	
5	1.24	3.34	14952	



DATA SUMMARY

Unit: Jotul North America – Model: F 50 TL

	RUN #	2	4	3	1	FAN 5			
Particulate Emissions:									
Concentration:	grains/dscf:	.1133	.0780	.0752	.0365	.0869			
Emissions Rate	grams/hr:	3.11	2.54	3.10	2.17	3.34			
Emissions Factor	grams/kg:	3.20	2.19	1.88	0.80	2.70			
Front Half Catch	% of total	35.8	30.7	28.6	45.5	25.4			
Total Mass Captured	total catch:	.7665	.4970	.3279	.0937	.5811			
Heat Output (EPA Default):	BTU/hr	11732.6	13951.3	19884	32882.7	14952.2			
Fuel Burn Rates:									
Average kg/hr (dry)	Kg/hr	0.97	1.157	1.649	2.73	1.24			
Fuel Moisture Content:									
Kindling (wet basis)	%	13.219	13.345	13.219	12.434	11.739			
Pretest Fuel (wet basis)	%	17.012	17.236	16.897	16.295	16.458			
Test Fuel (wet basis)	%	16.759	17.024	16.143	16.516	16.667			
Air to Fuel Ratio		-	-	-	-	-			
Average Stack Gas									
Avg CO_2	%	5.61	5.59	6.94	9.09	6.07			
Avg O_2	%	-	-	-	-	-			
Avg CO	%	1.32	1.38	1.07	0.27	.97			
Avg Moisture	%	7.19							
Avg Stack Gas Emissions:									
CO	g/Kg	193.31	201.12	138.42	30.16	140.27			
	g/hr	188.09	232.70	228.25	82.24	173.94			

Unit: Jotul North America – Model: F 50 TL

	RUN #	2	4	3	1	5			
Avg Stack Gas Flow Rate									
EPA CMB	dscfm	7.07	8.37	10.61	15.33	8.90			
Tracer Gas	dscfm	7.188	7.452	10.476	10.313	8.427			
Draft (static)	in H_2O	-.038	-.040	-.048	-.057	-.040			
Proportionality Average	%	100	100	100	100	100	100	100	100
Average Temperatures									
Stack Gas	°F	225	245	307	457	257			
Firebox	°F	-	-	-	-	-			
Secondary	°F	-	-	-	-	-			
Catalytic Combustor	°F	-	-	-	-	-			
Top	°F	322	329	393	498	348			
Left Side	°F	430	448	539	695	469			
Back	°F	333	319	389	452	376			
Right Side	°F	373	387	462	610	402			
Bottom	°F	294	307	353	419	308			
Temperature Change	°F	-119.6	-118.5	-87.3	-99.6	-68.1			
Test Chamber Enviroment									
Average Barometer	in. Hg	30.00	30.00	30.06	29.92	30.07			
Average Temperature	°F	74	71	74	89	74			
Ambient Moisture	% H_2O	1.35	1.20	1.30	1.85	1.55			
Relative Humidity	%RH	46.0	44.5	42.0	42.0	59.0			
Air Velocity	m/sec	0	0	0	0	0	0	0	0
Fuel Weight and Burn Time									
Density (dry basis)	gm/cm^3	-	-	-	-	-			
Coal Bed Weight	lbs	3.8	4.0	3.7	4.2	4.3			
Pre Test Fuel (inc kindling)	lbs	40.2	43.4	43.5	43.7	45.9			
Test Fuel	lbs	17.4	16.9	17.7	17.4	17.5			
Burn Time	min	405	330	245	145	320			

TABLE 1 ----- RAW DATA

CLIENT : Jotul TEST No. : 2

MODEL: Top Load DATE: 26-Aug-10

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	3.500	0.150	77	1.12	3.50	450
5	5.000	0.470	78	0.42	7.20	250
10	7.745	0.160	78	0.39	2.10	425
15	9.362	0.160	79	0.32	2.40	425
20	10.986	0.160	79	0.37	2.80	425
25	12.609	0.140	79	0.42	3.00	450
30	14.142	0.140	79	0.52	2.90	450
35	15.676	0.160	79	0.46	7.50	425
40	17.299	0.140	79	0.53	6.00	450
45	18.832	0.210	79	0.35	8.60	375
50	20.671	0.180	79	0.24	8.60	400
55	22.396	0.180	79	0.27	8.10	400
60	24.121	0.180	79	0.30	8.00	400
65	25.845	0.180	79	0.32	8.20	400
70	27.570	0.180	79	0.36	7.70	400
75	29.294	0.180	79	0.42	7.50	400
80	31.019	0.210	79	0.37	8.30	375
85	32.858	0.210	79	0.36	8.40	375
90	34.698	0.210	79	0.30	8.60	375
95	36.537	0.240	79	0.12	9.70	350
100	38.507	0.210	79	0.15	9.70	375
105	40.347	0.180	79	0.10	9.70	400
110	42.071	0.180	79	0.13	10.30	400
115	43.796	0.180	79	0.06	11.00	400
120	45.520	0.180	79	0.04	11.60	400
125	47.245	0.180	79	0.04	11.10	400
130	48.969	0.180	80	0.04	11.20	400
135	50.700	0.160	80	0.17	8.90	425
140	52.330	0.120	80	0.52	7.00	500
145	53.715	0.110	80	0.72	6.60	525
150	55.034	0.100	80	0.84	6.50	550
155	56.294	0.100	80	0.87	6.60	550
160	57.553	0.100	80	1.09	6.30	550
165	58.813	0.100	80	1.17	6.20	550
170	60.072	0.100	80	1.22	6.00	550
175	61.331	0.100	80	1.26	5.90	550

180	62.591	0.100	80	1.51	5.30	550
185	63.850	0.100	80	1.80	5.10	550
190	65.110	0.100	80	2.02	4.80	550
195	66.369	0.100	80	2.13	4.80	550
200	67.628	0.110	80	2.19	4.80	525
205	68.948	0.110	80	1.82	5.20	525
210	70.267	0.100	80	2.02	5.10	550
215	71.526	0.100	80	2.09	5.00	550
220	72.786	0.100	80	2.13	4.70	550
225	74.045	0.100	80	2.14	4.70	550
230	75.304	0.100	80	2.13	4.60	550
235	76.564	0.100	80	2.05	4.70	550
240	77.829	0.080	80	2.02	4.70	600
245	78.978	0.070	80	1.96	4.70	625
250	80.086	0.080	80	1.95	4.70	600
255	81.241	0.100	80	2.03	4.60	550
260	82.500	0.100	80	1.93	4.50	550
265	83.760	0.110	80	2.02	4.10	525
270	85.079	0.110	80	1.97	4.00	525
275	86.398	0.110	80	1.57	4.40	525
280	87.718	0.110	80	1.73	4.30	525
285	89.037	0.110	80	1.67	4.30	525
290	90.356	0.110	80	1.70	4.30	525
295	91.675	0.110	80	1.49	4.70	525
300	92.995	0.110	80	1.64	4.60	525
305	94.314	0.110	80	1.82	4.60	525
310	95.633	0.110	80	1.96	4.30	525
315	96.953	0.110	80	1.73	3.90	525
320	98.272	0.110	80	1.75	3.90	525
325	99.591	0.100	80	1.86	4.00	550
330	100.851	0.100	80	1.95	4.00	550
335	102.110	0.100	80	1.93	4.00	550
340	103.369	0.100	80	2.01	3.90	550
345	104.629	0.100	80	2.05	3.90	550
350	105.888	0.100	80	2.15	3.80	550
355	107.148	0.100	80	2.38	3.70	550
360	108.407	0.100	80	2.47	3.60	550
365	109.666	0.100	80	2.58	3.70	550
370	110.926	0.100	80	2.64	3.70	550
375	112.185	0.100	80	2.57	3.70	550
380	113.445	0.100	80	2.22	3.80	550
385	114.704	0.100	80	2.16	3.70	550
390	115.963	0.100	80	1.97	3.60	550
395	117.223	0.100	80	2.09	3.40	550
400	118.482	0.100	80	2.09	3.40	550
405	119.742	0.100	80	2.03	3.30	550

TABLE 2---RAW DATA

CLIENT : Jotul TEST No. 2

MODEL: Top Load DATE: 26-Aug-10

METER CAL. FACTOR (Y)	-------	0.916	Wt. WOOD BURNED(LB)	-------	17.4 Lbs
BAROMETRIC PRESS.(Pb)	-------	30 in Hg	WET,FUEL MOISTURE %	-------	16.759 %
LEAK RATE POST (Lp)	-------	0.011 cfm	Wt. PART. COLLECTED	-------	0.7665 g
WATER VOL. (V1c)	-------	172 Ml	METER VOLUME Vm	-------	116.242 mcf
TEST TIME (MIN)	-------	405 min	HC MOLE FRACTION	-------	0.0132

TABLE 3 -----FIELD DATA AVERAGES

CLIENT : Jotul TEST No. 2

MODEL: Top Load DATE: 26-Aug-10

****

AVG DELTA H	-------	0.13	in H2O	AVG PRCNT CO	-------	1.32	%
AVG METER TEMP. Tm	-------	80	deg F	AVG PRCNT CO2	-------	5.61	%
AVG PPM SO2	-------	496	PPM	AVG BAL CO2/CO	-------	4.24	%

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul TEST No. 2

MODEL: Top Load DATE: 26-Aug-10

STD SAMPLE VOL. Vm(std) d) ------	104.51 dscf	STACK GAS FLOW Qsd -------	424.491	dscf/Hr	
			7.07	& dscf/min	
VOL. WATER VAPOR Vw(s td) -----	8.096 scf	PARTICULATE CONCTRT. C s ------	0.0073	g/dscf	
PRCNT MSTR Bws -------	7.19 %	PARTC.EMISS. RATE E -------	3.11	g/Hr	
BURN RATE BR -------	0.97 Kg/Hr	MOLES OF GAS PER Lb WOOD Nt ----	0.51	Lb-mole/Lb	
CO EMISSION RATE -------	188.09 g/Hr & 193.31 g/Kgdry fuel	PART.EMISS. RATE ------	3.20	g/Kgdry fuel	

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Jotul TEST No. : 2

MODEL: Top Load DATE: 26-Aug-10

TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR	PROPRTN RATE VAR. AVERAGE
5	609.3	98	100
10	619.4	100	
15	619.2	100	
20	621.3	100	
25	620.9	100	
30	621.0	100	
35	621.4	100	
40	620.9	100	
45	621.0	100	
50	620.9	100	
55	621.2	100	
60	621.2	100	
65	620.8	100	
70	621.2	100	
75	620.8	100	
80	621.2	100	
85	620.9	100	
90	621.2	100	
95	620.9	100	
100	620.8	100	
105	621.2	100	
110	620.8	100	
115	621.2	100	
120	620.8	100	
125	621.2	100	
130	620.2	100	
135	622.2	100	
140	622.5	100	
145	622.2	100	
150	622.1	100	
155	622.6	100	
160	622.1	100	
165	622.6	100	
170	622.1	100	
175	622.1	100	
180	622.6	100	

185	622.1	100
190	622.6	100
195	622.1	100
200	622.1	100
205	622.6	100
210	622.1	100
215	622.1	100
220	622.6	100
225	622.1	100
230	622.1	100
235	622.6	100
240	625.1	101
245	619.3	100
250	622.1	100
255	622.6	100
260	622.1	100
265	622.6	100
270	622.1	100
275	622.1	100
280	622.6	100
285	622.1	100
290	622.1	100
295	622.1	100
300	622.6	100
305	622.1	100
310	622.1	100
315	622.6	100
320	622.1	100
325	622.1	100
330	622.6	100
335	622.1	100
340	622.1	100
345	622.6	100
350	622.1	100
355	622.6	100
360	622.1	100
365	622.1	100
370	622.6	100
375	622.1	100
380	622.6	100
385	622.1	100
390	622.1	100
395	622.6	100
400	622.1	100
405	622.6	100

COMPUTER INPUT DATA SHEET #1

Client: Total North America

Address: 55 Hutcherson

Gorham ME 04038

3.11

Phone: 1-800-797-5912 Fax:

Run No.: 2 Date of Test: 8-26-2010 Burn Rate: .973

Model No.: Top Loader ☒ min ☐ min-1.25 ☐ fan

Stove Type: ☐ Cat ☒ Non Cat ☐ Pellet ☐ 1.25-1.9 ☐ max ☐ insert

Dry Gas Meter Y Factor: .916 (0.000) (Data Sheet #2) Post Leak Rate: .011 cfm (.000) (Data Sheet #2) Time: 405 min. (000) (Data Sheet #2)

Dry Gas Meter Volume: 116.242 cf (00.000) (Data Sheet #2)

Stack Flow: 7,188 dscfm (00.000) (Data Sheet #2) Δ H: .132 in. H_2O (.000) (Data Sheet #2)

Maximum Vac.: 3.0 (0.0) (Data Sheet #2) Barometric Pressure: 30.00 in. Hg (00.00) (Data Sheet #2)

H_2O Captured: 172.0 g (00.0) (Data Sheet #3)

Front Half Catch % Of Total: 35.3 % (00.0) (Data Sheet #6) Total Particulate Catch: .7665 g (0.0000) (Data Sheet #6)

Flue Gas Moisture: 7,1979 % (00.000) (Data Sheet #7)

Particulate Emission: .1133 gr/dscf (0.0000) (Data Sheet #7)

Relative Humidity: 46.0 % RH (00.0) (Data Sheet #8) Ambient Moisture: 1.35 % H_2O (0.00) (Data Sheet #8)

Preburn Fuel Wt.: 40.2 lbs. (00.0) (Data Sheet #8) Coal Bed Wt.: 3.8 lbs. (00.0) (Data sheet #8) Test Fuel Wt.: 17.4 lbs. (00.0) (Data sheet #8)

Heat Output (EPA Default): 11732.6 BTU/hr (00,000.0) (Data Sheet #8)

Kindling Fuel % Moisture (wet): 13.219 % (00.000) (Data Sheet #10) Pretest Fuel % Moisture (wet): 17.012 % (00.000) (Data Sheet #10)

Test Fuel % Moisture (dry): 20.153 % (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove]) Test Fuel % Moisture (wet): 16.759 %

Fuel Higher Heating Value (dry): N/A BTU/lb. (0000) (Data Sheet #11)

Stack Static Pressure: -.038 in. H_2O (+/-.000) (Data Sheet #12)

Average Ambient Temperature: 74 °F (00) (Data Sheet #14) Stove Temperature Change: -119.6 °F (+/- 000.0) (Data Sheet #14)

Time start 1035

End 1720

Meter Temp 540

METER BOX DATA SHEET PAGE # 2

Page: 1 of 4

UNIT: Jstol TL RUN: 2 DATE: 8-26-2010

Meter Box: 5H Y Factor: .916

Leak checks: 15 " Hg @ .005 cfm _____ " Hg @ _____ cfm

15 " Hg @ .011 cfm _____ " Hg @ _____ cfm

Inject SO^2 @ 100 cc/min. Nozzle: Probe @ 3/8 " od Initial Volume: 1.500

ROTO: PRESS: .18			SAMPLING RATIO: 26 : 1				BP: 30.00		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1035	3.500	———	7.742	.15	77	450	77	2.0
5	40	5.000	———	13.909	.47	78	250	78	3.0
10	45	7.745	7.745	8.182	.16	78	425	78	2.0
15	50	9.362	9.362	8.166	.16	79	425	79	2.0
20	55	10.986	10.986	8.166	.16	79	425	79	2.0
25	1100	12.609	12.609	7.713	.14	79	450	79	2.0
30	05	14.142	14.142	7.713	.14	79	450	79	2.0
35	10	15.676	15.676	8.166	.16	79	425	79	2.0
40	15	17.299	17.299	7.713	.14	79	450	79	2.0
45	20	18.832	18.832	9.255	.21	79	375	79	2.0
50	25	20.671	20.671	8.677	.18	79	400	79	2.0
55	30	22.396	22.396	8.677	.18	79	400	79	2.0
ROTO PRESS: .18			TOTALS:	104.079	2.25	944	BP.: 30.00		
60	1135	24.121	24.121	8.677	.18	79	400	79	2.0
65	40	25.845	25.845	8.677	.18	79	400	79	2.0
70	45	27.570	27.570	8.677	.18	79	400	79	2.0
75	50	29.294	29.294	8.677	.18	79	400	79	2.0
80	55	31.019	31.019	9.255	.21	79	375	79	2.0
85	1200	32.858	32.858	9.255	.21	79	375	79	2.0
90	05	34.698	34.698	9.255	.21	79	375	79	2.0
95	10	36.537	36.537	9.916	.24	79	350	79	2.0
100	15	38.507	38.507	9.255	.21	79	375	79	2.0
105	20	40.347	40.347	8.677	.18	79	400	79	2.0
110	25	42.071	42.071	8.677	.18	79	400	79	2.0
115	30	43.796	43.796	8.677	.18	79	400	79	2.0
			TOTALS:	107.475	2.34	948	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	211.754	4.59	1892	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 2 of 4

UNIT: Jotul TL RUN: 2 DATE: 8-26-2010

Meter Box: SH Y Factor: .916

Leak checks: 15 " Hg @ 1005 cfm _____ " Hg @ _____ cfm

15 " Hg @ .011 cfm _____ " Hg @ _____ cfm

Inject SO^2 @ 100 cc/min. Nozzle : Probe @ 3/8 " od Initial Volume: 1,500

ROTO: PRESS: 14 SAMPLING RATIO: QL : 1 BP: 30.00

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1235	45.520	45.520	8.677	.18	79	400	79	2.0
125	40	47.245	47.245	8.677	.18	79	400	79	2.0
130	45	48.969	48.969	8.661	.18	80	400	80	2.0
135	50	50.700	50.700	8.151	.16	80	425	80	2.0
140	55	52.330	52.330	6.929	.12	80	500	80	2.0
145	1300	53.715	53.715	6.599	.11	80	525	80	2.0
150	05	55.034	55.034	6.299	.10	80	550	80	2.0
155	10	56.294	56.294	6.299	.10	80	550	80	2.0
160	15	57.553	57.553	6.299	.10	80	550	80	2.0
165	20	58.813	58.813	6.299	.10	80	550	80	2.0
170	25	60.072	60.072	6.299	.10	80	550	80	2.0
175	30	61.331	61.331	6.299	.10	80	550	80	2.0
ROTO PRESS:			TOTALS:	85.488	1.53	958	BP.: 30.00		
180	1335	62.591	62.591	6.299	.10	80	550	80	2.0
185	40	63.850	63.850	6.299	.10	80	550	80	2.0
190	45	65.110	65.110	6.299	.10	80	550	80	2.0
195	50	66.369	66.369	6.299	.10	80	550	80	2.0
200	55	67.628	67.628	6.599	.11	80	525	80	2.0
205	1400	68.948	68.948	6.599	.11	80	525	80	2.0
210	05	70.267	70.267	6.299	.10	80	550	80	2.0
215	10	71.526	71.526	6.299	.10	80	550	80	2.0
220	15	72.786	72.786	6.299	.10	80	550	80	2.0
225	20	74.045	74.045	6.299	.10	80	550	80	2.0
230	25	75.304	75.304	6.299	.10	80	550	80	2.0
235	30	76.564	76.564	6.299	.10	80	550	80	2.0
			TOTALS:	76.188	1.22	960	MAX VACC =		
TOTAL Cu Ft			TOTALS:	161.676	2.75	1918	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 3 of 4

UNIT: Jetol TL RUN: 2 DATE: 8-26-2010

Meter Box: SH Y Factor: .916

Leak checks: 15 " Hg @ .005 cfm _____ " Hg @ _____ cfm

15 " Hg @ .011 cfm _____ " Hg @ _____ cfm

Inject SO^2 @ 100 cc/min. Nozzle: Probe @ 3/8 " od Initial Volume: 1,500

ROTO: PRESS: .18			SAMPLING RATIO: 26 : 1				BP: 30.00		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
240	1435	77.823	77.823	5,774	.08	80	600	80	2.0
245	40	78.978	78.978	5,543	.07	80	625	80	2.0
250	45	80.086	80.086	5,774	.08	80	600	80	2.0
255	50	81.241	81.241	6,299	.10	80	550	80	2.0
260	55	82.500	82.500	6,299	.10	80	550	80	2.0
265	1500	83.760	83.760	6,599	.11	80	525	80	2.0
270	05	85.079	85.079	6,599	.11	80	525	80	2.0
275	10	86.398	86.398	6,599	.11	80	525	80	2.0
280	15	87.718	87.718	6,599	.11	80	525	80	2.0
285	20	89.037	89.037	6,599	.11	80	525	80	2.0
290	25	90.356	90.356	6,599	.11	80	525	80	2.0
295	30	91.675	91.675	6,599	.11	80	525	80	2.0
ROTO PRESS: .18			TOTALS:	75,882	1.20	960	BP.: 30.00		
300	1535	92.995	92.995	6,599	.11	80	525	80	2.0
305	40	94.314	94.314	6,599	.11	80	525	80	2.0
310	45	95.633	95.633	6,599	.11	80	525	80	2.0
315	50	96.953	96.953	6,599	.11	80	525	80	2.0
320	55	98.272	98.272	6,599	.11	80	525	80	2.0
325	1600	99.591	99.591	6,299	.10	80	550	80	2.0
330	05	100.851	100.851	6,299	.10	80	550	80	2.0
335	10	102.110	102.110	6,299	.10	80	550	80	2.0
340	15	103.369	103.369	6,299	.10	80	550	80	2.0
345	20	104.629	104.629	6,299	.10	80	550	80	2.0
350	25	105.888	105.888	6,299	.10	80	550	80	2.0
355	30	107.148	107.148	6,299	.10	80	550	80	2.0
			TOTALS:	77,088	1.25	960	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	152,970	2.45	1920	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 4 of 4

UNIT: Jotul TL RUN: 2 DATE: 8-26 2010

Meter Box: 5H Y Factor: .916

Leak checks: 15 " Hg @ .005 cfm _____ " Hg @ _____ cfm

15 " Hg @ .011 cfm _____ " Hg @ _____ cfm

Inject SO^2 @ 100 cc/min. Nozzle: Probe @ 3/8 " od Initial Volume: 1.500

ROTO: PRESS: .18 SAMPLING RATIO: 26 : 1 BP: 30.00

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
360	1135	108.407	108.407	6.299	.10	80	550	80	2.0
365	40	109.666	109.666	6.299	.10	80	550	80	2.0
370	45	110.926	110.926	6.299	.10	80	550	80	2.0
375	50	112.185	112.185	6.299	.10	80	550	80	2.0
380	55	113.445	113.445	6.299	.10	80	550	80	2.0
385	1100	114.704	114.704	6.299	.10	80	550	80	2.0
390	05	115.963	115.963	6.299	.10	80	550	80	2.0
395	10	117.223	117.223	6.299	.10	80	550	80	2.0
400	15	118.482	118.482	6.299	.10	80	550	80	2.0
405	20	119.742	119.742	6.299	.10	80	550	80	2.0
410				62.990	1.00	800			
415									

ROTO PRESS:			TOTALS:				BP.:			.182
420										
425										
430										
435										
440										
445										
450										
455										
460										
465				589.390		630				
470					10.79					
475										
			TOTALS:			80	MAX VACC =		3.0	
TOTAL Cu Ft.		116.242	TOTALS:	7.188	.132	540	AVG. BP:		30.00	

WOODSTOVE DATA SHEET 2A

Unit: Total TL Run: 2 Date: 8-26-2010 Page: 1 of 1

Time	Volume	Time	Volume	Time	Volume	Time	Volume
0	—	120	1.725	240	1.259	360	1.259
5	1.500	125	1.725	245	1.185	365	1.259
10	2.745	130	1.725	250	1.108	370	1.254
15	1.617	135	1.731	255	1.155	375	1.259
20	1.623	140	1.629	260	1.259	380	1.259
25	1.623	145	1.385	265	1.259	385	1.259
30	1.533	150	1.319	270	1.319	390	1.259
35	1.533	155	1.259	275	1.319	395	1.259
40	1.623	160	1.259	280	1.319	400	1.259
45	1.533	165	1.259	285	1.319	405	1.254
50	1.839	170	1.259	290	1.319	410	
55	1.725	175	1.259	295	1.319	415	
60	1.725	180	1.259	300	1.319	420	
65	1.725	185	1.259	305	1.319	425	
70	1.725	190	1.259	310	1.319	430	
75	1.725	195	1.259	315	1.319	435	
80	1.725	200	1.259	320	1.319	440	
85	1.839	205	1.319	325	1.319	445	
90	1.839	210	1.319	330	1.259	450	
95	1.839	215	1.259	335	1.259	455	
100	1.970	220	1.259	340	1.259	460	
105	1.839	225	1.259	345	1.259	465	
110	1.725	230	1.259	350	1.259	470	
115	1.725	235	1.259	355	1.259	475	

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : Total RUN : 2 DATE : 8-26-10

SCALE CHECK	LEVEL	ZEROED
INITIAL :	✓	✓
FINAL :	✓	✓

SCALE	WEIGHT
295.0 g	295.0
590.0 g	590.0
885.0 g	885.0

IMPINGER	#1	#2	#3	#4
FINAL WT	758.0	587.2	486.0	878.3
INITIAL WT	620.3	580.0	483.7	853.5
NET WT GRAMS	137.7	7.2	2.3	24.8

TOTAL CATCH : 172.0 GRAMS H_2O

FRONT HALF

FILTER #	196F	
FINAL WT g	.8210	
INITIAL WT g	.6579	
NET WT g	.1631	

BEAKER #	126
DESC.	ACETONE
FINAL WT g	105.8779
INITIAL WT g	105.7661
NET WT g	.1118
VOL. DESC. ml	75

BACK HALF

FILTER #	196B	
FINAL WT g	.4349	
INITIAL WT g	.3631	
NET WT g	.0718	

.1760
.1690

BEAKER #	127	128	129	130	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	104.3135	105.6668	106.5017	106.5617	
INITIAL WT g	104.0753	105.6083	106.4289	106.5019	
NET WT g	.2382	.0585	.0728	.0598	.1326
VOL. DESC ml	125	75	200 +	175 =	375

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 8-12-09 Time : 1205 By : AV

Manufacturer S & S Grade : # 25 Glass Front Size : 11 cm Lot No. :

Back Size: 8.2 cm Lot No. :

	DATE: 8-14-09	BY: AV	DATE: 8-19-09	BY: AV	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
191F	0.6645	0900	0.6647	0920		
192F	0.6630	0901	0.6631	0921		
193F	0.6621	0902	0.6623	0922		
194F	0.6568	0903	0.6568	0923		
195F	0.6602	0904	0.6602	0924		
196F	0.6578	0905	0.6579	0925		
197F	0.6600	0906	0.6601	0926		
198F	0.6615	0907	0.6615	0927		
199F	0.6575	0908	0.6574	0928		
200F	0.6618	0909	0.6618	0929		
191B	0.3600	0910	0.3601	0930		
192B	0.3597	0911	0.3599	0931		
193B	0.3594	0912	0.3593	0932		
194B	0.3596	0913	0.3596	0933		
195B	0.3570	0914	0.3571	0934		
196B	0.3630	0915	0.3631	0935		
197B	0.3598	0916	0.3598	0936		
198B	0.3640	0917	0.3640	0937		
199B	0.3602	0918	0.3602	0938		
200B	0.3605	0919	0.3605	0939		

Checked by: C. Wright Date: 8-12-09 Time: 1115

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 2-2-2010 Time : 1100 By : CP

	DATE: 2-5-10	BY: AV	DATE: 2-8-10	BY: CP	DATE:	BY:
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
126	105.7659	1145	105.7661	1210	✓	
127	104.0748	1146	104.0753	1211	✓	
128	105.6080	1147	105.6083	1212	✓ R-2	
129	106.4284	1148	106.4289	1213	✓	
130	106.5014	1149	105.5019	1214	✓	
131	106.6439	1150	106.8443	1215	✓	
132	105.3817	1151	105.3821	1216	✓	
133	106.5026	1152	106.5027	1217	✓	
134	107.6880	1153	107.6880	1218	✓	
135	104.5925	1154	104.5921	1219	✓	
136	107.0827	1155	107.0824	1220	✓	
137	104.1624	1156	104.1626	1221	✓	
138	105.2433	1157	105.2430	1222	✓	
139	104.1290	1158	104.1285	1223	✓	
140	106.9612	1159	106.9613	1224	✓	
141	102.2799	1200	102.2800	1225	✓	
142	107.8126	1201	107.8121	1226	✓	
143	105.5706	1202	105.5701	1227	✓	
144	106.3782	1203	106.3779	1228	✓	
145	101.5199	1204	101.5195	1229	✓	
146	101.3681	1205	101.3676	1230	✓	
147	106.9558	1206	106.9554	1231	✓	
148	104.7562	1207	104.7560	1232	✓	
149	107.5443	1208	107.5442	1233	✓	
150	106.7042	1209	106.7037	1234	✓	

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH	
2-5-10	1015	CP	(	78	43	Checked by : CW
2-9-10	1030	CP	(	78	40	Date : 2-10-10
		✓	✓			Time : 1317

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : Jotul TL RUN : 2 DATE : 8-26-10 Page : 1 of 1

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
126	8-27	1700	CP	105.8777	8-28	1615	CP	105.8774	8-29	1412	CP				
127	8-27	1700	CP	104.3130	8-28	1616	CP	104.3135	8-29	1413	CP				
128	8-27	1700	CP	105.6664	8-28	1617	CP	105.6668	8-29	1414	CP				
129	8-27	1700	CP	106.5013	8-28	1618	CP	106.5017	8-29	1415	CP				
130	8-27	1700	CP	106.5612	8-28	1619	CP	106.5617	8-29	1416	CP				

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
196F	8-26	1900	CP	.8322	8-27	1005	CP	.8246	8-28	1612	CP	.8214	8-29	1410	CP
				.8210	8-31	0725	CP								
196B	8-26	1900	CP	.4368	8-27	1006	CP	.4354	8-28	1613	CP	.4349	8-29	1411	CP

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	8-27-10	0953	CP	78	43
2	8-28-10	1600	CP	73	47
3	8-29-10	1400	CP	70	48
4	8-31-10	0720	CP	72	46
5					

Weighing Session	Date	Time	By	DB	%RH
6					
7					
8					
9					
10					

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 2-26-2010 Through	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0001	10.0004	.9999	.0999	CP	2-26-10	0840	72	46
100.0001	9.9999	.9999	.0999	CP	2-27-10	1045	72	46
100.0000	10.0000	1.0000	.0999	CP	2-28	1100	70	48
100.0000	10.0000	1.0000	.0999	CP	3-1	0900	66	49
100.0000	10.0002	.9998	.1002	CP	3-5	1200	70	48
100.0001	9.9999	.9999	.0998	CP	3-7	1330	68	47
100.0000	9.9999	.9999	.0999	CP	3-9	1130	70	41
100.0000	10.0001	1.0000	.0999	CP	3-10	1200	70	44
100.0000	10.0001	.9999	.0999	CP	3-11	0900	66	49
99.9999	9.9999	.9999	.0999	AV	3-15	1000	70	48
100.0000	10.0000	1.0000	.0998	CP	3-17	0900	72	46
100.0000	9.9998	1.0001	.1000	CP	4-8	1930	76	49
99.9999	10.0001	1.0000	.0999	CP	4-10	1630	73	47
99.9999	10.0001	1.0001	.1000	CP	4-11	1430	74	47
100.0000	10.0002	1.0000	.1000	CP	4-21	1830	77	49
100.0000	10.0000	1.0000	.0999	CP	4-22	1130	74	47
100.0000	10.0001	1.0000	.0999	CP	4-23	1015	74	44
100.0002	9.9999	1.0000	.1000	CP	4-24	0930	68	47
100.0000	9.9999	.9999	.1000	CP	4-25	0930	73	47
100.0000	9.9999	1.0001	.0999	CP	4-26	0900	76	42
100.0000	10.0002	1.0000	.0999	CP	4-30	1320	78	43
99.9998	10.0000	1.0002	.0999	CP	8-26	0845	78	49
100.0000	9.9998	1.0001	.0999	CP	8-27	0955	78	43
100.0000	10.0000	1.0000	.1000	CP	8-28	1600	73	47
99.9998	10.0000	.9999	.1000	CP	8-29	1400	70	48
100.0000	10.0000	1.0000	.0999	CP	8-31	0720	72	46
100.0001	10.0000	1.0000	.1000	CP	9-1	1330	76	49
100.0000	10.0001	1.0000	.0999	CP	9-2	1300	68	47
100.0000	10.0000	1.0000	.1000	CP	9-3	1130	72	46

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 5-10-2009 Through 2-25-2010	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0001	10.0002	1.0000	.0999	CP	5-10	1545	74	44
100.0001	10.0001	.9999	.0999	CP	6-19	1110	70	48
100.0001	10.0000	.9998	.0998	CP	6-22	0930	74	44
100.0001	10.0000	.9999	.0999	CP	6-24	1610	78	46
100.0001	10.0000	1.0000	.0999	CP	6-25	1000	78	46
100.0001	10.0001	1.0001	.0999	CP	6-26	0900	73	47
99.9998	10.0000	1.0001	.1000	CP	6-27	1300	76	45
100.0000	10.0002	1.0000	.0999	CP	6-28	1400	78	43
100.0000	10.0000	1.0000	.0999	CP	6-29	1130	74	47
100.0000	10.0000	1.0000	.0999	CP	7-1	1230	70	48
100.0000	9.9998	1.0000	.0998	CP	8-7	1310	75	48
99.9998	10.0000	1.0000	.0999	CP	8-8	1600	77	44
100.0000	10.0000	1.0000	.0999	CP	8-9	1720	78	46
100.0002	9.9999	1.0000	.0998	CP	8-10	0900	78	46
100.0000	10.0001	1.0001	.0998	CP	8-11	1126	78	46
100.0003	10.0001	1.0001	.1000	CP	8-12	0910	78	46
100.0000	10.0000	1.0001	.1000	CP	8-14	1630	78	46
100.0000	10.0000	1.0001	.0999	CP	8-19	0900	74	47
100.0002	10.0001	1.0000	.1000	CP	8-24	0900	72	42
100.0000	9.9999	.9999	.0999	CP	8-25	0900	70	48
100.0000	10.0000	1.0000	.0999	CP	8-26	1340	77	46
100.0003	10.0000	.9999	.1000	CP	9-5	1120	77	49
100.0000	10.0001	1.0000	.0999	CP	9-8	1410	78	41
100.0000	10.0001	1.0001	.0998	CP	9-11	1050	78	43
100.0000	10.0000	1.0000	.0999	CP	9-12	1220	78	46
100.0000	10.0001	1.0000	.0999	CP	9-13	1430	78	46
100.0000	10.0001	.9999	.1000	CP	9-14	1100	75	48
100.0000	10.0000	.9999	.0999	CP	1-29	1400	74	44
100.0000	10.0001	1.0000	.1000	CP	1-30	1800	78	46
100.0000	10.0001	1.0001	.1000	CP	2-1	0700	66	49
100.0000	9.9999	1.0001	.1000	CP	2-2	1100	72	46
100.0000	9.9997	1.0001	.1000	CP	2-4	1015	75	41
100.0000	10.0000	1.0000	.0998	CP	2-5	1015	78	43
100.0000	10.0001	1.0000	.1000	CP	2-7	1400	70	44
100.0002	10.0001	1.0000	.0999	CP	2-8	1200	78	46
100.0000	10.0000	1.0000	.1000	CP	2-9	1030	78	40
100.0000	10.0000	1.0000	.0999	CP	2-23	1830	77	49
100.0000	10.0001	1.0000	.0999	CP	2-24	0820	69	49
100.0000	10.0002	1.0000	.0999	CP	2-25	0940	69	47

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 8-27-2008 Through 5-9-2009	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9999	10.0000	1.0000	.0999	CK	8-27	0900	78	46
100.0001	10.0000	1.0000	.0999	CK	8-28	0930	78	46
100.0001	10.0001	1.0001	.0997	CK	8-29	1300	78	46
100.0000	10.0000	1.0000	.1000	CK	8-30	1030	78	46
100.0001	10.0003	1.0001	.0999	CK	8-31	1015	76	49
100.0000	10.0001	1.0000	.0997	CK	9-1	1100	74	44
100.0000	10.0001	.9999	.1000	CK	9-2	0845	75	48
99.9999	10.0000	.9999	.0998	CK	9-4	1000	77	47
99.9999	10.0002	1.0001	.0999	CK	9-8	0930	77	49
99.9999	9.9999	.9998	.0998	CK	9-9	1000	74	48
99.9997	9.9997	1.0000	.0999	CK	9-11	1500	76	45
100.0000	9.9997	.9999	.0999	CK	9-17	0930	77	49
100.0000	10.0000	1.0000	.0999	CK	9-18	0900	78	46
100.0000	10.0000	.9999	.0999	CK	9-19	0915	78	49
100.0000	10.0000	.9999	.0999	CK	9-22	1030	77	46
100.0000	10.0001	1.0000	.0998	CK	9-24	1330	78	49
100.0001	10.0001	1.0000	.0999	CK	9-25	0930	78	46
100.0000	9.9999	1.0001	.0998	CK	9-26	0920	78	46
100.0001	9.9999	1.0001	.0999	AV	9-29	0955	78	46
100.0000	10.0001	1.0000	.0998	CK	10-2	0945	75	44
100.0000	10.0000	1.0000	.0999	CK	10-3	0930	78	46
100.0000	9.9999	1.0000	.0999	CK	10-4	1530	78	46
100.0000	9.9999	.9999	.0999	CK	10-6	0930	77	49
100.0000	10.0001	1.0002	.1000	CK	10-7	1700	78	49
100.0000	10.0000	1.0000	.0999	CK	10-8	1000	78	49
99.9999	10.0000	1.0001	.0999	CK	10-9	1030	78	43
100.0000	9.9999	1.0001	.1000	CK	10-10	0930	78	40
100.0000	9.9998	.9999	.0997	CK	10-11	1430	74	47
100.0000	10.0001	1.0000	.1000	CK	10-13	0940	78	46
100.0000	10.0002	.9999	.0999	CK	10-14	2030	77	49
100.0000	10.0002	1.0000	.1000	CK	10-16	1220	78	43
100.0000	9.9999	1.0000	.0999	CK	10-18	1130	74	47
99.9998	10.0000	.9999	.0999	CK	5-3	1200	78	43
100.0000	10.0001	1.0000	.0999	CK	5-4	1000	72	47
100.0000	10.0001	1.0000	.0997	CK	5-5	1000	76	45
99.9998	10.0000	1.0000	.0999	CK	5-6	1100	77	49
100.0000	10.0001	1.0001	.1000	CK	5-7	1600	77	42
100.0000	10.0001	1.0000	.0999	CK	5-8	1600	76	45
100.0000	10.0003	1.0000	.1000	CK	5-9	1300	76	38

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 10-22-07 Through 8-26-2008	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0000	10.0001	1.0000	.0998	CP	10-22	1630	78	46
99.9999	10.0001	1.0000	.1001	CP	10-23	1000	74	44
100.0002	10.0002	1.0002	.0999	CP	10-24	1400	73	47
100.0002	10.0000	1.0001	.0998	CP	10-26	1700	74	40
100.0003	10.0001	1.0001	.0999	CP	10-27	0820	78	40
99.9999	10.0000	.9999	.0997	CP	10-28	1200	78	40
100.0000	9.9999	.9999	.0999	CP	10-29	1700	76	42
99.9998	9.9999	.9999	.1000	CP	10-30	1600	78	43
99.9997	10.0000	.9999	.0999	CP	11-16	1500	68	47
100.0001	10.0002	1.0000	.0999	CP	11-19	1730	73	40
100.0000	10.0002	.9999	.0999	CP	11-20	1100	64	44
99.9998	9.9999	.9999	.0998	CP	1-18-08	1230	76	45
100.0002	10.0002	.9999	.0999	CP	1-21-08	1430	65	48
99.9999	10.0007	1.0001	.0999	CP	1-22-08	1200	68	47
100.0002	9.9999	.9999	.0998	CP	1-23-08	1400	74	47
99.9999	10.0000	1.0002	.1000	CP	1-31-08	1900	74	44
100.0000	10.0003	1.0000	.0996	CP	2-1-08	1530	76	45
99.9997	9.9999	.9999	.0999	CP	2-16-08	1700	68	47
100.0001	10.0002	1.0000	.1000	CP	2-18-08	1400	72	46
99.9999	10.0001	.9999	.0998	CP	2-22-08	1800	68	47
99.9999	10.0001	1.0000	.0999	CP	2-23-08	1800	78	43
100.0000	10.0000	1.0000	.0999	CP	5-8-08	1030	78	43
100.0001	10.0001	1.0000	.0999	CP	5-9-08	0930	69	47
100.0000	10.0001	.9999	.0999	CP	5-10-08	1330	74	47
99.9998	9.9999	1.0000	.0998	CP	5-11-08	0900	74	44
100.0003	10.0001	.9999	.0998	CP	5-12	1400	70	48
99.9999	10.0001	1.0000	.1000	CP	5-13	1000	77	42
99.9999	9.9997	1.0000	.1000	CP	5-14	1230	77	42
99.9999	10.0001	.9999	.1000	CP	6-5-08	1430	72	46
100.0001	10.0000	1.0000	.0999	CP	6-9-08	1400	74	44
99.9999	9.9999	1.0000	.0999	CP	6-9-08	1800	73	47
100.0001	10.0001	.9999	.0998	CP	8-11-08	0930	77	42
100.0003	10.0000	1.0001	.0999	CP	8-12-08	1011	78	43
100.0000	10.0001	1.0000	.0999	CP	8-13-08	0950	76	49
100.0002	10.0000	1.0000	.0998	CP	8-18-08	0930	74	44
100.0001	9.9999	1.0000	.0998	CP	8-20-08	1110	76	45
100.0000	9.9999	.9999	.0998	CP	8-21-08	0915	75	48
100.0002	10.0000	1.0000	.1002	CP	8-22-08	0910	75	45
100.0000	10.0001	1.0001	.0999	CP	8-26-08	0900	78	43

BLANK PROCESSING DATA SHEET # 5

UNIT: Jotul TL RUN: 2 DATE: 8-26-10

BLANKS DONE: 10-30-2007

BEAKER	A	B	C
	200 ml ACETONE	75 ml DICHLOR	200 ml WATER
	FISHER OPTIMA LOT #023283	FISHER OPTIMA LOT #035941	DWNA Inc Sparklettes Distilled
FINAL WEIGHT	108.9009	106.3077	106.9680
TARE WEIGHT	108.8995	106.3063	106.9644
NET WEIGHT	.0014	.0014	.0036

TARE BEAKERS INTO DESC : TIME: 1700 DATE: 10-20-07

DATE: 10-22 BY: CP DATE: 10-23 BY CP DATE: BY:

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.8994	1700	108.8995	1027		
B	106.3060	1701	106.3063	1028		
C	106.9639	1702	106.9644	1029		

FINAL BEAKERS INTO DESC : TIME: 1040 DATE: 10-27-07

DATE: 10-29 BY: CP DATE: 10-30 BY CP DATE: BY:

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9011	1721	108.9009	1619		
B	106.3074	1722	106.3077	1621		
C	106.9678	1723	106.9680	1622		

TARE QC

DATE	TIME	BY	WB	DB	%
10-22	1630	CP		78	46
10-23	1000	CP		74	44

FINAL QC

DATE	TIME	BY	WB	DB	%
10-29	1700	CP		76	42
10-30	1600	CP		78	43

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT: Jotul TL RUN: 2 DATE: 8-26-10

BLANK CALCULATIONS

Acetone: .0014 g + 200 ml = .000007 g/ml

Dicholoromethane: .0014 g + 75 ml = .000019 g/ml

Distilled Water: .0036 g + 200 ml = .000018 g/ml

FRONT HALF CATCH

FILTERS: .1631 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .1631 g

BEAKERS: .1118 (Total Catch) g - 75 (.0005) (ml Acetone) (.000007 g) (Blank Value / ml Acetone) = .1113 g

TOTAL FRONT HALF CATCH : .2744 g

BACK HALF CATCH

FILTERS: .0718 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0718 g

BEAKERS:

Acetone: .2382 (Total Catch) g - 125 (.0009) (ml Acetone) (.000007 g) (Blank Value / ml Acetone) = .2373 g

Extract: .0585 (Total Catch) g - 75 (.0014) (ml Dichloromethane) (.000019 g) (Blank Value / Dichloromethane) = .0571 g

Water: .1326 (Total Catch) g - 375 (.0068) (ml Water) (.000018 g) (Blank Value / Water) = .1259 g

TOTAL BACK HALF CATCH: .4921 g

TOTAL CATCH: .7665 g

% FRONT HALF: 35.8 %

CALCULATIONS DATA SHEET # 7

UNIT : Jotul TL RUN : 2 DATE : 8-26-2010

1) $Vm(std) = \dfrac{(116.242\ Vm)(17.64)(.916\ mcf)\left(30.00\ "Hg + \frac{.132"\ H_2O}{13.6}\right)}{(540\ TmA)} = \dfrac{104.3819}{000.0000}$ dscf

2) $Vw(std) = (.04707)(172.0\ ml\ H_2O) = \dfrac{8.0960}{00.0000}$ scf

3) $Asw = \dfrac{(8.0960\ scf)}{(8.0960\ scf + 104.3819\ dscf)} = \dfrac{.0720}{.0000}$ Bws × 100 = $\dfrac{7.1979}{00.0000}$ % H_2O

4) $Cs = \dfrac{(.7665\ g.)}{(104.3819\ dscf)}(15.43) = \dfrac{.1133}{0.0000}$ gr / dscf

5) Estimated g / hr = $\dfrac{(.7665\ g.)}{(104.3819\ dscf)}\left(\dfrac{7.188}{00.0000}\ dscfm\right)(60) = \dfrac{3.1670}{00.0000}$ g / hr

Vm =	total cubic feet pulled on meter box during test	(p. 2)	(000.000 Vm)
mcf =	meter correction factor (Y factor) of meter box used for test	(p. 2)	(0.000 mcf)
" Hg =	average barometric pressure during test	(p. 2)	(00.00 " Hg)
" H_2O =	average delta H for test	(p. 2)	(.000 " H_2O)
TmA =	average meter temperature for test in degrees Absolute	(p. 2)	(000 TmA)
ml H_2O =	total water caught during test	(p. 3)	(000.0 ml H_2O)
g. =	total particulate catch for test	(p. 6)	(00.0000 g.)
dscfm =	average stack flow during test	(p. 2)	(00.000 dscf)

TEST DATA SHEET # 8

UNIT: Jotul TL RUN: 2 DATE: 8-26-2010

Test Chamber Air Velocity Start: Ø Stop: Ø Avg.: Ø

Wet Bulb / Dry Bulb

Pre : WB: 59 DB: 70 = 52 % RH 1.3 % H_2O

Post : WB: 62 DB: 78 = 40 % RH 1.4 % H_2O

Average: 46 % RH 1.35 % H_2O

Empty Stove Weight (lbs): N/A w/ stack & oil seal : Wet: N/A Dry: 546.3

Kindling Weight (lbs): Paper: .1 Wood: 1.6

Preburn Fuel Weight: 19.5 + 19.1 Total: 38.6

Kindling & Preburn Fuel Weight (wood only) (lbs): **Total**: 40.2

Coal Bed Wt Range (lbs): 4.3 - 3.5 **Scale**: 550.6 - 549.8

Upper : .25 × fuel weight : Always round DOWN to nearest tenth

Lower : .20 × fuel weight : Always round UP to nearest tenth **Actual Coal Bed Weight**: 3.8

Maximum Coal Bed Removal (lbs): ((4.3 (Upper) + 3.5 (Lower)) ÷ 2) .25 = .9 (round down to nearest tenth)

Test Fuel (.75" × 1.5" × 5" spacers) = 20 pcs

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" × 4"	16.5	4	9.4	54.0
4" × 4"	16.5	2	8.0	46.0

Test Fuel Weight: 17.4 lbs

Estimated Dry Burn Rate:

$$\frac{17.4 - (17.4 \times .16759)}{2.2046} \times \frac{60}{\frac{405}{\text{TIME}}} = .973 \text{ kg / hr}$$

Estimated **BTU's/hr**: 19,140 × $\frac{63}{100}$ × $\frac{.973}{\text{DBR}}$ = 11732.6 BTU's/hr

EPA Default Efficiencies : Non-cat : 63 Cat : 72 Pellet : 78

395 = .99

WOOD STOVE OPERATING DATA PAGE #9

Unit : Jotul TL Run : 2 Date : 8-26-2010

FIRE STARTED: 0650

WARM UP AND PREBURN:

PRIMARY AIR : Set wide open for all warm-up / preburn fuel charges. Then set to 9/32" at start of preburn.

SECONDARY AIR : N/A CAT BYPASS : N/A

CHARCOAL BED PREPARATION :

Raked and leveled prior to each warm-up / preburn charge. At 1 1/2 min. prior to loading last fuel, raked and leveled. In stove 20 sec.

TEST:

DOOR wide open during loading Ø min. 45 sec.

PRIMARY AIR : Opened full for first 5 min., then set to run setting of 9/32".

SECONDARY AIR : N/A CAT BYPASS : N/A

FAN:

ON / OFF during warm-up

ON / OFF first 30 minutes of test

Fan speed set at LOW

ON / OFF during preburn

ON / OFF balance of test run

WOOD DATA: KINDLING: A mix of the grades listed below:

	SIZE	MILL	GRADE	SPECIES
PREBURN:	2x4	Manke/Tacoma	Std. or better	s. grn D fir
TEST:	2x4	Packwood	# 2 or better	s. grn D fir
	4x4	Packwood	# 2 or better	s. grn D fir

PELLET FUEL MANUFACTURER : N/A BRAND : N/A

All Grades WCLB rules:

WARM UP INFORMATION:

All pre-burn / warm up fuel pieces were either 12 or 16 inches.

1st warm up / pre-burn fuel charge (19.5 lbs.) added at 0700

2nd warm up / pre-burn fuel charge (19.1 lbs.) added at 0818

3rd warm up / pre-burn fuel charge (lbs.) added at

4th warm up / pre-burn fuel charge (lbs.) added at

5th warm up / pre-burn fuel charge (lbs.) added at

TEST DATA SHEET #10

Unit : Jotul TL Run : 2 Date : 8-26-2010

Room Temperature : 74 °F Temperature Correction Set? : (Yes) No

Calibration Check: 12.0% + or – 0.2%? (Yes) No

Time Test Fuel moisture reading taken : 0845

pc #	Dimen.	Use	TOP	BOTTOM	SIDE	Avg Corrected
1	2"×4"×8'	K	16.1	14.7	14.9	15.233
2						
3						
4	2"×4"×8'	P	18.6	18.7	18.7	18.7
5	2"×4"×8'	P	20.2	19.9	19.9	20.0
6	2"×4"×8'	P	23.5	22.4	22.6	22.8
7	2"×4"×8'	P				61.5
8	2"×4"×8'	P				
9						
10						
11	2×4×16.5"	T	18.5	17.4	18.1	18.0
12	"	T	17.7	18.0	18.0	17.9
13	"	T	22.7	23.0	23.5	23.1
14	"	T	22.3	22.7	22.7	22.6
15	4×4×16.5"	T	18.9	18.9	19.1	19.0
16	"	T	19.4	20.2	21.0	20.2
17						120.8
18						
19						
20	Spacers	T	22.5	22.0	22.5	22.3

Key for Use : K = Kindling P = Pretest Fuel T = Test Fuel

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	15.233 %	20.500 %	20.133 %
Wet Moisture % :	13.219 %	17.012 %	16.759 %

To obtain Wet from Dry : $\frac{100 \times \%\ \text{Dry Reading}}{100 + \%\text{Dry Reading}}$ = % Moisture, Wet Basis

Acceptable Ranges : 16 - 20 % wet: 19 - 25 % dry (17.5 - 22.5 on Meter Uncor. reading) at 70°

GAS DATA SHEET #12

WEIGHT: 550.1 DATE: 8-26-2016

UNIT: Jotul TL RUN: 2 PAGE: 1 OF 3

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
0 1035	567.5	17.4	—	140	3.5	.642	16.1	.110	1.12	.037	450
5 40	566.8	16.7	.7	288	7.2	.522	13.1	.040	.42	.050	.250
10 45	566.6	16.5	.2	.082	2.1	.729	18.3	.037	.39	.043	.425
15 50	566.5	16.4	.1	.041	2.4	.717	18.0	.030	.32	.042	.425
20 55	566.2	16.1	.3	.113	2.8	.701	17.6	.035	.37	.043	.425
25 1100	565.9	15.8	.3	.120	3.0	.689	17.3	.040	.42	.042	.450
30 05	565.6	15.5	.3	.117	2.9	.689	17.3	.050	.52	.041	.450
35 10	565.2	15.1	.4	.302	7.5	.511	12.8	.044	.46	.045	.425
40 15	564.6	14.5	.6	.242	6.0	.566	14.2	.051	.53	.047	.450
45 20	564.0	13.9	.6	.345	8.6	.471	11.8	.033	.35	.051	.375
50 25	563.4	13.3	.6	.343	8.6	.475	11.9	.022	.24	.053	.400
55 30	562.9	12.8	.5	.326	8.1	.495	12.4	.025	.27	.052	.400
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.546	*****
60 35	562.4	12.3	.5	.322	8.0	.499	12.5	.028	.30	.053	.400
65 40	561.9	11.8	.5	.330	8.2	.487	12.2	.030	.32	.054	.400
70 45	561.4	11.3	.5	.309	7.7	.507	12.7	.034	.36	.055	.400
75 50	560.9	10.8	.5	.301	7.5	.511	12.8	.040	.42	.054	.400
80 55	560.3	10.2	.6	.334	8.3	.483	12.1	.035	.37	.053	.375
85 1200	559.8	9.7	.5	.335	8.4	.479	12.0	.034	.36	.054	.375
90 05	559.3	9.2	.5	.343	8.6	.475	11.9	.028	.30	.055	.375
95 10	558.8	8.7	.5	.387	9.7	.435	10.9	.011	.12	.054	.350
100 15	558.2	8.1	.6	.391	9.7	.435	10.9	.013	.15	.051	.375
105 20	557.7	7.6	.5	.391	9.7	.435	10.9	.013	.15	.050	.400
110 25	557.2	7.1	.5	.412	10.3	.415	10.4	.008	.10	.050	.400
115 30	556.7	6.6	.5	.440	11.0	.383	9.6	.011	.13	.051	.400
UBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.634	*****
20 35	556.2	6.1	.5	.466	11.6	.363	9.1	.004	.06	.052	.400
25 40	555.7	5.6	.5	.447	11.1	.383	9.6	.002	.04	.054	.400
30 45	555.2	5.1	.5	.448	11.2	.379	9.5	.002	.04	.051	.400
35 50	554.8	4.7	.4	.356	8.9	.467	11.7	.015	.17	.050	.425
40 55	554.6	4.5	.2	.281	7.0	.526	13.2	.050	.52	.046	.500
45 1300	554.5	4.4	.1	.266	6.6	.534	13.4	.070	.72	.045	.525
50 05	554.3	4.2	.2	.259	6.5	.570	14.3	.082	.84	.044	.550
55 10	554.2	4.1	.1	.265	6.6	.530	13.3	.085	.87	.043	.550
00 15	554.0	3.9	.2	.251	6.3	.534	13.4	.107	1.09	.040	.550
05 20	553.9	3.8	.1	.246	6.2	.534	13.4	.115	1.17	.039	.550
10 25	553.8	3.7	.1	.241	6.0	.538	13.5	.120	1.22	.038	.550
15 30	553.6	3.5	.2	.237	5.9	.542	13.6	.124	1.26	.038	.550
UBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.540	*****
OTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	1.720	*****

FAN?

GAS DATA SHEET #12

WEIGHT: 550.1 DATE: 8-26-2010

UNIT: Total TL RUN: 2 PAGE: 2 OF 3

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
180 35	553.5	3.4	.1	.214	5.3	.554	13.9	1.49	1.51	.039	.550
185 40	553.4	3.3	.1	.703	5.1	.554	13.9	.178	1.80	.038	.550
190 45	553.3	3.2	.1	.194	4.8	.554	13.9	.200	2.02	.037	.550
195 50	553.2	3.1	.1	.191	4.8	.550	13.8	.211	2.13	.036	.550
200 55	553.1	3.0	.1	.194	4.8	.550	13.8	.217	2.19	.035	.525
205 1400	553.1	3.0	.0	.209	5.2	.546	13.7	.180	1.82	.034	.525
210 05	553.0	2.9	.1	.205	5.1	.542	13.6	.200	2.02	.035	.550
215 10	552.9	2.8	.1	.199	5.0	.546	13.7	.207	2.09	.034	.550
220 15	552.8	2.7	.1	.187	4.7	.554	13.9	.211	2.13	.034	.550
225 20	552.8	2.7	.0	.186	4.7	.554	13.9	.212	2.14	.035	.550
230 25	552.7	2.6	.1	.185	4.6	.558	14.0	.211	2.13	.034	.550
235 30	552.6	2.5	.1	.187	4.7	.558	14.0	.203	2.05	.033	.550
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.424	*****
240 35	552.5	2.4	.1	.190	4.7	.558	14.0	.200	2.02	.033	.600
245 40	552.4	2.3	.1	.187	4.7	.562	14.1	.194	1.96	.034	.625
250 45	552.3	2.2	.1	.189	4.7	.562	14.1	.193	1.95	.033	.600
255 50	552.2	2.1	.1	.184	4.6	.562	14.1	.201	2.03	.032	.550
260 55	552.2	2.1	.0	.179	4.5	.570	14.3	.191	1.93	.032	.550
265 1500	552.1	2.0	.1	.163	4.1	.582	14.6	.200	2.02	.033	.525
270 05	552.0	1.9	.1	.160	4.0	.590	14.8	.195	1.97	.033	.525
275 10	551.9	1.8	.1	.178	4.4	.590	14.8	.155	1.57	.032	.525
280 15	551.9	1.8	.0	.171	4.3	.586	14.7	.171	1.73	.031	.525
285 20	551.8	1.7	.1	.173	4.3	.590	14.8	.165	1.67	.030	.525
290 25	551.7	1.6	.1	.171	4.3	.590	14.8	.168	1.70	.030	.525
295 30	551.6	1.5	.1	.189	4.7	.582	14.6	.147	1.49	.030	.525
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.383	*****
300 35	551.5	1.4	.1	.183	4.6	.578	14.5	.162	1.64	.029	.525
305 40	551.5	1.4	.0	.184	4.6	.570	14.3	.180	1.82	.029	.525
310 45	551.4	1.3	.1	.173	4.3	.578	14.5	.194	1.96	.030	.525
315 50	551.4	1.3	.0	.157	3.9	.602	15.1	.171	1.73	.029	.525
320 55	551.3	1.2	.1	.157	3.9	.602	15.1	.173	1.75	.028	.525
325 1600	551.2	1.1	.1	.161	4.0	.594	14.9	.184	1.86	.027	.550
330 05	551.1	1.0	.1	.161	4.0	.588	14.8	.193	1.95	.026	550
335 10	551.1	1.0	.0	.161	4.0	.593	14.9	.191	1.93	.025	550
340 15	551.0	.9	.1	.154	3.9	.594	14.9	.199	2.01	.025	550
345 20	550.9	.8	.1	.153	3.9	.588	14.8	.203	2.05	.025	550
350 25	550.9	.8	.0	.148	3.8	.592	14.9	.213	2.15	.025	550
355 30	550.8	.7	.1	.144	3.7	.583	14.6	.236	2.38	.025	550
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.323	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	1.130	*****

GAS DATA SHEET #12

WEIGHT: 550-1 DATE: 8-26-2010

UNIT: Jotul TL RUN: 2 PAGE: 3 OF 3

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
30 35	550.7	.6	.1	.143	3.6	.587	14.7	2.45	2.47	-.025	550
35 40	550.7	.6	ø	.146	3.7	.579	14.5	2.56	2.58	-.025	550
40 45	550.6	.5	.1	.149	3.7	.576	14.5	2.62	2.64	-.025	550
45 50	550.5	.4	.1	.148	3.7	.579	14.5	2.55	2.57	-.025	550
50 55	550.4	.3	.1	.150	3.8	.585	14.7	2.20	2.22	-.025	550
55 1700	550.3	.2	.1	.147	3.7	.596	14.9	2.14	2.16	-.025	550
1700 05	550.3	.2	ø	.140	3.6	.665	15.2	1.95	1.97	-.025	550
05 10	550.2	.1	.1	.133	3.4	.611	15.3	.207	2.09	-.025	550
10 15	550.2	.1	ø	.132	3.4	.612	15.3	.207	2.09	-.025	550
15 20	550.1	ø	.1	.129	3.3	.617	15.5	.201	2.03	-.025	550
20 25											
25 30										-.250	
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****		*****
30 35											
35 40											
40 45											
45 50											
50 55											
55 1800											
1800 05											
05 10											
10 15											
15 20											
20 25											
25 30											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****		*****
30 35											
35 40											
40 45											
45 50											
50 55											
55 1900											
1900 05											
05 10											
10 15											
15 20											
20 25											
25 30										-3.100	
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****		*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-1.038	*****

1-82

PREBURN DATA SHEET #13

UNIT: JU RUN: 2 DATE: 8-26-2010 PAGE: 1 of 1

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
0 0930	551.2	—	572	560	611	558	701	469			75	-057	PREBURN START: # 1.6 UP
5 35	551.0	.2	392	537	789	510	685	477			74	-055	COAL BED SCALE RANGE:
10 40	550.9	.1	337	505	741	481	644	479			74	-051	550.6 → 544.8
15 45	550.8	.1	314	483	703	461	615	476			74	-050	PRIMARY AIR:
20 50	550.7	.1	289	438	656	441	574	473			73	-049	SECONDARY AIR: N/A
25 55	550.6	.1	270	413	615	418	540	469			72	-047	FAN: LOW
30 1000	550.5	.1	258	395	593	421	522	466			72	-046	PUMPS ON AT:
35 05	550.4	.1	245	370	563	407	496	459			72	-045	CHECK WB/DB: N/A
40 10	550.4	.0	238	364	546	397	481	456			71	-043	
45 15	550.4	.0	230	352	527	389	465	452			72	-042	
50 20	550.3	.1	222	333	506	389	448	444			71	-040	424
55 25	550.2	.1	216	323	490	345	435	439			71	-039	416
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	
60 30	550.1	.1	210	313	477	401	424	436			71	-038	
65 35	550.1	.0	210	306	463	392	417	430			71	-037	
70 40													
75 45													
80 50													
85 55													
90 1100													

Jotul- Top Loader

Temperature Data Sheet 14

Run 2
8/26/10

Time	Stack	Top	LT Side	Back	Rt Side	Bottom	Firebox	Sec/Cat	Ambient	Tube Furn	Smpl Box	Smpl Out	C-Gas Box	C-Gas Out	SO2 Out
********	Chn 103	Chn 104	Chn 105	Chn 106	Chn 107	Chn 108	Chn 109	Chn 110	Chn 111	Chn 112	Chn 113	Chn 114	Chn 115	Chn 116	Chn 117
0	210	306	463	392	412	430	######	######	72	1528	230	61	231	34	38
5	366	305	441	381	395	427	######	######	73	1509	230	47	231	34	38
10	230	304	424	362	379	414	######	######	71	1491	230	47	231	35	38
15	212	289	402	343	360	401	######	######	71	1475	228	47	230	36	38
20	205	280	383	327	344	390	######	######	70	1460	228	47	229	36	38
25	200	270	366	313	328	376	######	######	70	1447	228	47	231	36	39
30	195	263	352	301	316	364	######	######	70	1436	232	47	231	36	39
35	232	275	342	289	308	353	######	######	69	1426	235	48	230	36	39
40	237	299	341	279	308	342	######	######	69	1417	238	47	230	36	39
45	277	329	344	272	314	333	######	######	69	1409	240	48	230	36	39
50	288	361	361	268	328	325	######	######	69	1402	241	48	230	36	38
55	288	378	386	267	336	316	######	######	69	1396	242	48	229	37	39
60	292	383	406	268	345	309	######	######	69	1391	242	48	229	37	39
65	295	391	423	271	359	303	######	######	69	1387	243	48	229	37	39
70	292	395	437	275	375	299	######	######	69	1384	241	48	229	37	39
75	294	400	454	279	389	295	######	######	69	1383	238	48	230	36	38
80	299	401	470	283	399	288	######	######	70	1382	237	49	230	37	38
85	301	409	487	292	412	287	######	######	69	1379	236	48	228	37	38
90	303	415	501	300	424	283	######	######	69	1377	236	48	232	36	38
95	308	414	508	310	433	282	######	######	70	1376	235	48	233	36	39
100	310	419	520	323	442	280	######	######	70	1376	234	48	236	36	39
105	312	422	530	336	450	280	######	######	72	1377	234	48	238	36	39
110	319	425	541	346	458	280	######	######	72	1377	233	49	240	37	39
115	324	432	554	352	467	279	######	######	73	1378	232	49	242	37	39
120	333	445	568	358	477	279	######	######	74	1379	232	50	245	37	39
125	332	457	580	365	489	279	######	######	74	1383	231	50	248	38	39
130	331	474	589	373	499	278	######	######	74	1386	231	51	248	39	39
135	314	474	594	380	507	278	######	######	75	1389	232	51	248	39	39
140	294	463	591	385	501	277	######	######	76	1391	231	52	248	38	39
145	280	446	580	386	488	278	######	######	76	1393	231	53	248	39	39
150	270	432	566	388	476	278	######	######	76	1394	231	53	248	39	39
155	261	412	553	391	465	279	######	######	76	1395	231	54	248	38	39
160	252	400	540	394	456	281	######	######	76	1396	230	54	248	38	38
165	245	388	529	397	449	282	######	######	77	1398	231	54	248	38	38
170	239	377	519	399	442	284	######	######	77	1399	234	55	248	38	38

Jotul- Top Loader

Temperature Data Sheet 14

Run 2
8/26/10

175	234	366	510	401	436	285	######	######	77	1400	235	55	248	38	38
180	227	358	502	398	429	286	######	######	77	1401	237	55	247	38	38
185	223	349	494	392	422	287	######	######	77	1401	238	55	247	39	37
190	218	341	486	386	415	288	######	######	77	1402	240	56	247	38	37
195	215	336	478	381	409	287	######	######	76	1403	241	56	247	38	37
200	211	328	470	375	402	288	######	######	76	1404	242	56	246	39	37
205	209	323	464	370	397	289	######	######	75	1404	243	47	246	39	37
210	206	320	459	366	392	290	######	######	75	1405	243	46	245	39	37
215	203	316	454	361	388	290	######	######	75	1405	244	47	245	39	37
220	199	309	448	357	384	290	######	######	75	1405	244	47	245	39	37
225	198	306	442	354	379	289	######	######	75	1405	244	47	244	38	36
230	196	303	436	351	374	290	######	######	75	1405	244	47	244	38	36
235	195	298	430	350	370	289	######	######	75	1405	244	47	243	38	36
240	193	295	425	348	367	289	######	######	75	1406	244	47	243	38	36
245	192	290	421	346	363	288	######	######	75	1406	245	47	243	38	36
250	192	289	418	344	360	288	######	######	75	1406	244	47	242	37	36
255	190	284	414	343	357	287	######	######	75	1406	244	47	242	37	36
260	189	285	411	341	354	286	######	######	75	1406	244	48	242	37	35
265	187	280	407	341	350	285	######	######	75	1406	245	48	242	37	35
270	185	280	402	339	346	285	######	######	75	1407	245	48	241	37	35
275	184	277	397	335	344	284	######	######	75	1407	245	49	242	36	35
280	182	276	392	332	342	283	######	######	75	1408	245	49	242	36	35
285	180	274	387	328	341	282	######	######	74	1408	245	49	241	36	34
290	179	272	383	326	338	280	######	######	75	1408	245	49	241	36	34
295	179	271	380	324	337	279	######	######	75	1408	245	49	241	36	34
300	179	269	376	322	337	278	######	######	75	1408	245	50	241	36	34
305	180	268	374	322	336	278	######	######	75	1408	245	50	241	35	34
310	179	266	371	320	335	277	######	######	76	1408	245	50	241	35	34
315	175	266	368	319	333	276	######	######	75	1408	245	50	241	35	34
320	173	264	365	317	330	275	######	######	75	1408	245	50	241	35	34
325	172	261	361	314	327	275	######	######	75	1408	245	50	240	35	34
330	171	258	358	313	322	274	######	######	75	1407	245	51	240	35	34
335	171	255	355	312	319	273	######	######	75	1408	245	51	240	34	33
340	171	252	353	310	317	272	######	######	75	1408	246	51	240	34	33
345	171	250	350	308	314	271	######	######	76	1408	245	51	240	34	33
350	170	249	348	306	311	271	######	######	75	1407	245	51	240	34	33
355	170	246	347	304	308	270	######	######	75	1407	245	51	239	34	33

Jotul- Top Loader

Temperature Data Sheet 14

Run 2
8/26/10

360	170	245	346	302	306	269	######	######	75	1407	245	52	240	34	33
365	170	242	344	301	303	269	######	######	75	1407	245	52	239	33	33
370	170	241	343	301	301	268	######	######	74	1407	244	52	239	33	33
375	170	240	342	301	299	267	######	######	75	1406	245	52	239	33	33
380	169	240	341	300	297	267	######	######	74	1406	244	52	239	33	33
385	168	238	340	300	297	265	######	######	74	1406	244	53	239	33	33
390	167	236	338	298	295	265	######	######	74	1406	245	53	238	33	33
395	166	234	336	297	294	264	######	######	74	1405	244	53	238	32	33
400	165	233	333	295	292	263	######	######	74	1405	245	53	238	32	33
405	164	231	331	293	289	262	######	######	74	1404	245	58	238	32	33

Jotul- Top Loader

Run 2
8/26/10

TEMPERATURE DATA SHEET #14A

		TEST TIME	405		
STACK AVG	225	TOP AVG	322	LT SIDE AVG	430
BACK AVG	333	RT SIDE AVG	373	BOTTOM AVG	294
FIREBOX AVG	########	SEC/CAT AVG	########	AMBIENT AVG	74

END	281.0	
START	400.6	
	-119.6	DELTA T

CIRCLE: **LOSS / GAIN**

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 8-26-2010 Analyte : CO_2 (15-1)

Unit : Jotul TL Run # : 2

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 % CO_2 Cyl. Press. : 420 PSI

Certified by : AIR LIQUIDE Date : 04-19-04

Span Cyl. # : 487905 Conc. : 12.20 % CO_2 Cyl. Press. : 1396 PSI

Certified by : AIR LIQUIDE Date : 11-1-07

Analyzer : Make : HORIBA Model : PIR-2000 SN : 407069

Range : 0 - 25.0 % CO_2 Analyzer Output : 0 - 1.0 v.

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % CO_2

EPA Control Limits = ± 2.5% of 25.0 % CO_2 = ± 0.625 % CO_2

Method 28 A = ± .2 % of 25.0 % CO_2 = ± .05 % CO_2

PRE RUN Audit : by : G Worthington Time : 0900 Temp : 74 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.069	.069	.274
SPAN	48.8	.488	12.20	48.6	.486	12.213	.013	.052

POST RUN Audit : by : G Worthington Time : 1735 Temp : 74 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	-.001	.044	.044	.175
SPAN	48.8	.488	12.20	48.5	.485	12.138	-.062	-.246

± Conc. Difference = Act % - Exp (Std) %

Zero % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X 100

Span % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X100

ZERO / SPAN CHECK DATA SHEET #15-2

Date : 9-26-2010 Analyte : O_2 (15-2)

Unit : Total TL Run # : 2

Zero Cyl. # : 168TAC 3A Conc. : 0.00 % O_2 Cyl. Press. : 420 PSI

Certified by : AIR LIQUIDE Date : 04-19-04

Span Cyl. # : 487905 Conc. : 12.60 % O_2 Cyl. Press. : 1390 PSI

Certified by : AIR LIQUIDE Date : 11-1-07

Analyzer : Make : TELEDYNE Model : 320 A SN : 37400

Range : 0 - 25.0 % O_2 Analyzer Output : 0 - 1.0 v.

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % O_2

EPA Control Limits = ± 2.5% of 25.0 % O_2 = ± 0.625 % O_2

Method 28 A = ± .2 % of 25.0 % O_2 = ± .05 % O_2

PRE RUN Audit : by : C. Worthington Time : 0900 Temp : 74 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.001	-.021	-.021	-.082
SPAN	12.60	.504	12.6	12.6	.504	12.636	.036	.145

POST RUN Audit : by : C. Worthington Time : 1735 Temp : 74 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.002	.005	.005	.018
SPAN	12.60	.504	12.6	12.6	.505	12.661	.061	.245

± Conc. Difference = Act % - Exp (Std) %

Zero % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X 100

Span % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X100

ZERO / SPAN CHECK DATA SHEET #15-3

Date : 8-16-2010 Analyte : CO (15-3)

Unit : Jotul TL Run # : 2

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 % CO Cyl. Press. : 420 PSI

Certified by : AIR LIQUIDE Date : 04-19-04

Span Cyl. # : CC487905 Conc. : 4.90 % CO Cyl. Press. : 1390 PSI

Certified by : AIR LIQUIDE Date : 11-1-07

Analyzer : Make : HORIBA Model : PIR-2000 SN : 408005

Range : 0 - 10.0 % CO Analyzer Output : 0 - 1.0 v.

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 10.0 % CO

EPA Control Limits = ± 2.5% of 10.0 % CO = ± 0. 25 % CO

Method 28 A = ± .2 % of 10.0 % CO = ± .02 % CO

PRE RUN Audit : by : C Walmsley Time : 0900 Temp : 74 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.005	.005	.048
SPAN	49.0	.490	4.90	49.0	.490	4.911	.011	.114

POST RUN Audit : by : C Walmsley Time : 1735 Temp : 74 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.005	.005	.048
SPAN	49.0	.490	4.90	48.9	.489	4.901	.001	.014

± Conc. Difference = Act % - Exp (Std) %

Zero % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X 100

Span % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X100

ZERO / SPAN CHECK DATA SHEET #15-4

Date : 8-26-2010 Analyte : SO_2 (15-4)

Unit : Jotul TL Run # : 2

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 ppm SO_2 Cyl. Press. : 420 PSI

Certified by : AIR LIQUIDE Date : 04-19-04

Span Cyl. # : CC82089 Conc. : 1250 ppm SO_2 Cyl. Press. : 1700 PSI

Certified by : AIR LIQUIDE Date : 01-3-2007

Analyzer : Make : HORIBA Model : PIR-2000 SN : 403019

Range : 0 - 2500 ppm SO_2 Analyzer Output : 0 - 1.0 v.

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 2500 ppm SO_2

EPA Control Limits = ± 2.5% of 2500 ppm SO_2 = ± 62.5 ppm SO_2

PRE RUN Audit : by : C. Watson Time : 0900 Temp : 74 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	1.305	1.305	.052
SPAN	50.0	.500	1250	50.0	.500	1248.0	-2.000	-.080

POST RUN Audit : by : C. Watson Time : 1735 Temp : 74 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	-.002	-3.682	-3.682	-.147
SPAN	50.0	.500	1250	50.3	.503	1255.5	5.500	.220

± Conc. Difference = Act % - Exp (Std) %

Zero % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X 100

Span % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X100

QUALITY CHECKS DATA SHEET # 16

UNIT: Total T2 RUN: 2 DATE: 8-26-2010

Thermocouple Check:

T/C # 1	— °F	T/C # 13	65.7 °F
T/C # 2	— °F	T/C # 14	64.3 °F
T/C # 3	64.6 °F	T/C # 15	66.3 °F
T/C # 4	63.2 °F	T/C # 16	62.3 °F
T/C # 5	62.6 °F	T/C # 17	60.7 °F
T/C # 6	62.7 °F	T/C # 18	68.0 °F
T/C # 7	62.4 °F	T/C # 19	— °F
T/C # 8	62.0 °F	T/C # 20	— °F
T/C # 9	— °F	T/C # 21	— °F
T/C # 10	— °F	T/C # 22	— °F
T/C # 11	60.1 °F	T/C # 23	— °F
T/C # 12	71.4 °F	T/C # 24	— °F

Thermocouple Readout:

Pretest zero and span check and calibration — post test zero and span — % difference

ZERO -1.4 °F Adj. to 0.0 °F ZERO .1 °F Difference .005 %

SPAN 2000.4 °F Adj. to 2000.0 °F SPAN 2000.0 °F Difference 0 %

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 200.3 °F	400	= 400.1 °F
600	= 600.0 °F	800	= 799.9 °F	1000	= 1000.0 °F
1200	= 1200.0 °F	1400	= 1399.8 °F	1600	= 1599.9 °F
1800	= 1800.1 °F	2000	= 2000.0 °F		

Sample Train Leak Check	Pre ✓	Post ✓
C-gas Train Leak Check	Pre ✓	Post ✓
SO_2 Train Leak Check	Pre ✓	Post ✓
Static Gauge Zero Check	Pre ✓	Post ✓

Scale Check Pre: — = 10.0

Post: 560.0 − 550.0 = 10.0

Stack Cleaned Prior to Test Run: YES ____ NO X

TABLE 1 ----- RAW DATA

CLIENT : Jotul TEST No. : 4

MODEL: Top Load DATE: 30-Aug-10

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	197.000	0.150	75	1.22	4.20	500
5	198.500	0.950	75	0.50	8.20	200
10	202.276	0.190	75	0.33	2.80	450
15	203.960	0.170	75	0.52	2.90	475
20	205.556	0.130	75	0.60	4.20	550
25	206.934	0.190	75	0.38	7.50	450
30	208.618	0.270	75	0.31	10.10	375
35	210.639	0.270	76	0.21	11.60	375
40	212.667	0.240	76	0.69	11.70	400
45	214.568	0.310	77	0.20	12.00	350
50	216.749	0.310	77	0.13	10.40	350
55	218.929	0.310	77	0.22	9.90	350
60	221.110	0.310	77	0.17	10.00	350
65	223.290	0.310	78	0.21	10.00	350
70	225.479	0.230	78	0.45	9.20	400
75	227.394	0.210	79	0.54	8.40	425
80	229.204	0.180	80	0.70	7.60	450
85	230.914	0.180	80	0.66	7.60	450
90	232.624	0.180	80	0.72	7.80	450
95	234.333	0.180	80	0.60	8.60	450
100	236.043	0.200	81	0.42	9.10	425
105	237.867	0.230	81	0.06	10.60	400
110	239.804	0.260	81	0.03	10.70	375
115	241.870	0.230	81	0.17	8.70	400
120	243.807	0.180	81	0.54	5.70	450
125	245.529	0.150	81	2.07	4.70	500
130	247.080	0.090	81	2.56	4.00	625
135	248.320	0.110	81	2.44	4.00	575
140	249.669	0.120	81	2.34	3.80	550
145	251.078	0.130	81	2.21	3.80	525
150	252.555	0.150	81	2.09	3.70	500
155	254.106	0.160	81	2.03	3.60	475
160	255.737	0.150	81	2.09	3.80	500
165	257.288	0.150	81	2.04	3.70	500
170	258.838	0.150	81	2.02	3.70	500
175	260.389	0.150	81	2.03	3.80	500

180	261.939	0.120	81	2.08	3.90	550
185	263.349	0.130	81	2.05	3.90	525
190	264.825	0.130	81	2.13	3.90	525
195	266.302	0.130	81	2.05	3.70	525
200	267.779	0.130	81	1.96	3.70	525
205	269.255	0.130	81	2.05	3.80	525
210	270.732	0.130	81	2.20	3.90	525
215	272.209	0.130	81	2.08	4.00	525
220	273.685	0.130	81	2.06	3.90	525
225	275.162	0.150	81	2.05	3.80	500
230	276.712	0.130	81	2.22	4.00	525
235	278.189	0.130	81	1.84	3.90	525
240	279.665	0.130	81	1.69	4.00	525
245	281.142	0.130	81	1.81	4.00	525
250	282.619	0.130	81	1.88	3.90	525
255	284.095	0.130	81	1.84	3.90	525
260	285.572	0.130	81	1.94	3.90	525
265	287.049	0.130	81	1.93	3.70	525
270	288.526	0.130	81	1.79	3.80	525
275	290.002	0.130	81	1.23	4.60	525
280	291.479	0.130	81	1.20	4.30	525
285	292.956	0.130	81	1.47	4.30	525
290	294.432	0.130	81	1.59	4.30	525
295	295.909	0.150	81	1.96	4.10	500
300	297.459	0.150	81	1.95	4.10	500
305	299.010	0.150	81	2.00	4.00	500
310	300.560	0.130	81	1.86	3.80	525
315	302.037	0.130	81	1.86	3.90	525
320	303.513	0.130	81	1.82	3.90	525
325	304.990	0.130	81	1.74	3.80	525
330	306.467	0.130	81	1.82	3.80	525

TABLE 2---RAW DATA

CLIENT : Jotul TEST No. 4

MODEL: Top Load DATE: 30-Aug-10

METER CAL. FACTOR (Y) -------	0.916		Wt. WOOD BURNED(LB) -------	16.9	Lbs
BAROMETRIC PRESS.(Pb) -------	30	in Hg	WET,FUEL MOISTURE % -------	17.024	%
LEAK RATE POST (Lp) -------	0.000	cfm	Wt. PART. COLLECTED -------	0.497	g
WATER VOL. (V1c) -------	146.1	Ml	METER VOLUME Vm -------	109.467	mcf
TEST TIME (MIN) -------	330	min	HC MOLE FRACTION -------	0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT : Jotul TEST No. 4

MODEL: Top Load DATE: 30-Aug-10

****

AVG DELTA H	-------	0.18	in H2O	AVG PRCNT CO	-------	1.38	%
AVG METER TEMP. Tm	-------	80	deg F	AVG PRCNT CO2	-------	5.59	%
AVG PPM SO2	-------	480	PPM	AVG BAL CO2/CO	-------	4.04	%

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul TEST No. 4

MODEL: Top Load DATE: 30-Aug-10

****

STD SAMPLE VOL. Vm(std) d) ------	98.40	dscf	STACK GAS FLOW Qsd -------	502.495	dscf/Hr & 8.37 dscf/min
VOL. WATER VAPOR Vw(s td) -----	6.877	scf	PARTICULATE CONCTRT. C s ------	0.0051	g/dscf
PRCNT MSTR Bws -------	6.53	%	PARTC.EMISS. RATE E -------	2.54	g/Hr
BURN RATE BR -------	1.16	Kg/Hr	MOLES OF GAS PER Lb WOOD Nt ----	0.51	Lb-mole/Lb
CO EMISSION RATE -------	232.70 g/Hr & 201.12	g/Kgdry fuel	PART.EMISS. RATE ------	2.19	g/Kgdry fuel

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Jotul TEST No. : 4

MODEL: Top Load DATE: 30-Aug-10

	TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR		PROPRTN RATE VAR. AVERAGE	
	5	680.2	98		100	
	10	686.2	99			
	15	687.3	99			
	20	687.6	99			
	25	687.3	99			
	30	687.3	99			
	35	686.9	99			
	40	688.6	99			
	45	687.8	99			
	50	690.0	100			
	55	689.7	99			
	60	690.0	100			
	65	689.0	99			
	70	691.2	100			
	75	690.3	100			
	80	691.9	100			
	85	691.5	100			
	90	691.5	100			
	95	691.1	100			
	100	690.8	100			
	105	695.3	100			
	110	695.0	100			
	115	695.0	100			
	120	695.0	100			
	125	695.0	100			
	130	695.5	100			
	135	695.0	100			
	140	695.6	100			
	145	695.0	100			
	150	695.4	100			
	155	695.5	100			
	160	694.8	100			
	165	695.5	100			
	170	695.1	100			
	175	695.5	100			
	180	695.1	100			

185	695.5	100
190	694.9	100
195	695.4	100
200	695.4	100
205	694.9	100
210	695.4	100
215	695.4	100
220	694.9	100
225	695.4	100
230	695.1	100
235	695.4	100
240	694.9	100
245	695.4	100
250	695.4	100
255	694.9	100
260	695.4	100
265	695.4	100
270	695.4	100
275	694.9	100
280	695.4	100
285	695.4	100
290	694.9	100
295	695.4	100
300	695.1	100
305	695.5	100
310	695.1	100
315	695.4	100
320	694.9	100
325	695.4	100
330	695.4	100

COMPUTER INPUT DATA SHEET #1

2.54

Client: Jotul North America

Address: 55 Hutcherson

Gorham, ME 04038

Phone: 1-800-797-5912 Fax:

Run No.: 4 Date of Test: 8-30-2010 Burn Rate: 1.157

Model No.: Top Loader ☐ min ☒ min-1.25 ☐ fan

Stove Type: ☐ Cat ☒ Non Cat ☐ Pellet ☐ 1.25-1.9 ☐ max ☐ insert

Dry Gas Meter Y Factor: .916 (0.000) (Data Sheet #2) Post Leak Rate: 0.000 cfm (.000) (Data Sheet #2) Time: 330 min. (000) (Data Sheet #2)

Dry Gas Meter Volume: 109.467 cf (00.000) (Data Sheet #2)

Stack Flow: 7.452 dscfm (00.000) (Data Sheet #2) Δ H: .179 in. H_2O (.000) (Data Sheet #2)

Maximum Vac.: 3.0 (0.0) (Data Sheet #2) Barometric Pressure: 30.00 in. Hg (00.00) (Data Sheet #2)

H_2O Captured: 146.1 g (00.0) (Data Sheet #3)

Front Half Catch % Of Total: 30.7 % (00.0) (Data Sheet #6) Total Particulate Catch: .4970 g (0.0000) (Data Sheet #6)

Flue Gas Moisture: 6.5378 % (00.000) (Data Sheet #7)

Particulate Emission: .0780 gr/dscf (0.0000) (Data Sheet #7)

Relative Humidity: 44.5 % RH (00.0) (Data Sheet #8) Ambient Moisture: 1.2 % H_2O (0.00) (Data Sheet #8)

Preburn Fuel Wt.: 43.4 lbs. (00.0) (Data Sheet #8) Coal Bed Wt.: 4.0 lbs. (00.0) (Data sheet #8) Test Fuel Wt.: 16.9 lbs. (00.0) (Data sheet #8)

Heat Output (EPA Default): 13951.3 BTU/hr (00,000.0) (Data Sheet #8)

Kindling Fuel % Moisture (wet): 13.345 % (00.000) (Data Sheet #10) Pretest Fuel % Moisture (wet): 17.236 % (00.000) (Data Sheet #10)

Test Fuel % Moisture (dry): 20.517 % (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove]) Test Fuel % Moisture (wet): 17.024 %

Fuel Higher Heating Value (dry): N/A BTU/lb. (0000) (Data Sheet #11)

Stack Static Pressure: -.040 in. H_2O (+/- .000) (Data Sheet #12)

Average Ambient Temperature: 71 °F (00) (Data Sheet #14) Stove Temperature Change: -118.5 °F (+/- 000.0) (Data Sheet #14)

Time Start 1030
End 1600

Meter Temp 540

METER BOX DATA SHEET PAGE # 2

Page: 1 of 3

UNIT: Jutul TL RUN: 4 DATE: 8-30-2010

Meter Box: 5H Y Factor: .916

Leak checks: 15 " Hg @ .000 cfm _____ " Hg @ _____ cfm

15 " Hg @ .000 cfm _____ " Hg @ _____ cfm

Inject SO^2 @ 100 cc/min. Nozzle: Probe @ 3/8 " od Initial Volume: 1,560

ROTO: PRESS: .18 SAMPLING RATIO: 23 : 1 BP: 30.00

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1030	197.000	—	6.993	.15	75	500	75	2.0
5	35	198.500	—	17.484	.95	75	200	75	3.0
10	40	202.276	202.276	7.770	.19	75	450	75	2.0
15	45	203.960	203.960	7.361	.17	75	475	75	2.0
20	50	205.556	205.556	6.358	.13	75	550	75	2.0
25	55	206.934	206.934	7.770	.19	75	450	75	2.0
30	1100	208.618	208.618	9.325	.27	75	375	75	2.0
35	05	210.639	210.639	9.307	.27	76	375	76	2.0
40	10	212.467	212.467	8.725	.24	76	400	76	2.0
45	15	214.568	214.568	9.953	.31	77	350	77	2.0
50	20	216.749	216.749	9.953	.31	77	350	77	2.0
55	25	218.929	218.929	9.953	.31	77	350	77	2.0
ROTO PRESS:		.18	TOTALS:	110.952	3.49	908	BP.:	30.00	
60	1130	221.110	221.110	9.953	.31	77	350	77	2.0
65	35	223.290	223.290	9.935	.31	78	350	78	2.0
70	40	225.479	225.479	8.693	.23	78	400	78	2.0
75	45	227.394	227.394	8.166	.21	79	425	79	2.0
80	50	229.204	229.204	7.713	.18	80	450	80	2.0
85	55	230.914	230.914	7.713	.18	80	450	80	2.0
90	1200	232.624	232.624	7.713	.18	80	450	80	2.0
95	05	234.333	234.333	7.713	.18	80	450	80	2.0
100	10	236.043	236.043	8.136	.20	81	425	81	2.0
105	15	237.867	237.867	8.645	.23	81	400	81	2.0
110	20	239.804	239.804	9.221	.26	81	375	81	2.0
115	25	241.870	241.870	8.645	.23	81	400	81	2.0
			TOTALS:	102.246	2.70	956	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	213.198	6.19	1864	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 2 of 3

UNIT: Jotul T2 RUN: 4 DATE: 8-30-2010

Meter Box: SH Y Factor: .916

Leak checks: 15 " Hg @ 1.000 cfm _____ " Hg @ _____ cfm

15 " Hg @ 1.000 cfm _____ " Hg @ _____ cfm

Inject SO^2 @ 100 cc/min. Nozzle: Probe @ 3/8 " od Initial Volume: 1,500

ROTO: PRESS: .18			SAMPLING RATIO: 23			: 1	BP: 30.00		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1230	243.807	243.807	7.684	.18	81	450	81	2.0
125	35	245.529	245.529	6.916	.15	81	500	81	2.0
130	40	247.080	247.080	5.533	.09	81	625	81	2.0
135	45	248.320	248.320	6.014	.11	81	575	81	2.0
140	50	249.669	249.669	6.287	.12	81	550	81	2.0
145	55	251.078	251.078	6.587	.13	81	525	81	2.0
150	1300	252.555	252.555	6.916	.15	81	500	81	2.0
155	05	254.106	254.106	7.280	.16	81	475	81	2.0
160	10	255.737	255.737	6.916	.15	81	500	81	2.0
165	15	257.288	257.288	6.916	.15	81	500	81	2.0
170	20	258.838	258.838	6.916	.15	81	500	81	2.0
175	25	260.389	260.389	6.916	.15	81	500	81	2.0
ROTO PRESS: .18			TOTALS:	80.881	1.69	972	BP.: 30.00		
180	1330	261.939	261.939	6.287	.12	81	550	81	2.0
185	35	263.349	263.349	6.587	.13	81	525	81	2.0
190	40	264.825	264.825	6.587	.13	81	525	81	2.0
195	45	266.302	266.302	6.587	.13	81	525	81	2.0
200	50	267.779	267.779	6.587	.13	81	525	81	2.0
205	55	269.255	269.255	6.587	.13	81	525	81	2.0
210	1400	270.732	270.732	6.587	.13	81	525	81	2.0
215	05	272.209	272.209	6.587	.13	81	525	81	2.0
220	10	273.685	273.685	6.587	.13	81	525	81	2.0
225	15	275.162	275.162	6.916	.15	81	500	81	2.0
230	20	276.712	276.712	6.587	.13	81	525	81	2.0
235	25	278.189	278.189	6.587	.13	81	525	81	2.0
			TOTALS:	79.073	1.57	972	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	159.954	3.26	1944	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 3 of 3

UNIT: John TL RUN: 4 DATE: 8-30 2010

Meter Box: SH Y Factor: .916

Leak checks: 15 " Hg @ .000 cfm _____ " Hg @ _____ cfm

15 " Hg @ .000 cfm _____ " Hg @ _____ cfm

Inject SO^2 @ 100 cc/min. Nozzle: Probe @ 3/8 " od Initial Volume: 1.500

ROTO: PRESS: .18			SAMPLING RATIO: 23 : 1				BP: 30.00		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
240	1430	279.665	279.665	6.587	.13	81	525	81	2.0
245	35	281.142	281.142	6.587	.13	81	525	81	2.0
250	40	282.619	282.619	6.587	.13	81	525	81	2.0
255	45	284.095	284.095	6587	.13	81	525	81	2.0
260	50	285.572	285.572	6.587	.13	81	525	81	2.0
265	55	287.049	287.049	6.587	.13	81	525	81	2.0
270	1500	288.526	288.526	6.587	.13	81	525	81	2.0
275	05	290.002	290.002	6.587	.13	81	525	81	2.0
280	10	291.479	291.479	6.587	.13	81	525	81	2.0
285	15	292.956	292.956	6.587	.13	81	525	81	2.0
290	20	294.432	294.432	6.587	.13	81	525	81	2.0
295	25	295.909	295.909	6.916	.15	81	500	81	2.0
ROTO PRESS: .18			TOTALS:	79.373	1.58	972	BP.: 30.00		
300	1530	297.459	297.459	6.916	.15	81	500	81	2.0
305	35	299.010	299.010	6.916	.15	81	500	81	2.0
310	40	300.560	300.560	6.587	.13	81	525	81	2.0
315	45	302.037	302.037	6.587	.13	81	525	81	2.0
320	50	303.513	303.513	6.587	.13	81	525	81	2.0
325	55	304.990	304.990	6.587	.13	81	525	81	2.0
330	1600	306.467	306.467	6.587	.13	81	525	81	2.0
335				(46.767)	(.95)	(567)			
340				(126.140)	(2.53)	(1539)			
345									
350									
355				499.292	11.98	5347			
			TOTALS:			80	MAX VACC =		3.0
TOTAL Cu Ft.		109.467	TOTALS:	7.452	(.179)	446	AVG. BP:		30.00

(540)

* 1.67

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : Total TL RUN : 4 DATE : 8-30-10

SCALE CHECK	LEVEL	ZEROED
INITIAL :	✓	✓
FINAL :	✓	✓

SCALE	WEIGHT
295.0 g	295.0
590.0 g	590.0
885.0 g	885.0

IMPINGER	#1	#2	#3	#4
FINAL WT	738.3	590.5	485.9	915.5
INITIAL WT	622.5	582.7	483.5	895.4
NET WT GRAMS	115.8	7.8	2.4	20.1

TOTAL CATCH : 146.1 GRAMS H_2O

FRONT HALF

FILTER #	198F	
FINAL WT g	.7563	
INITIAL WT g	.6615	
NET WT g	.0948	

BEAKER #	136
DESC.	ACETONE
FINAL WT g	107.1405
INITIAL WT g	107.0824
NET WT g	.0581
VOL. DESC. ml	75

BACK HALF

FILTER #	198B	
FINAL WT g	.4165	
INITIAL WT g	.3640	
NET WT g	.0525	

BEAKER #	137	138	139	140	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	104.3250	105.2941	104.1728	107.0115	
INITIAL WT g	104.1626	105.2430	104.1258	106.9613	
NET WT g	.1624	.0511	.0470	.0502	(.0972)
VOL. DESC ml	125	75	175 +	175	= 350

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 2-2-2010 Time : 1100 By : CP

	DATE: 2-5-10	BY: AV	DATE: 2-8-10	BY: CP	DATE:	BY:
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
126	105.7659	1145	105.7661	1210	✓	
127	104.0748	1146	104.0753	1211	✓	
128	105.6080	1147	105.6083	1212	✓	
129	106.4284	1148	106.4289	1213	✓	
130	106.5014	1149	105.5019	1214	✓	
131	106.8439	1150	106.8443	1215	✓	
132	105.3817	1151	105.3821	1216	✓	
133	106.5026	1152	106.5027	1217	✓	
134	107.6880	1153	107.6885	1218	✓	
135	104.5925	1154	104.5921	1219	✓	
136	107.0827	1155	107.0824	1220	✓	
137	104.1624	1156	104.1626	1221	✓	
138	105.2433	1157	105.2430	1222	✓ K-4	
139	104.1290	1158	104.1285	1223	✓	
140	106.9612	1159	106.9613	1224	✓	
141	102.2799	1200	102.2800	1225	✓	
142	107.8126	1201	107.8121	1226	✓	
143	105.5706	1202	105.5701	1227	✓	
144	106.3782	1203	106.3779	1228	✓	
145	101.5199	1204	101.5195	1229	✓	
146	101.3681	1205	101.3676	1230	✓	
147	106.9558	1206	106.9554	1231	✓	
148	104.7562	1207	104.7560	1232	✓	
149	107.5443	1208	107.5442	1233	✓	
150	106.7042	1209	106.7037	1234	✓	

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
2-5-10	1015	CP	✓	78	43
2-9-10	1030	CP	✓	78	40

Checked by : CP
Date : 2-10-10
Time : 1317

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 8-12-09 Time : 1205 By : AV

Manufacturer S & S Grade : # 25 Glass Front Size : 11 cm Lot No. :

Back Size: 8.2 cm Lot No. :

	DATE: 8-14-09	BY: AV	DATE: 8-19-09	BY: AV	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
191F	0.6645	0900	0.6647	0920		
192F	0.6630	0901	0.6631	0921		
193F	0.6621	0902	0.6623	0922		
194F	0.6568	0903	0.6568	0923		
195F	0.6602	0904	0.6602	0924		
196F	0.6578	0905	0.6579	0925		
197F	0.6600	0906	0.6601	0926		
198F	0.6615	0907	0.6615	0927	R-4	
199F	0.6575	0908	0.6574	0928		
200F	0.6618	0909	0.6619	0929		
191B	0.3600	0910	0.3601	0930		
192B	0.3597	0911	0.3599	0931		
193B	0.3594	0912	0.3593	0932		
194B	0.3596	0913	0.3596	0933		
195B	0.3570	0914	0.3571	0934		
196B	0.3630	0915	0.3631	0935		
197B	0.3598	0916	0.3598	0936		
198B	0.3640	0917	0.3640	0937	R-4	
199B	0.3602	0918	0.3602	0938		
200B	0.3605	0919	0.3605	0939		

Checked by: C Watkins Date: 8-19-09 Time: 1115

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : Jotul TL **RUN :** 4 **DATE :** 8-30-10 **Page :** 1 of 1

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
136	8-31	1400	CP	107.1404	9-1	1333	CP	107.1405	9-2	1305	CP				
137	8-31	1400	CP	104.3245	9-1	1334	CP	104.3250	9-2	1306	CP				
138	8-31	1400	CP	105.2837	9-1	1335	CP	105.2841	9-2	1307	CP				
139	8-31	1400	CP	104.1724	9-1	1336	CP	104.1728	9-2	1308	CP				
140	8-31	1400	CP	107.0110	9-1	1337	CP	107.0115	9-2	1309	CP				

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
1983	8-30	1530	CP	.2569	8-31	0830	CP	.2563	9-1	1331	CP				
1988	8-30	1830	CP	.4169	8-31	0834	CP	.4165	9-1	1332	CP				

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	8-31-10	0720	CP	72	46
2	9-1-10	1330	CP	76	49
3	9-2-10	1300	CP	68	47
4					
5					

Weighing Session	Date	Time	By	DB	%RH
6					
7					
8					
9					
10					

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 2-26-2010 Through	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0001	10.0004	.9999	.0999	CP	2-26-10	0840	72	46
100.0001	9.9999	.9999	.0999	CP	2-27-10	1045	72	46
100.0000	10.0000	1.0000	.0999	CP	2-28	1100	70	48
100.0000	10.0000	1.0000	.0999	CP	3-1	0900	66	49
100.0000	10.0002	.9998	.1002	CP	3-5	1200	70	48
100.0001	9.9999	.9999	.0998	CP	3-7	1330	68	47
100.0000	9.9999	.9999	.0999	CP	3-9	1130	70	41
100.0000	10.0001	1.0000	.0999	CP	3-10	1200	70	44
100.0000	10.0001	.9999	.0999	CP	3-11	0900	66	49
99.9999	9.9999	.9999	.0999	CP	3-15	1000	70	48
100.0000	10.0000	1.0000	.0998	CP	3-17	0900	72	46
100.0000	9.9998	1.0001	.1000	CP	4-8	1430	76	49
99.9999	10.0001	1.0000	.0999	CP	4-10	1630	73	42
99.9999	10.0001	1.0001	.1000	CP	4-11	1430	74	41
100.0000	10.0002	1.0000	.1000	CP	4-21	1830	77	49
100.0000	10.0000	1.0000	.0999	CP	4-22	1130	74	47
100.0000	10.0001	1.0000	.0999	CP	4-23	1015	74	44
100.0002	9.9999	1.0000	.1000	CP	4-24	0930	68	47
100.0000	9.9999	.9999	.1000	CP	4-25	0930	73	47
100.0000	9.9999	1.0001	.0999	CP	4-26	0900	76	42
100.0000	10.0002	1.0000	.0999	CP	4-30	1320	78	43
99.9998	10.0000	1.0002	.0999	CP	8-26	0845	78	49
100.0000	9.9998	1.0001	.0999	CP	8-27	0955	78	43
100.0000	10.0000	1.0000	.1000	CP	8-28	1600	73	47
99.9998	10.0000	.9999	.1000	CP	8-29	1400	70	48
100.0000	10.0000	1.0000	.0999	CP	8-31	0720	72	46
100.0001	10.0000	1.0000	.1000	CP	9-1	1330	76	49
100.0000	10.0001	1.0000	.0999	CP	9-2	1300	68	47
100.0000	10.0000	1.0000	.1000	CP	9-3	1130	72	46

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 5-10-2009 Through 2-25-2010	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0001	10.0002	1.0000	.0999	CP	5-10	1545	74	44
100.0001	10.0001	.9999	.0999	CP	6-19	1110	70	48
100.0001	10.0000	.9998	.0998	CP	6-22	0930	74	44
100.0001	10.0000	.9999	.0999	CP	6-24	1610	78	46
100.0001	10.0000	1.0000	.0999	CP	6-25	1000	78	46
100.0001	10.0001	1.0001	.0999	CP	6-26	0900	73	47
99.9998	10.0000	1.0001	.1000	CP	6-27	1300	76	45
100.0000	10.0002	1.0000	.0999	CP	6-28	1400	78	43
100.0000	10.0000	1.0000	.0999	CP	6-29	1130	74	47
100.0000	10.0000	1.0000	.0999	CP	7-1	1230	70	48
100.0000	9.9998	1.0000	.0998	CP	8-7	1310	75	48
99.9998	10.0000	1.0000	.0999	CP	8-8	1400	77	46
100.0000	10.0000	1.0000	.0999	CP	8-9	1720	78	46
100.0002	9.9999	1.0000	.0998	CP	8-10	0900	78	46
100.0000	10.0001	1.0001	.0998	CP	8-11	1126	78	46
100.0003	10.0001	1.0001	.1000	CP	8-12	0910	78	46
100.0000	10.0000	1.0001	.1000	CP	8-14	1630	78	46
100.0000	10.0000	1.0001	.0999	CP	8-19	0900	74	47
100.0002	10.0001	1.0000	.1000	CP	8-24	0900	72	42
100.0000	9.9999	.9999	.0999	CP	8-25	0900	70	48
100.0000	10.0000	1.0000	.0999	CP	8-26	1340	77	46
100.0003	10.0000	.9999	.1000	CP	9-5	1120	77	49
100.0000	10.0001	1.0000	.0999	CP	9-8	1410	78	41
100.0000	10.0001	1.0001	.0998	CP	9-11	1050	78	43
100.0000	10.0000	1.0000	.0999	CP	9-12	1220	78	46
100.0000	10.0001	1.0000	.0999	CP	9-13	1430	78	46
100.0000	10.0001	.9999	.1000	CP	9-14	1100	75	48
100.0000	10.0000	.9999	.0999	CP	1-29	1400	74	44
100.0000	10.0001	1.0000	.1000	CP	1-30	1800	78	46
100.0000	10.0001	1.0001	.1000	CP	2-1	0700	64	49
100.0000	9.9999	1.0001	.1000	CP	2-2	1100	72	46
100.0000	9.9997	1.0001	.1000	CP	2-4	1015	75	41
100.0000	10.0000	1.0000	.0998	CP	2-5	1015	78	43
100.0000	10.0001	1.0000	.1000	CP	2-7	1400	70	44
100.0002	10.0001	1.0000	.0999	CP	2-8	1200	78	46
100.0000	10.0000	1.0000	.1000	CP	2-9	1030	78	40
100.0000	10.0000	1.0000	.0999	CP	2-23	1830	77	49
100.0000	10.0001	1.0000	.0999	CP	2-24	0820	69	49
100.0000	10.0002	1.0000	.0999	CP	2-25	0940	69	47

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 8-27-2008 Through 5-9-2009	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9999	10.0000	1.0000	.0999		8-27	0900	78	46
100.0001	10.0000	1.0000	.0999		8-28	0930	78	46
100.0001	10.0001	1.0001	.0997		8-29	1300	78	46
100.0000	10.0000	1.0000	.1000		8-30	1030	78	46
100.0001	10.0003	1.0001	.0999		8-31	1015	76	49
100.0000	10.0001	1.0000	.0997		9-1	1100	74	44
100.0000	10.0001	.9999	.1000		9-2	0845	75	48
99.9999	10.0000	.9999	.0998		9-4	1000	77	47
99.9999	10.0002	1.0001	.0999		9-8	0930	77	49
99.9999	9.9999	.9998	.0998		9-9	1000	74	48
99.9997	9.9997	1.0000	.0999		9-11	1500	76	45
100.0000	9.9997	.9999	.0999		9-17	0930	77	49
100.0000	10.0000	1.0000	.0999		9-18	0900	78	46
100.0000	10.0000	.9999	.0999		9-19	0915	78	49
100.0000	10.0001	.9999	.0999		9-22	1030	77	46
100.0000	10.0001	1.0000	.0998		9-24	1330	78	49
100.0001	10.0001	1.0000	.0999		9-25	0930	78	46
100.0000	9.9999	1.0001	.0998		9-26	0920	78	46
100.0001	9.9999	1.0001	.0999	AV	9-29	0955	78	46
100.0000	10.0001	1.0000	.0998		10-2	0945	75	44
100.0000	10.0000	1.0000	.0999		10-3	0930	78	46
100.0000	9.9999	1.0000	.0999		10-4	1530	78	46
100.0000	9.9999	.9999	.0999		10-6	0930	77	49
100.0000	10.0001	1.0002	.1000		10-7	1700	78	49
100.0000	10.0000	1.0000	.0999		10-8	1000	78	49
99.9999	10.0000	1.0001	.0999		10-9	1030	78	43
100.0000	9.9999	1.0001	.1000		10-10	0930	78	40
100.0000	9.9998	.9999	.0997		10-11	1430	74	47
100.0000	10.0001	1.0000	.1000		10-13	0940	78	46
100.0000	10.0000	.9999	.0999		10-14	2030	77	49
100.0000	10.0002	1.0000	.1000		10-16	1220	78	43
100.0000	9.9999	1.0000	.0999		10-18	1130	74	47
99.9998	10.0000	.9999	.0999		5-3	1200	78	43
100.0000	10.0001	1.0000	.0999		5-4	1000	72	42
100.0000	10.0001	1.0000	.0997		5-5	1000	76	45
99.9998	10.0000	1.0000	.0999		5-6	1100	77	49
100.0000	10.0001	1.0001	.1000		5-7	1600	77	42
100.0000	10.0001	1.0000	.0999		5-8	1600	76	45
100.0000	10.0003	1.0000	.1000		5-9	1300	76	38

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 10-22-07 Through 8-26-2008	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0006	10.0001	1.0000	.0998	CP	10-22	1630	78	46
99.9999	10.0001	1.0000	.1001	CP	10-23	1000	74	44
100.0002	10.0002	1.0002	.0999	CP	10-24	1400	73	47
100.0002	10.0000	1.0001	.0998	CP	10-26	1700	74	40
100.0003	10.0001	1.0001	.0999	CP	10-27	0820	78	40
99.9999	10.0000	.9999	.0997	CP	10-28	1200	78	40
100.0000	9.9999	.9999	.0999	CP	10-29	1700	76	42
99.9998	9.9999	.9999	.1000	CP	10-30	1600	78	43
99.9997	10.0000	.9999	.0999	CP	11-16	1500	68	47
100.0001	10.0002	1.0000	.0999	CP	11-19	1730	73	40
100.0000	10.0002	.9999	.0999	CP	11-20	1100	69	44
99.9998	9.9999	.9999	.0998	CP	1-18-08	1230	76	45
100.0002	10.0002	.9999	.0999	CP	1-21-08	1430	65	48
99.9999	10.0002	1.0001	.0999	CP	1-22-08	1200	68	47
100.0002	9.9999	.9999	.0998	CP	1-23-08	1400	74	47
99.9999	10.0000	1.0002	.1000	CP	1-31-08	1900	74	44
100.0000	10.0003	1.0000	.0996	CP	2-1-08	1530	76	45
99.9997	9.9999	.9999	.0999	CP	2-16-08	1700	68	47
100.0001	10.0002	1.0000	.1000	CP	2-18-08	1400	72	46
99.9999	10.0001	.9999	.0998	CP	2-22-08	1800	68	47
99.9999	10.0001	1.0000	.0999	CP	2-28-08	1800	78	43
100.0000	10.0000	1.0000	.0999	CP	5-8-08	1030	78	43
100.0001	10.0001	1.0000	.0999	CP	5-9-08	0930	69	47
100.0000	10.0001	.9999	.0999	CP	5-10-08	1330	74	47
99.9998	9.9999	1.0000	.0998	CP	5-11-08	0900	74	44
100.0003	10.0001	.9999	.0998	CP	5-12	1400	70	48
99.9999	10.0001	1.0000	.1000	CP	5-13	1000	77	42
99.9999	9.9997	1.0000	.1000	CP	5-14	1230	77	42
99.9999	10.0001	.9999	.1000	CP	6-5-08	1430	72	46
100.0001	10.0000	1.0000	.0999	CP	6-9-08	1400	74	44
99.9999	9.9999	1.0000	.0999	CP	6-9-08	1800	73	47
100.0001	10.0001	.9999	.0998	CP	8-11-08	0930	77	42
100.0003	10.0000	1.0001	.0999	CP	8-12-08	1011	78	43
100.0000	10.0001	1.0000	.0999	CP	8-13-08	0950	76	49
100.0002	10.0000	1.0000	.0998	CP	8-18-08	0930	74	44
100.0001	9.9999	1.0000	.0998	CP	8-20-08	1110	76	45
100.0000	9.9999	.9999	.0998	CP	8-21-08	0915	75	48
100.0002	10.0000	1.0000	.1002	CP	8-22-08	0910	75	45
100.0000	10.0001	1.0001	.0999	CP	8-26-08	0910	78	43

BLANK PROCESSING DATA SHEET # 5

UNIT: Jotol TL RUN: 4 DATE: 8-30-10

BLANKS DONE: 10-30-2007

BEAKER	A	B	C
	200 ml ACETONE	75 ml DICHLOR	200 ml WATER
	FISHER OPTIMA LOT #023283	FISHER OPTIMA LOT #03 5941	DWNA Inc Sparklettes Distilled
FINAL WEIGHT	108.9009	106.3077	106.9680
TARE WEIGHT	108.8995	106.3063	106.9644
NET WEIGHT	.0014	.0014	.0036

TARE BEAKERS INTO DESC: TIME: 1700 DATE: 10-20-07

DATE: 1022 BY: Cp DATE: 1023 BY Cp DATE: BY:

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.8994	1700	108.8995	1027		
B	106.3060	1701	106.3063	1028		
C	106.9639	1702	106.9644	1029		

FINAL BEAKERS INTO DESC: TIME: 1040 DATE: 10-27-07

DATE: 1029 BY: Cp DATE: 1030 BY Cp DATE: BY:

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9011	1721	108.9009	1619		
B	106.3074	1722	106.3077	1621		
C	106.9678	1723	106.9680	1622		

TARE QC

DATE	TIME	BY	WB	DB	%
10-22	1630	Cp		78	46
10-23	1000	Cp		74	44

FINAL QC

DATE	TIME	BY	WB	DB	%
10-29	1700	Cp		76	42
10-30	1600	Cp		78	43

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT: Total TL RUN: 4 DATE: 8-30-10

BLANK CALCULATIONS

Acetone: .0014 g + 200 ml = .000007 g/ml

Dicholoromethane: .0014 g + 75 ml = .000019 g/ml

Distilled Water: .0036 g + 200 ml = .000018 g/ml

FRONT HALF CATCH

FILTERS: .0948 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0948 g

BEAKERS: .0581 (Total Catch) g - 75 (ml Acetone) (.000007 g) (Blank Value / ml Acetone) .0005 = .0576 g

TOTAL FRONT HALF CATCH : .1524 g

BACK HALF CATCH

FILTERS: .0525 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0525 g

BEAKERS:

Acetone: .1624 (Total Catch) g - 125 (ml Acetone) (.000007 g) (Blank Value / ml Acetone) .0009 = .1615 g

Extract: .0411 (Total Catch) g - 75 (ml Dichloromethane) (.000019 g) (Blank Value / Dichloromethane) (.0014) = .0397 g

Water: .0972 (Total Catch) g - 350 (ml Water) (.000018 g) (Blank Value / Water) .0063 = .0909 g

TOTAL BACK HALF CATCH : .3446 g

TOTAL CATCH : .4970 g

% FRONT HALF : 30.7 %

CALCULATIONS DATA SHEET # 7

UNIT : Jotul TL RUN : 4 DATE : 8-30-2010

1) Vm (std) = $\dfrac{(109.467\ \text{Vm})(17.64)(.916\ \text{mcf})\left(30.00\ \text{" Hg} + \dfrac{.179\ \text{" } H_2O}{13.6}\right)}{(540\ \text{TmA})} = \dfrac{98.3094}{000.0000}$ dscf

2) Vw (std) = (.04707) (146.1 ml H_2O) = $\dfrac{6.8769}{00.0000}$ scf

3) Asw = $\dfrac{(6.8769\ \text{scf})}{(6.8769\ \text{scf} + 98.3094\ \text{dscf})} = \dfrac{.0654}{.0000}$ Bws × 100 = $\dfrac{6.5378}{00.0000}$ % H_2O

4) Cs = $\dfrac{(.4970\ \text{g.})}{(98.3094\ \text{dscf})}$ (15.43) = $\dfrac{.0780}{0.0000}$ gr / dscf

5) Estimated g / hr = $\dfrac{(.4970\ \text{g.})}{(98.3094\ \text{dscf})}$ ($\dfrac{7,452}{00.0000}$ dscfm) (60) = $\dfrac{2,2604}{00.0000}$ g / hr

Vm =	total cubic feet pulled on meter box during test	(p. 2)	(000.000 Vm)
mcf =	meter correction factor (Y factor) of meter box used for test	(p. 2)	(0.000 mcf)
" Hg =	average barometric pressure during test	(p. 2)	(00.00 " Hg)
" H_2O =	average delta H for test	(p. 2)	(.000 " H_2O)
TmA =	average meter temperature for test in degrees Absolute	(p. 2)	(000 TmA)
ml H_2O =	total water caught during test	(p. 3)	(000.0 ml H_2O)
g. =	total particulate catch for test	(p. 6)	(00.0000 g.)
dscfm =	average stack flow during test	(p. 2)	(00.000 dscf)

TEST DATA SHEET # 8

UNIT : Jotul TL RUN : 4 DATE : 8-30-2010

Test Chamber Air Velocity Start : Ø Stop : Ø Avg.: Ø

Wet Bulb / Dry Bulb

Pre : WB : 57 DB : 70 = 45 % RH 1.1 % H_2O

Post : WB : 60 DB : 74 = 44.6 % RH 1.3 % H_2O

Average : 44.5 % RH 1.2 % H_2O

Empty Stove Weight (lbs) : N/A w/ stack & oil seal : Wet : N/A Dry : 546.2

Kindling Weight (lbs) : Paper : .1 Wood : 1.6

Preburn Fuel Weight : 20.5 + 21.3 Total : 41.8

Kindling & Preburn Fuel Weight (wood only) (lbs) : **Total** : 43.4

Coal Bed Wt Range (lbs) : 4.2 - 3.4 Scale : 550.4 - 549.6

Upper : .25 × fuel weight : Always round DOWN to nearest tenth

Lower : .20 × fuel weight : Always round UP to nearest tenth **Actual Coal Bed Weight** : 4.0

Maximum Coal Bed Removal (lbs) : ((4.2 (Upper) + 3.4 (Lower)) ÷ 2) .25 = .9 (round down to nearest tenth)

Test Fuel (.75" × 1.5" × 5" spacers) = 20 pcs

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" × 4"	16.5	4	9.0	53.3
4" × 4"	16.5	2	7.9	46.7

Test Fuel Weight : 16.9 lbs

Estimated Dry Burn Rate :

$$\frac{16.9 - (16.9 \times .17024)}{2.2046} \times \frac{60}{\frac{330}{\text{TIME}}} = 1.157 \text{ kg / hr}$$

Estimated BTU's/hr : 19,140 × $\frac{63}{100}$ × $\frac{1.157}{\text{DBR}}$ = 13951.3 BTU's/hr

EPA Default Efficiencies : Non-cat : 63 Cat : 72 Pellet : 78

305

WOOD STOVE OPERATING DATA PAGE #9

Unit : Jotul TL Run : 4 Date : 8-30-2010

FIRE STARTED: 0645

WARM UP AND PREBURN:

PRIMARY AIR : Set wide open for all warm-up / preburn fuel charges. Then set to 3/8" at start of preburn.

SECONDARY AIR : N/A CAT BYPASS : N/A

CHARCOAL BED PREPARATION :

Raked and leveled prior to each warm-up / preburn charge. At 1 1/2 min. prior to loading last fuel, raked and leveled. In stove 15 sec.

TEST:

DOOR wide open during loading Ø min. 35 sec.

PRIMARY AIR : Opened full for first 5 min., then set to run setting of 3/8".

SECONDARY AIR : N/A CAT BYPASS : N/A

FAN:

ON / (OFF) during warm-up

ON / (OFF) first 30 minutes of test

Fan speed set at Low

(ON) / OFF during preburn

(ON) / OFF balance of test run

WOOD DATA: KINDLING: A mix of the grades listed below:

	SIZE	MILL	GRADE	SPECIES
PREBURN:	2x4	Manke/Tacoma	Std. or better	s. grn D fir
TEST:	2x4	Packwood	# 2 or better	s. grn D fir
	4x4	Packwood	# 2 or better	s. grn D fir

PELLET FUEL MANUFACTURER : N/A BRAND : N/A

All Grades WCLB rules:

WARM UP INFORMATION:

All pre-burn / warm up fuel pieces were either 12 or 16 inches.

1st warm up / pre-burn fuel charge (20.5 lbs.) added at 0653

2nd warm up / pre-burn fuel charge (21.5 lbs.) added at 0810

3rd warm up / pre-burn fuel charge (_____ lbs.) added at _____

4th warm up / pre-burn fuel charge (_____ lbs.) added at _____

5th warm up / pre-burn fuel charge (_____ lbs.) added at _____

TEST DATA SHEET #10

Unit : Jotul TC Run : 4 Date : 8-30-2010

Room Temperature : 70 °F Temperature Correction Set? : (Yes) No

Calibration Check: 12.0% + or – 0.2%? (Yes) No

Time Test Fuel moisture reading taken : 0900

pc #	Dimen.	Use	TOP	BOTTOM	SIDE	Avg Corrected
1	2"×4"×8'	K	16.5	14.7	15.0	15.400
2						
3						
4	2"×4"×8'	P	18.7	18.3	18.2	18.4
5	2"×4"×8'	P	20.7	18.3	18.7	19.2
6	2"×4"×8'	P	22.6	22.2	22.7	22.3
7	2"×4"×8'	P	23.2	23.6	23.5	23.4
8	2"×4"×8'	P				83.3
9						
10						
11	2×4×16.5"	T	18.7	18.3	18.3	18.4
12	"	T	18.7	18.2	20.7	19.2
13	"	T	23.2	23.5	23.6	23.4
14	"	T	22.2	22.7	22.6	22.5
15	4×4×16.5"	T	18.7	20.0	19.5	19.4
16	"	T	20.5	20.1	20.1	20.2
17						123.1
18						
19						
20	Spacers	T	21.5	22.0	22.2	21.9

Key for Use : K = Kindling P = Pretest Fuel T = Test Fuel

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	15.400 %	20.825 %	20.517 %
Wet Moisture % :	13.345 %	17.236 %	17.024 %

To obtain Wet from Dry : $\frac{100 \times \%\ \text{Dry Reading}}{100 + \%\text{Dry Reading}}$ = % Moisture, Wet Basis

Acceptable Ranges : 16 - 20 % wet: 19 - 25 % dry (17.5 - 22.5 on Meter Uncor. reading) at 70°

GAS DATA SHEET #12

WEIGHT: 550.2 DATE: 8-30-2016

UNIT: Jotul TC RUN: 4 PAGE: 1 OF 2

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
0 1030	567.1	16.9	—	.166	4.2	.610	15.3	.120	1.22	.038	.500
5 35	565.9	15.7	1.2	.328	8.2	.483	12.1	.048	.50	.055	.200
10 40	565.6	15.4	.3	.110	2.8	.701	17.6	.031	.33	.051	.450
15 45	565.3	15.1	.3	.115	2.9	.689	17.3	.050	.52	.047	.475
20 50	564.9	14.7	.4	.166	4.2	.638	16.0	.056	.60	.049	.550
25 55	564.3	14.1	.6	.300	7.5	.514	12.9	.036	.38	.050	.450
30 1100	563.5	13.3	.8	.406	10.1	.411	10.3	.029	.31	.055	.375
35 05	562.8	12.6	.7	.464	11.6	.356	8.9	.019	.21	.058	.375
40 10	562.0	11.8	.8	.469	11.7	.336	8.4	.067	.69	.060	.400
45 15	561.2	11.0	.8	.480	12.0	.344	8.6	.018	.20	.061	.350
50 20	560.5	10.3	.7	.417	10.4	.407	10.2	.011	.13	.060	.350
55 25	559.8	9.6	.7	.398	9.9	.423	10.6	.020	.22	.060	.350
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.644	*****
60 30	559.2	9.0	.6	.403	10.0	.423	10.6	.015	.17	.060	.350
65 35	558.7	8.5	.5	.400	10.0	.423	10.5	.019	.21	.059	.350
70 40	558.1	7.9	.6	.364	9.2	.443	11.1	.043	.45	.055	.400
75 45	557.6	7.4	.5	.357	8.4	.514	12.9	.052	.54	.052	.425
80 50	557.2	7.0	.4	.306	7.6	.499	12.5	.068	.70	.051	.450
85 55	556.8	6.6	.4	.304	7.6	.499	12.5	.064	.66	.050	.450
90 1200	556.4	6.2	.4	.311	7.8	.487	12.2	.070	.72	.049	.450
95 05	556.0	5.8	.4	.344	8.6	.463	11.6	.058	.60	.049	.450
100 10	555.5	5.3	.5	.366	9.1	.447	11.2	.040	.42	.048	.425
105 15	555.0	4.8	.5	.426	10.6	.403	10.1	.004	.06	.050	.400
110 20	554.5	4.3	.5	.428	10.7	.399	10.0	.001	.03	.052	.375
115 25	554.1	3.9	.4	.340	8.7	.475	11.9	.015	.17	.050	.400
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.625	*****
120 30	553.8	3.6	.3	.229	5.7	.578	14.5	.052	.54	.050	.450
125 35	553.7	3.5	.1	.189	4.7	.558	14.0	.205	2.07	.045	.500
130 40	553.6	3.4	.1	.161	4.0	.566	14.2	.254	2.56	.044	.625
135 45	553.5	3.3	.1	.161	4.0	.570	14.3	.242	2.44	.041	.575
140 50	553.4	3.2	.1	.151	3.8	.582	14.6	.232	2.34	.040	.550
145 55	553.3	3.1	.1	.150	3.8	.586	14.7	.219	2.21	.039	.525
150 1300	553.2	3.0	.1	.148	3.7	.598	15.0	.207	2.09	.038	.500
155 05	553.2	3.0	.0	.143	3.6	.602	15.1	.201	2.03	.038	.475
160 10	553.1	2.9	.1	.152	3.8	.594	14.9	.207	2.09	.038	.500
165 15	553.0	2.8	.1	.149	3.7	.598	15.0	.202	2.04	.037	.500
170 20	552.9	2.7	.1	.148	3.7	.598	15.0	.200	2.02	.035	.500
175 25	552.8	2.6	.1	.150	3.8	.594	14.9	.201	2.03	.034	.500
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.479	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	1.748	*****

Fan?

GAS DATA SHEET #12

WEIGHT: 550.2 DATE: 8-30-2010

UNIT: Jotul TL RUN: 4 PAGE: 2 OF 2

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
180 30	552.8	2.6	.0	.154	3.9	.590	14.8	.206	2.08	.034	.550
185 35	552.7	2.5	.1	.154	3.9	.590	14.8	.203	2.05	.033	.525
190 40	552.6	2.4	.1	.156	3.9	.586	14.7	.211	2.13	.033	.525
195 45	552.5	2.3	.1	.149	3.7	.598	15.0	.203	2.05	.033	.525
200 50	552.4	2.2	.1	.149	3.7	.602	15.1	.194	1.96	.032	.525
205 55	552.3	2.1	.1	.151	3.8	.590	14.9	.203	2.05	.032	.525
210 1400	552.3	2.1	.0	.154	3.9	.586	14.7	.218	2.20	.032	.525
215 05	552.2	2.0	.1	.158	4.0	.586	14.7	.206	2.08	.032	.525
220 10	552.1	1.9	.1	.156	3.9	.590	14.8	.204	2.06	.032	.525
225 15	552.0	1.8	.1	.152	3.8	.594	14.9	.203	2.05	.032	.500
230 20	551.9	1.7	.1	.159	4.0	.578	14.5	.220	2.22	.031	.525
235 25	551.8	1.6	.1	.156	3.9	.598	15.0	.182	1.84	.031	.525
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.387	*****
240 30	551.7	1.5	.1	.158	4.0	.602	15.1	.167	1.69	.031	.525
245 35	551.6	1.4	.1	.160	4.0	.594	14.9	.179	1.81	.031	.525
250 40	551.6	1.4	.0	.156	3.9	.598	15.0	.186	1.88	.031	.525
255 45	551.5	1.3	.1	.155	3.9	.598	15.0	.182	1.84	.031	.525
260 50	551.4	1.2	.1	.155	3.9	.594	14.9	.192	1.94	.031	.525
265 55	551.3	1.1	.1	.149	3.7	.602	15.1	.191	1.93	.031	.525
270 1500	551.2	1.0	.1	.153	3.8	.606	15.2	.177	1.79	.030	.525
275 05	551.1	.9	.1	.183	4.6	.594	14.9	.121	1.23	.030	.525
280 10	551.0	.8	.1	.173	4.3	.610	15.3	.118	1.20	.030	.525
285 15	551.0	.8	.0	.171	4.3	.598	15.0	.145	1.47	.030	.525
290 20	550.9	.7	.1	.174	4.3	.594	14.9	.157	1.59	.030	.525
295 25	550.8	.6	.1	.163	4.1	.586	14.7	.194	1.96	.030	.500
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.366	*****
300 30	550.7	.5	.1	.164	4.1	.586	14.7	.193	1.95	.030	.500
305 35	550.6	.4	.1	.161	4.0	.590	14.8	.198	2.00	.030	.500
310 40	550.5	.3	.1	.153	3.8	.602	15.1	.184	1.86	.030	.525
315 45	550.5	.3	.0	.155	3.9	.598	15.0	.184	1.86	.030	.525
320 50	550.4	.2	.1	.154	3.9	.598	15.0	.180	1.82	.030	.525
325 55	550.3	.1	.1	.153	3.8	.606	15.2	.172	1.74	.030	.525
330 1600	550.2	.0	.1	.151	3.8	.602	15.1	.180	1.82	.030	.525
335 05											
340 10										.210	
345 15											
350 20											
355 25											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.963	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	2.711	*****

-.040

PREBURN DATA SHEET #13

UN- JUL [illegible] RUN: 4 DATE: 8-30-2010 PAGE: 1 of 1

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
0 09:20	551.4	—	485	540	783	581	686	592			70	-057	PREBURN START: @ 1.0 UP
5 25	551.3	-.1	367	506	756	538	658	596			70	-054	COAL BED SCALE RANGE:
10 30	551.2	-.1	338	481	726	516	630	586			70	-051	550.4 → 549.6
15 35	551.1	-.1	316	455	695	496	603	576			69	-049	PRIMARY AIR: 1.375"
20 40	551.0	-.1	301	436	666	475	579	563			69	-047	SECONDARY AIR: N/A
25 45	550.9	-.1	290	419	645	468	562	550			69	-046	FAN: LOW
30 50	550.8	-.1	273	398	617	457	539	540			70	-045	PUMPS ON AT: ✓
35 55	550.7	-.1	264	382	594	506	517	527			69	-043	CHECK WB/DB: N/A
40 100	550.6	-.1	258	372	579	495	507	519			70	-041	
45 05	550.6	-.0	247	360	557	475	489	506			69	-040	
50 10	550.5	-.1	240	349	541	459	474	495			69	-039	
53 13	550.4	-.1	231	334	519	437	453	481			70	-038	
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	
60 20	550.3	-.1	229	322	510	427	446	472			68	-038	435
65 25	550.3	-.0	223	316	497	409	432	465			68	-038	"
70 30	550.2	-.1	219	305	486	387	424	455			64	-038	410
75 35													
80 40													

7

Jotul- Top Loader

Temperature Data Sheet 14

Run 4
8/30/10

Time	Stack	Top	LT Side	Back	Rt Side	Bottom	Firebox	Sec/Cat	Ambient	Tube Furn	Smpl Box	Smpl Out	C-Gas Box	C-Gas Out	SO2 Out
********	Chn 103	Chn 104	Chn 105	Chn 106	Chn 107	Chn 108	Chn 109	Chn 110	Chn 111	Chn 112	Chn 113	Chn 114	Chn 115	Chn 116	Chn 117
0	219	305	486	387	424	455	######	######	68	1324	231	59	246	31	35
5	536	316	469	392	410	448	######	######	68	1317	232	42	246	32	35
10	283	330	463	376	407	439	######	######	68	1310	233	41	247	33	35
15	247	318	442	358	389	424	######	######	69	1304	234	42	248	33	35
20	244	306	424	343	371	412	######	######	68	1298	235	43	247	33	36
25	279	314	420	331	359	397	######	######	68	1290	236	44	245	34	36
30	319	345	434	322	352	388	######	######	68	1283	236	44	245	34	36
35	349	379	458	300	358	372	######	######	69	1276	235	44	245	34	36
40	364	412	480	289	378	362	######	######	69	1271	235	44	245	34	37
45	370	435	508	285	398	353	######	######	69	1266	235	45	245	34	37
50	366	449	537	286	424	348	######	######	69	1262	234	45	245	34	37
55	358	455	556	287	448	341	######	######	69	1259	235	45	245	34	37
60	355	462	564	291	465	333	######	######	70	1256	234	46	245	34	37
65	352	460	567	299	478	330	######	######	70	1253	232	46	245	34	37
70	342	459	571	309	486	327	######	######	70	1251	231	45	248	34	37
75	326	450	571	316	486	323	######	######	70	1250	230	45	248	34	37
80	316	446	566	320	483	320	######	######	70	1250	233	45	248	34	36
85	310	437	559	322	479	318	######	######	71	1250	236	46	247	34	36
90	303	432	557	325	475	316	######	######	72	1250	238	46	247	34	36
95	303	423	560	333	471	315	######	######	72	1250	240	47	247	34	36
100	307	422	566	339	470	314	######	######	72	1251	242	47	247	34	36
105	327	425	573	345	474	312	######	######	72	1251	244	48	247	34	36
110	336	436	589	352	487	310	######	######	72	1252	246	48	246	34	36
115	332	445	596	357	501	308	######	######	72	1254	248	48	246	34	36
120	307	444	586	361	510	307	######	######	72	1256	247	48	246	34	36
125	282	433	569	359	499	305	######	######	72	1259	247	48	246	34	36
130	261	414	550	354	481	302	######	######	73	1263	247	49	246	34	36
135	249	394	533	351	465	302	######	######	72	1268	246	49	247	33	35
140	238	379	516	345	449	301	######	######	73	1273	246	49	247	33	35
145	229	363	501	339	435	300	######	######	72	1280	245	50	247	33	35
150	221	347	487	332	423	298	######	######	72	1285	245	50	248	33	35
155	214	332	474	326	412	296	######	######	72	1290	244	50	245	33	35
160	209	325	462	321	401	296	######	######	72	1295	246	50	245	33	35
165	204	317	451	316	392	294	######	######	72	1299	248	50	245	33	35
170	200	309	441	312	383	292	######	######	73	1301	248	50	244	33	35

175	198	303	432	308	376	290	######	######	73	1304	247	51	243	32	34
180	197	296	424	305	369	290	######	######	72	1306	247	51	242	33	34
185	195	290	417	302	362	288	######	######	72	1308	246	45	242	33	34
190	192	283	410	299	357	285	######	######	72	1310	246	41	241	33	34
195	190	279	405	298	352	283	######	######	72	1311	246	40	240	33	34
200	187	275	399	296	347	282	######	######	72	1312	245	40	240	33	34
205	188	268	394	304	343	280	######	######	72	1313	245	41	238	32	33
210	189	266	390	308	339	277	######	######	71	1314	244	41	237	32	33
215	188	263	388	309	337	277	######	######	71	1315	243	42	237	32	33
220	188	265	385	308	334	275	######	######	72	1315	243	42	237	32	33
225	187	260	383	308	333	275	######	######	71	1313	242	43	235	32	33
230	187	259	380	308	331	274	######	######	72	1310	241	43	235	32	33
235	186	259	378	308	329	274	######	######	72	1307	241	44	235	32	33
240	185	259	376	308	329	274	######	######	72	1304	241	44	235	32	33
245	184	258	373	308	328	273	######	######	72	1301	241	44	235	32	33
250	184	254	371	309	327	272	######	######	72	1300	240	45	234	32	33
255	183	253	369	310	325	272	######	######	72	1298	240	45	234	32	33
260	182	252	367	310	324	271	######	######	72	1296	240	45	234	32	33
265	182	249	365	309	323	270	######	######	72	1294	240	46	234	32	33
270	181	248	363	308	321	269	######	######	72	1294	240	46	234	32	33
275	180	248	361	308	319	269	######	######	72	1294	240	47	233	31	33
280	181	247	359	308	318	267	######	######	72	1294	240	48	233	31	33
285	182	250	357	307	318	267	######	######	72	1295	240	48	234	31	32
290	183	249	356	305	320	265	######	######	72	1294	239	49	233	31	32
295	183	249	353	305	320	265	######	######	72	1294	239	49	233	31	32
300	183	250	350	305	321	265	######	######	72	1294	239	50	233	31	32
305	182	248	348	305	321	263	######	######	72	1294	240	50	233	31	32
310	181	250	345	304	322	262	######	######	73	1294	240	50	234	31	32
315	181	249	343	304	321	261	######	######	73	1294	241	50	233	31	32
320	181	247	341	304	320	261	######	######	73	1294	241	51	234	31	32
325	181	247	339	303	319	258	######	######	73	1294	242	51	233	31	32
330	180	247	337	303	318	258	######	######	73	1294	242	51	233	31	32

TEMPERATURE DATA SHEET #14A

		TEST TIME	330		
STACK AVG	245	TOP AVG	329	LT SIDE AVG	448
BACK AVG	319	RT SIDE AVG	387	BOTTOM AVG	307
FIREBOX AVG	########	SEC/CAT AVG	########	AMBIENT AVG	71

END	292.6	
START	411.1	
	-118.5	DELTA T

CIRCLE: LOSS / GAIN

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 8-30-2010 Analyte : CO_2 (15-1)

Unit : Jotul TL Run # : 4

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 % CO_2 Cyl. Press. : 420 PSI

Certified by : AIR LIQUIDE Date : 04-19-04

Span Cyl. # : 487905 Conc. : 12.20 % CO_2 Cyl. Press. : 1396 PSI

Certified by : AIR LIQUIDE Date : 11-1-07

Analyzer : Make : HORIBA Model : PIR-2000 SN : 407069

Range : 0 - 25.0 % CO_2 Analyzer Output : 0 - 1.0 v.

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % CO_2

EPA Control Limits = ± 2.5% of 25.0 % CO_2 = ± 0.625 % CO_2

Method 28 A = ± .2 % of 25.0 % CO_2 = ± .05 % CO_2

PRE RUN Audit : by : G Worthington Time : 0925 Temp : 72 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.069	.069	.274
SPAN	48.8	.488	12.20	48.9	.489	12.238	.038	.152

POST RUN Audit : by : G Worthington Time : 1640 Temp : 73 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	-.002	.019	.019	.075
SPAN	48.8	.488	12.20	48.5	.485	12.138	-.062	-.246

± Conc. Difference = Act % - Exp (Std) %

Zero % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X 100

Span % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X100

ZERO / SPAN CHECK DATA SHEET #15-2

Date : 8-30-2010 Analyte : O_2 (15-2)

Unit : Jotul TL Run # : 4

Zero Cyl. # : 168TAC 3A Conc. : 0.00 % O_2 Cyl. Press. : 420 PSI

Certified by : AIR LIQUIDE Date : 04-19-04

Span Cyl. # : 487905 Conc. : 12.60 % O_2 Cyl. Press. : 1390 PSI

Certified by : AIR LIQUIDE Date : 11-1-07

Analyzer : Make : TELEDYNE Model : 320 A SN : 37400

Range : 0 - 25.0 % O_2 Analyzer Output : 0 - 1.0 v.

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % O_2

EPA Control Limits = ± 2.5% of 25.0 % O_2 = ± 0.625 % O_2

Method 28 A = ± .2 % of 25.0 % O_2 = ± .05 % O_2

PRE RUN Audit : by : C. Wrenn Time : 0925 Temp : 72 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.001	-.021	-.021	-.082
SPAN	12.60	.504	12.6	12.6	.504	12.636	.036	.145

POST RUN Audit : by : C. Wrenn Time : 1640 Temp : 73 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.001	-.021	-.021	-.082
SPAN	12.60	.504	12.6	12.6	.505	12.661	.061	.245

± Conc. Difference = Act % - Exp (Std) %

Zero % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X 100

Span % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X100

ZERO / SPAN CHECK DATA SHEET #15-3

Date : 8-30-2010 Analyte : CO (15-3)

Unit : Jotul TL Run # : 4

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 % CO Cyl. Press. : 420 PSI

Certified by : AIR LIQUIDE Date : 04-19-04

Span Cyl. # : CA487905 Conc. : 4.90 % CO Cyl. Press. : 1390 PSI

Certified by : AIR LIQUIDE Date : 11-1-07

Analyzer : Make : HORIBA Model : PIR-2000 SN : 408005

Range : 0 - 10.0 % CO Analyzer Output : 0 - 1.0 v.

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 10.0 % CO

EPA Control Limits = ± 2.5% of 10.0 % CO = ± 0. 25 % CO

Method 28 A = ± .2 % of 10.0 % CO = ± .02 % CO

PRE RUN Audit : by : G Wadsworth Time : 0925 Temp : 72 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.005	.005	.048
SPAN	49.0	.490	4.90	49.0	.490	4.911	.011	.114

POST RUN Audit : by : G Wadsworth Time : 1640 Temp : 73 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.005	.005	.048
SPAN	49.0	.490	4.90	49.0	.490	4.911	.011	.114

± Conc. Difference = Act % - Exp (Std) %

Zero % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X 100

Span % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X100

ZERO / SPAN CHECK DATA SHEET #15-4

Date : 8-30-2010 Analyte : SO_2 (15-4)

Unit : Jotul TL Run # : 4

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 ppm SO_2 Cyl. Press. : 420 PSI

Certified by : AIR LIQUIDE Date : 04-19-04

Span Cyl. # : CC82089 Conc. : 1250 ppm SO_2 Cyl. Press. : 1700 PSI

Certified by : AIR LIQUIDE Date : 01-3-2007

Analyzer : Make : HORIBA Model : PIR-2000 SN : 403019

Range : 0 - 2500 ppm SO_2 Analyzer Output : 0 - 1.0 v.

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 2500 ppm SO_2

EPA Control Limits = ± 2.5% of 2500 ppm SO_2 = ± 62.5 ppm SO_2

PRE RUN Audit : by : C. Walmsley Time : 0925 Temp : 72 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	1.305	1.305	.052
SPAN	50.0	.500	1250	50.0	.500	1248.0	-2.000	-.080

POST RUN Audit : by : C. Walmsley Time : 1646 Temp : 73 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.2	.002	6.929	6.292	.252
SPAN	50.0	.500	1250	50.3	.503	1255.5	5.500	.220

± Conc. Difference = Act % - Exp (Std) %

Zero % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X 100

Span % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X100

QUALITY CHECKS DATA SHEET # 16

UNIT : Jotul T2 RUN : 4 DATE : 8-30-2010

Thermocouple Check:

T/C # 1	— °F	T/C # 13	62.3 °F
T/C # 2	— °F	T/C # 14	62.5 °F
T/C # 3	62.4 °F	T/C # 15	62.0 °F
T/C # 4	59.4 °F	T/C # 16	56.7 °F
T/C # 5	58.0 °F	T/C # 17	53.2 °F
T/C # 6	57.8 °F	T/C # 18	65.7 °F
T/C # 7	58.0 °F	T/C # 19	— °F
T/C # 8	57.8 °F	T/C # 20	— °F
T/C # 9	— °F	T/C # 21	— °F
T/C # 10	— °F	T/C # 22	— °F
T/C # 11	59.3 °F	T/C # 23	— °F
T/C # 12	63.7 °F	T/C # 24	— °F

Thermocouple Readout:

Pretest zero and span check and calibration — post test zero and span — % difference

ZERO .5 °F Adj. to 0.0 °F ZERO .1 °F Difference .1005 %

SPAN 1997.4 °F Adj. to 2000.0 °F SPAN 2001.6 °F Difference .1080 %

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 200.3 °F	400	= 400.1 °F
600	= 600.0 °F	800	= 799.9 °F	1000	= 999.9 °F
1200	= 1199.8 °F	1400	= 1399.6 °F	1600	= 1599.6 °F
1800	= 1799.9 °F	2000	= 2000.0 °F		

Sample Train Leak Check	Pre ✓	Post ✓
C-gas Train Leak Check	Pre ✓	Post ✓
SO_2 Train Leak Check	Pre ✓	Post ✓
Static Gauge Zero Check	Pre ✓	Post ✓

Scale Check Pre : 560.3 − 550.3 = 10.0

Post : 560.2 − 550.2 = 10.0

Stack Cleaned Prior to Test Run : YES ____ NO X

TABLE 1 ----- RAW DATA

CLIENT : Jotul TEST No. : 3

MODEL: Top Load DATE: 27-Aug-10

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	121.500	0.150	74	1.03	4.90	325
5	123.000	0.210	75	0.52	7.80	275
10	124.788	0.100	77	0.55	4.10	400
15	126.027	0.070	77	0.92	6.90	475
20	127.070	0.070	77	0.98	7.00	475
25	128.114	0.100	78	0.71	9.80	400
30	129.352	0.170	78	0.21	12.80	300
35	131.004	0.210	78	0.22	12.20	275
40	132.805	0.210	78	0.22	12.40	275
45	134.605	0.210	78	0.23	12.40	275
50	136.406	0.210	78	0.22	12.50	275
55	138.207	0.210	78	0.07	11.90	275
60	140.008	0.200	80	0.12	12.50	275
65	141.837	0.200	82	0.11	11.30	275
70	143.679	0.200	82	0.07	10.80	275
75	145.521	0.170	82	0.13	11.70	300
80	147.216	0.170	83	0.04	11.60	300
85	148.911	0.170	83	0.16	9.30	300
90	150.606	0.140	83	0.34	8.10	325
95	152.171	0.140	83	0.41	7.40	325
100	153.735	0.140	83	0.42	7.20	325
105	155.300	0.140	83	0.44	7.20	325
110	156.865	0.120	83	0.72	6.20	350
115	158.318	0.110	83	1.27	4.80	375
120	159.675	0.110	83	1.53	4.70	375
125	161.031	0.110	83	1.92	4.50	375
130	162.388	0.110	83	1.94	4.40	375
135	163.744	0.120	83	2.01	4.50	350
140	165.197	0.120	83	2.14	4.60	350
145	166.650	0.120	83	2.22	4.50	350
150	168.104	0.120	83	2.42	4.50	350
155	169.557	0.120	83	1.42	5.20	350
160	171.010	0.120	83	1.57	5.20	350
165	172.463	0.120	83	1.20	5.60	350
170	173.916	0.120	83	1.22	5.40	350
175	175.370	0.120	83	1.27	5.20	350

180	176.823	0.140	83	1.28	5.10	325
185	178.385	0.140	83	1.34	5.10	325
190	179.947	0.140	83	1.58	4.80	325
195	181.510	0.140	83	1.25	4.90	325
200	183.072	0.140	83	1.22	4.80	325
205	184.634	0.140	83	1.55	5.00	325
210	186.196	0.140	83	1.72	4.90	325
215	187.759	0.140	83	1.77	4.80	325
220	189.321	0.140	83	1.77	4.60	325
225	190.883	0.140	83	1.78	4.50	325
230	192.445	0.110	83	1.86	4.70	375
235	193.800	0.110	83	1.79	4.30	375
240	195.154	0.110	83	1.78	4.20	375
245	196.508	0.110	83	1.86	4.10	375

TABLE 2---RAW DATA

CLIENT : Jotul TEST No. 3

MODEL: Top Load DATE: 27-Aug-10

METER CAL. FACTOR (Y) -------	0.916		Wt. WOOD BURNED(LB) -------	17.7	Lbs
BAROMETRIC PRESS.(Pb) -------	30.06	in Hg	WET,FUEL MOISTURE % -------	16.143	%
LEAK RATE POST (Lp) -------	0.000	cfm	Wt. PART. COLLECTED -------	0.3279	g
WATER VOL. (V1c) -------	120.8	Ml	METER VOLUME Vm -------	75.008	mcf
TEST TIME (MIN) -------	245	min	HC MOLE FRACTION -------	0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT : Jotul TEST No. 3

MODEL: Top Load DATE: 27-Aug-10

AVG DELTA H	-------	0.14	in H2O	AVG PRCNT CO	-------	1.07	%
AVG METER TEMP. Tm	-------	81	deg F	AVG PRCNT CO2	-------	6.94	%
AVG PPM SO2	-------	336	PPM	AVG BAL CO2/CO	-------	6.48	%

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul TEST No. 3

MODEL: Top Load DATE: 27-Aug-10

STD SAMPLE VOL. Vm(std) d) ------	67.35	dscf	STACK GAS FLOW Qsd -------	636.751	dscf/Hr
				&	
				10.61	dscf/min
VOL. WATER VAPOR Vw(s td) -----	5.686	scf	PARTICULATE CONCTRT. C s ------	0.0049	g/dscf
PRCNT MSTR Bws -------	7.79	%	PARTC.EMISS. RATE E -------	3.10	g/Hr
BURN RATE BR -------	1.65	Kg/Hr	MOLES OF GAS PER Lb WOOD Nt ----	0.46	Lb-mole/Lb
CO EMISSION RATE -------	228.25	g/Hr	PART.EMISS. RATE ------	1.88	g/Kgdry fuel
	&				
	138.42	g/Kgdry fuel			

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Jotul TEST No. : 3

MODEL: Top Load DATE: 27-Aug-10

TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR	PROPRTN RATE VAR. AVERAGE
5	443.4	98	100
10	446.1	98	
15	448.6	99	
20	448.4	99	
25	448.5	99	
30	447.4	99	
35	447.9	99	
40	447.6	99	
45	447.4	99	
50	447.6	99	
55	447.6	99	
60	446.8	99	
65	452.1	100	
70	454.4	100	
75	454.4	100	
80	455.7	101	
85	455.3	100	
90	455.3	100	
95	455.4	101	
100	455.1	100	
105	455.4	101	
110	455.4	101	
115	455.3	100	
120	455.6	101	
125	455.2	100	
130	455.6	101	
135	455.2	100	
140	455.3	100	
145	455.3	100	
150	455.6	101	
155	455.3	100	
160	455.3	100	
165	455.3	100	
170	455.3	100	
175	455.6	101	
180	455.3	100	

185	454.5	100
190	454.5	100
195	454.8	100
200	454.5	100
205	454.5	100
210	454.5	100
215	454.8	100
220	454.5	100
225	454.5	100
230	454.5	100
235	454.9	100
240	454.6	100
245	454.6	100

COMPUTER INPUT DATA SHEET #1

3,10

Client: Jotul North America

Address: 55 Hutcherson
Gorham, ME 04038

Phone: 1-800-797-5912 Fax:

Run No.: 3 Date of Test: 8-27-2010 Burn Rate: 1.649

Model No.: Top Loader ☐ min ☐ min-1.25 ☐ fan

Stove Type: ☐ Cat ☒ Non Cat ☐ Pellet ☒ 1.25-1.9 ☐ max ☐ insert

Dry Gas Meter Y Factor: .916 (0.000) (Data Sheet #2) Post Leak Rate: .000 cfm (.000) (Data Sheet #2) Time: 245 min. (000) (Data Sheet #2)

Dry Gas Meter Volume: 75.008 cf (00.000) (Data Sheet #2)

Stack Flow: 10,476 dscfm (00.000) (Data Sheet #2) Δ H: 1.141 in. H_2O (.000) (Data Sheet #2)

Maximum Vac.: 3.0 (0.0) (Data Sheet #2) Barometric Pressure: 30.06 in. Hg (00.00) (Data Sheet #2)

H_2O Captured: 120.8 g (00.0) (Data Sheet #3)

Front Half Catch % Of Total: 28.6 % (00.0) (Data Sheet #6) Total Particulate Catch: .3279 g (0.0000) (Data Sheet #6)

Flue Gas Moisture: 7.7968 % (00.000) (Data Sheet #7)

Particulate Emission: .0752 gr/dscf (0.0000) (Data Sheet #7)

Relative Humidity: 42.0 % RH (00.0) (Data Sheet #8) Ambient Moisture: 1.3 % H_2O (0.00) (Data Sheet #8)

Preburn Fuel Wt.: 43.5 lbs. (00.0) (Data Sheet #8) Coal Bed Wt.: 3.7 lbs. (00.0) (Data sheet #8) Test Fuel Wt.: 17.7 lbs. (00.0) (Data sheet #8)

Heat Output (EPA Default): 19884. BTU/hr (00,000.0) (Data Sheet #8)

Kindling Fuel % Moisture (wet): 13.219 % (00.000) (Data Sheet #10) Pretest Fuel % Moisture (wet): 16.897 % (00.000) (Data Sheet #10)

Test Fuel % Moisture (dry): 19.250 % (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove]) Test Fuel % Moisture (wet): 16.143 %

Fuel Higher Heating Value (dry): N/A BTU/lb. (0000) (Data Sheet #11)

Stack Static Pressure: -.048 in. H_2O (+/- .000) (Data Sheet #12)

Average Ambient Temperature: 74 °F (00) (Data Sheet #14) Stove Temperature Change: -873 °F (+/- 000.0) (Data Sheet #14)

Time Start 1140
End 1545

Meter Temp 542

METER BOX DATA SHEET PAGE # 2

Page: 1 of 3

UNIT: Jotul TL RUN: 3 DATE: 8-27-2010

Meter Box: 5H Y Factor: .916

Leak checks: 15 " Hg @ .000 cfm _____ " Hg @ _____ cfm

15 " Hg @ 1.000 cfm _____ " Hg @ _____ cfm

Inject SO^2 @ 100 cc/min. Nozzle: Probe @ 3/8 " od Initial Volume: 1.500

ROTO: PRESS: .18 SAMPLING RATIO: 36. : 1 BP: 30.12

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1146	121.500	—	10.822	.15	74	325	74	2.0
5	45	123.000	—	12.766	.21	75	275	75	3.0
10	50	124.788	124.788	8.744	.10	77	400	77	2.0
15	55	126.027	126.027	7.363	.07	77	475	77	2.0
20	1200	127.070	127.070	7.363	.07	77	475	77	2.0
25	05	128.114	128.114	8.744	.10	78	400	78	2.0
30	10	129.352	129.352	11.659	.17	78	300	78	2.0
35	15	131.004	131.004	12.719	.21	78	275	78	2.0
40	20	132.805	132.805	12.719	.21	78	275	78	2.0
45	25	134.605	134.605	12.719	.21	78	275	78	2.0
50	30	136.406	136.406	12.719	.21	78	275	78	2.0
55	35	138.207	138.207	12.719	.21	78	275	78	2.0
ROTO PRESS:		.18	TOTALS:	131.056	1.92	922	BP.:	30.00	
60	1240	140.008	140.008	12.548	.20	80	275	80	2.0
65	45	141.837	141.837	12.551	.20	82	275	82	2.0
70	50	143.679	143.679	12.551	.20	82	275	82	2.0
75	55	145.521	145.521	11.484	.17	83	300	83	2.0
80	1300	147.216	147.216	11.484	.17	83	300	83	2.0
85	05	148.911	148.911	11.484	.17	83	300	83	2.0
90	10	150.606	150.606	10.601	.14	83	325	83	2.0
95	15	152.171	152.171	10.601	.14	83	325	83	2.0
100	20	153.735	153.735	10.601	.14	83	325	83	2.0
105	25	155.300	155.300	10.601	.14	83	325	83	2.0
110	30	156.865	156.865	9.843	.12	83	350	83	2.0
115	35	158.318	158.318	9.187	.11	83	375	83	2.0
			TOTALS:	133.586	1.90	991	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	264.642	3.82	1917	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 2 of 3

UNIT: Jotul TL RUN: 3 DATE: 8-27-2016

Meter Box: SH Y Factor: .916

Leak checks: 15 " Hg @ 1.000 cfm _____ " Hg @ _____ cfm

15 " Hg @ 1.000 cfm _____ " Hg @ _____ cfm

Inject SO^2 @ 100 cc/min. Nozzle : Probe @ 3/8 " od Initial Volume: 1,500

ROTO: PRESS: .18			SAMPLING RATIO: 36 : 1				BP: 30.10		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1340	159.675	159.675	9,187	.11	83	375	83	2.0
125	45	161.031	161.031	9,187	.11	83	375	83	2.0
130	50	162.388	162.388	9,187	.11	83	375	83	2.0
135	55	163.744	163.744	9,843	.12	83	350	83	2.0
140	1400	165.197	165.197	9,843	.12	83	350	83	2.0
145	05	166.650	166.650	9.843	.12	83	350	83	2.0
150	10	168.104	168.104	9.843	.12	83	350	83	2.0
155	15	169.557	169.557	9.843	.12	83	350	83	2.0
160	20	171.010	171.010	9.843	.12	83	350	83	2.0
165	25	172.463	172.463	9.843	.12	83	350	83	2.0
170	30	173.916	173.916	9.843	.12	83	350	83	2.0
175	35	175.370	175.370	9.843	.12	83	350	83	2.0
ROTO PRESS: .18			TOTALS:	116,148	1.41	996	BP.: 30.05		
180	1440	176.823	176.823	10.618	.14	83	325	83	2.0
185	45	178.385	178.385	10.618	.14	83	325	83	2.0
190	50	179.947	179.947	10.618	.14	83	325	83	2.0
195	55	181.510	181.510	10.618	.14	83	325	83	2.0
200	1500	183.072	183.072	10.618	.14	83	325	83	2.0
205	05	184.634	184.634	10.618	.14	83	325	83	2.0
210	10	186.196	186.196	10.618	.14	83	325	83	2.0
215	15	187.759	187.759	10.618	.14	83	325	83	2.0
220	20	189.321	189.321	10.618	.14	83	325	83	2.0
225	25	190.883	190.883	10.618	.14	83	325	83	2.0
230	30	192.445	192.445	9.202	.11	83	375	83	2.0
235	35	193.800	193.800	9.202	.11	83	375	83	2.0
			TOTALS:	124,584	1.62	996	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	240,732	3.03	1992	AVG. BP:		

*

METER BOX DATA SHEET PAGE # 2

Page: 3 of 3

UNIT: Sotul TL RUN: 3 DATE: 8-27-2010

Meter Box: SH Y Factor: .916

Leak checks: 15 " Hg @ 1.000 cfm _____ " Hg @ _____ cfm

15 " Hg @ 1.000 cfm _____ " Hg @ _____ cfm

Inject SO^2 @ 100 cc/min. Nozzle: Probe @ 3/8 " od Initial Volume: 1.500

ROTO: PRESS: .18 SAMPLING RATIO: 36 : 1 BP: 30.05

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
240	1540	195.154	195.154	9,202	.11	83	375	83	20
245	45	196.508	196.508	9,202	.11	83	375	83	20
250				(18.404)	(.22)	(166)			
255									
260									
265									
270									
275									
280									
285									
290									
295									
ROTO PRESS:			TOTALS:				BP.:		
300									
305									
310									
315									
320									
325									
330									
335									
340									
345									
350						4075			
355				523.778	7.07	82			
			TOTALS:				MAX VACC =		3.0
TOTAL Cu Ft.		75.008	TOTALS:	10.476	.141	542	AVG. BP:		30.06

1.500

WOODSTOVE DATA SHEET 2A

Unit: Jotul TL Run: 3 Date: 8-27-2010 Page: 1 of 1

Time	Volume	Time	Volume	Time	Volume	Time	Volume
0	—	120	1.356	240	1.354	360	
5	1.500	125	1.356	245	1.354	365	
10	1.788	130	1.356	250		370	
15	1.239	135	1.356	255		375	
20	1.043	140	1.453	260		380	
25	1.043	145	1.453	265		385	
30	1.239	150	1.453	270		390	
35	1.651	155	1.453	275		395	
40	1.801	160	1.453	280		400	
45	1.801	165	1.453	285		405	
50	1.801	170	1.453	290		410	
55	1.801	175	1.453	295		415	
60	1.801	180	1.453	300		420	
65	1.828	185	1.562	305		425	
70	1.842	190	1.562	310		430	
75	1.842	195	1.562	315		435	
80	1.695	200	1.562	320		440	
85	1.695	205	1.562	325		445	
90	1.695	210	1.562	330		450	
95	1.565	215	1.562	335		455	
100	1.565	220	1.562	340		460	
105	1.565	225	1.562	345		465	
110	1.565	230	1.562	350		470	
115	1.453	235	1.354	355		475	

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : Joliet TL RUN : 3 DATE : 8-27-10

SCALE CHECK	LEVEL	ZEROED
INITIAL :	✓	✓
FINAL :	✓	✓

SCALE	WEIGHT
295.0 g	295.0
590.0 g	590.0
885.0 g	885.0

IMPINGER	#1	#2	#3	#4
FINAL WT	728.6	592.3	485.5	895.5
INITIAL WT	631.9	587.4	484.0	877.8
NET WT GRAMS	96.7	4.9	1.5	17.7

TOTAL CATCH : 120.8 GRAMS H_2O

FRONT HALF

FILTER #	197F	
FINAL WT g	.7175	
INITIAL WT g	.6601	
NET WT g	.0574	

BEAKER #	131
DESC.	ACETONE
FINAL WT g	106.8811
INITIAL WT g	106.8443
NET WT g	.0368
VOL. DESC. ml	75

BACK HALF

.3368
.3708

FILTER #	197B	
FINAL WT g	.4083	
INITIAL WT g	.3598	
NET WT g	.0485	

BEAKER #	132	133	134	135	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	105.4864	106.5160	107.7295	104.6271	
INITIAL WT g	105.3821	106.5027	107.6880	104.5921	
NET WT g	.1043	.0133	.0415	.0350	.0765
VOL. DESC ml	100	75	200 +	150 =	350

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 8-12-09 Time : 1205 By : AV

Manufacturer S & S Grade : # 25 Glass Front Size : 11 cm Lot No. :

Back Size: 8.2 cm Lot No. :

	DATE: 8-14-09	BY: AV	DATE: 8-19-09	BY: AV	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
191F	0.6645	0900	0.6647	0920		
192F	0.6630	0901	0.6631	0921		
193F	0.6621	0902	0.6623	0922		
194F	0.6568	0903	0.6568	0923		
195F	0.6602	0904	0.6602	0924		
196F	0 6578	0905	0.6579	0925		
197F	0.6600	0906	0.6601	0926	R-3	
198F	0.6615	0907	0.6615	0927		
199F	0.6575	0908	0.6574	0928		
200F	0.6618	0909	0.6618	0929		
191B	0.3600	0910	0.3601	0930		
192B	0.3597	0911	0.3599	0931		
193B	0.3594	0912	0.3593	0932		
194B	0.3596	0913	0.3596	0933		
195B	0.3570	0914	0.3571	0934		
196B	0.3630	0915	0.3631	0935		
197B	0.3598	0916	0.3598	0936	R-3	
198B	0.3640	0917	0.3640	0937		
199B	0.3602	0918	0.3602	0938		
200B	0.3605	0919	0.3605	0939		

Checked by: C. Watling Date: 8-19-09 Time: 1115

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 2-2-2010 Time : 1100 By : CP

	DATE: 2-5-10	BY: AV	DATE: 2-8-10	BY: CP	DATE:	BY:
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
126	105.7659	1145	105.7661	1210	✓	
127	104.0748	1146	104.0753	1211	✓	
128	105.6080	1147	105.6083	1212	✓	
129	106.4284	1148	106.4289	1213	✓	
130	106.5014	1149	105.5019	1214	✓	
131	106.8439	1150	106.8443	1215	✓	
132	105.3817	1151	105.3821	1216	✓	
133	106.5026	1152	106.5027	1217	✓ Run 3	
134	107.6880	1153	107.6880	1218	✓	
135	104.5925	1154	104.5921	1219	✓	
136	107.0827	1155	107.0824	1220	✓	
137	104.1624	1156	104.1626	1221	✓	
138	105.2433	1157	105.2430	1222	✓	
139	104.1290	1158	104.1285	1223	✓	
140	106.9612	1159	106.9613	1224	✓	
141	102.2799	1200	102.2800	1225	✓	
142	107.8126	1201	107.8121	1226	✓	
143	105.5706	1202	105.5701	1227	✓	
144	106.3782	1203	106.3779	1228	✓	
145	101.5199	1204	101.5195	1229	✓	
146	101.3681	1205	101.3676	1230	✓	
147	106.9558	1206	106.9554	1231	✓	
148	104.7562	1207	104.7560	1232	✓	
149	107.5443	1208	107.5442	1233	✓	
150	106.7042	1209	106.7037	1234	✓	

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
2-5-10	1015	CP	(	78	43
2-9-10	1030	CP	(	78	40
			)		

Checked by : CW 2/10/10

Date : 2-10-10

Time : 1317

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : Total TL RUN : 3 DATE : 8-27-10 Page : 1 of 1

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
131	8-28	1700	CP	106.8816	8-29	1422	CP	106.8811	8-31	0727	CP				
132	8-28	1700	CP	105.4868	8-29	1423	CP	105.4864	8-31	0728	CP				
133	8-28	1700	CP	106.5163	8-29	1424	CP	106.5160	8-31	0729	CP				
134	8-28	1700	CP	107.7300	8-29	1425	CP	107.7295	8-31	0730	CP				
135	8-28	1700	CP	104.6274	8-29	1430	CP	104.6271	8-31	0731	CP				

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
197A	8-27	1830	CP	.7206	8-28	1620	CP	.7173	8-29	1426	CP	.7175	8-31	0726	CP
197B	8-27	1830	CP	.4088	8-28	1621	CP	.4083	8-29	1424	CP				

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	8-28-10	1620	CP	73	47
2	8-29-10	1400	CP	70	48
3	8-31-10	0720	CP	72	46
4					
5					

Weighing Session	Date	Time	By	DB	%RH
6					
7					
8					
9					
10					

BLANK PROCESSING DATA SHEET # 5

UNIT: Jotul TL RUN: 3 DATE: 8-27-10

BLANKS DONE: 10-30-2007

BEAKER	A	B	C
	200 ml ACETONE	75 ml DICHLOR	200 ml WATER
	FISHER OPTIMA LOT #023283	FISHER OPTIMA LOT #035941	DWNA Inc Sparklettes Distilled
FINAL WEIGHT	108.9009	106.3077	106.9680
TARE WEIGHT	108.8995	106.3063	106.9644
NET WEIGHT	.0014	.0014	.0036

TARE BEAKERS INTO DESC : TIME: 1700 DATE: 10-20-07

DATE: 10-22 BY: Cp DATE: 10-23 BY Cp DATE: BY:

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.8994	1700	108.8995	1027		
B	106.3060	1701	106.3063	1028		
C	106.9639	1702	106.9644	1029		

FINAL BEAKERS INTO DESC : TIME: 1040 DATE: 10-27-07

DATE: 10-29 BY: Cp DATE: 10-30 BY Cp DATE: BY:

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9011	1721	108.9009	1619		
B	106.3074	1722	106.3077	1621		
C	106.9678	1723	106.9680	1622		

TARE QC

DATE	TIME	BY	WB	DB	%
10-22	1630	Cp		78	46
10-23	1000	Cp		74	44

FINAL QC

DATE	TIME	BY	WB	DB	%
10-29	1700	Cp		76	42
10-30	1600	Cp		78	43

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 2-26-2010 Through	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0001	10.0004	.9999	.0999	CP	2-26-10	0840	72	46
100.0001	9.9999	.9999	.0999	CP	2-27-10	1045	72	46
100.0000	10.0000	1.0000	.0999	CP	2-28	1100	70	48
100.0000	10.0000	1.0000	.0999	CP	3-1	0900	66	49
100.0000	10.0002	.9998	.1002	CP	3-5	1200	70	48
100.0001	9.9999	.9999	.0998	CP	3-7	1330	68	47
100.0000	9.9999	.9999	.0999	CP	3-9	1130	70	41
100.0000	10.0001	1.0000	.0999	CP	3-10	1200	70	44
100.0000	10.0001	.9999	.0999	CP	3-11	0900	66	49
99.9999	9.9999	.9999	.0999	AV	3-15	1000	70	48
100.0000	10.0000	1.0000	.0998	CP	3-17	0900	72	46
100.0000	9.9998	1.0001	.1000	CP	4-8	1930	76	49
99.9999	10.0001	1.0000	.0999	CP	4-10	1630	73	47
99.9999	10.0001	1.0001	.1000	CP	4-11	1430	74	47
100.0000	10.0002	1.0000	.1000	CP	4-21	1830	77	49
100.0000	10.0000	1.0000	.0999	CP	4-22	1130	74	47
100.0000	10.0001	1.0000	.0999	CP	4-23	1015	74	44
100.0002	9.9999	1.0000	.1000	CP	4-24	0930	68	47
100.0000	9.9999	.9999	.1000	CP	4-25	0930	73	47
100.0000	9.9999	1.0001	.0999	CP	4-26	0900	76	42
100.0000	10.0002	1.0000	.0999	CP	4-30	1320	78	43
99.9998	10.0000	1.0002	.0999	CP	8-26	0845	78	49
100.0000	9.9998	1.0001	.0999	CP	8-27	0955	78	43
100.0000	10.0000	1.0000	.1000	CP	8-28	1600	73	47
99.9998	10.0000	.9999	.1000	CP	8-29	1400	70	48
100.0000	10.0000	1.0000	.0999	CP	8-31	0720	72	46
100.0001	10.0000	1.0000	.1000	CP	9-1	1330	76	49
100.0000	10.0001	1.0000	.0999	CP	9-2	1300	68	47
100.0000	10.0000	1.0000	.1000	CP	9-3	1130	72	46

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 5-10-2009 Through 2-25-2010	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0001	10.0002	1.0000	.0999	CP	5-10	1545	74	44
100.0001	10.0001	.9999	.0999	CP	6-19	1110	70	48
100.0001	10.0000	.9998	.0998	CP	6-22	0930	74	44
100.0001	10.0000	.9999	.0999	CP	6-24	1610	78	46
100.0001	10.0000	1.0000	.0999	CP	6-25	1000	78	46
100.0001	10.0001	1.0001	.0999	CP	6-26	0900	73	47
99.9998	10.0000	1.0001	.1000	CP	6-27	1300	76	45
100.0000	10.0002	1.0000	.0999	CP	6-28	1400	78	43
100.0000	10.0000	1.0000	.0999	CP	6-29	1130	74	47
100.0000	10.0000	1.0000	.0999	CP	7-1	1230	70	48
100.0000	9.9998	1.0000	.0998	CP	8-7	1310	75	48
99.9998	10.0000	1.0000	.0999	CP	8-8	1600	77	46
100.0000	10.0000	1.0000	.0999	CP	8-9	1720	78	46
100.0002	9.9999	1.0000	.0998	CP	8-10	0900	78	46
100.0000	10.0001	1.0001	.0998	CP	8-11	1126	78	46
100.0003	10.0001	1.0001	.1000	CP	8-12	0910	78	46
100.0000	10.0000	1.0001	.1000	CP	8-14	1630	78	46
100.0000	10.0000	1.0001	.0999	CP	8-19	0900	74	47
100.0002	10.0001	1.0000	.1000	CP	8-24	0900	72	42
100.0000	9.9999	.9999	.0999	CP	8-25	0900	70	48
100.0000	10.0000	1.0000	.0999	CP	8-26	1340	77	46
100.0003	10.0000	.9999	.1000	CP	9-5	1120	77	49
100.0000	10.0001	1.0000	.0999	CP	9-8	1410	78	41
100.0000	10.0001	1.0001	.0998	CP	9-11	1050	78	43
100.0000	10.0000	1.0000	.0999	CP	9-12	1220	78	46
100.0000	10.0001	1.0000	.0999	CP	9-13	1430	78	46
100.0000	10.0001	.9999	.1000	CP	9-14	1100	75	48
100.0000	10.0000	.9999	.0999	CP	1-29	1400	74	44
100.0000	10.0001	1.0000	.1000	CP	1-30	1800	78	46
100.0000	10.0001	1.0001	.1000	CP	2-1	0700	64	49
100.0000	9.9999	1.0001	.1000	CP	2-2	1100	72	46
100.0000	9.9997	1.0001	.1000	CP	2-4	1015	75	41
100.0000	10.0000	1.0000	.0998	CP	2-5	1015	78	43
100.0000	10.0001	1.0000	.1000	CP	2-7	1400	70	44
100.0002	10.0001	1.0000	.0999	CP	2-8	1200	78	46
100.0000	10.0000	1.0000	.1000	CP	2-9	1030	78	40
100.0000	10.0000	1.0000	.0999	CP	2-23	1830	77	49
100.0000	10.0001	1.0000	.0999	CP	2-24	0820	69	49
100.0000	10.0002	1.0000	.0999	CP	2-25	0940	69	47

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 8-27-2008 Through 5-9-2009	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9999	10.0000	1.0000	.0999	CK	8-27	0900	78	46
100.0001	10.0000	1.0000	.0999	CK	8-28	0930	78	46
100.0001	10.0001	1.0001	.0997	CK	8-29	1300	78	46
100.0000	10.0000	1.0000	.1000	CK	8-30	1030	78	46
100.0001	10.0003	1.0001	.0999	CK	8-31	1015	76	49
100.0000	10.0001	1.0000	.0997	CK	9-1	1100	74	44
100.0000	10.0001	.9999	.1000	CK	9-2	0845	75	48
99.9999	10.0000	.9999	.0998	CK	9-4	1000	77	47
99.9999	10.0002	1.0001	.0999	CK	9-8	0930	77	49
99.9999	9.9999	.9998	.0998	CK	9-9	1000	74	48
99.9997	9.9997	1.0000	.0999	CK	9-11	1500	76	45
100.0000	9.9997	.9999	.0999	CK	9-17	0930	77	49
100.0000	10.0000	1.0000	.0999	CK	9-18	0900	78	46
100.0000	10.0000	.9999	.0999	CK	9-19	0915	78	49
100.0000	10.0000	.9999	.0999	CK	9-22	1030	77	46
100.0000	10.0001	1.0000	.0998	CK	9-24	1330	78	49
100.0001	10.0001	1.0000	.0999	CK	9-25	0930	78	46
100.0000	9.9999	1.0001	.0998	CK	9-26	0920	78	46
100.0001	9.9999	1.0001	.0999	AV	9-29	0955	78	46
100.0000	10.0001	1.0000	.0998	CK	10-2	0945	75	44
100.0000	10.0000	1.0000	.0999	CK	10-3	0930	78	46
100.0000	9.9999	1.0000	.0999	CK	10-4	1530	78	46
100.0000	9.9999	.9999	.0999	CK	10-6	0930	77	49
100.0000	10.0001	1.0002	.1000	CK	10-7	1700	78	49
100.0000	10.0000	1.0000	.0999	CK	10-8	1000	78	49
99.9999	10.0000	1.0001	.0999	CK	10-9	1030	78	43
100.0000	9.9999	1.0001	.1000	CK	10-10	0930	78	40
100.0000	9.9998	.9999	.0997	CK	10-11	1430	74	47
100.0000	10.0001	1.0000	.1000	CK	10-13	0940	78	46
100.0000	10.0002	.9999	.0999	CK	10-14	2030	77	49
100.0000	10.0002	1.0000	.1000	CK	10-16	1220	78	43
100.0000	9.9999	1.0000	.0999	CK	10-18	1130	74	47
99.9998	10.0000	.9999	.0999	CK	5-3	1200	78	43
100.0000	10.0001	1.0000	.0999	CK	5-4	1000	72	42
100.0000	10.0001	1.0000	.0997	CK	5-5	1000	76	45
99.9998	10.0000	1.0000	.0999	CK	5-6	1100	77	49
100.0000	10.0001	1.0001	.1000	CK	5-7	1600	77	42
100.0000	10.0001	1.0000	.0999	CK	5-8	1600	76	45
100.0000	10.0003	1.0000	.1000	CK	5-9	1300	76	38

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 10-22-07 Through 8-26-2008	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0006	10.0001	1.0000	.0998	CP	10-22	1630	78	46
99.9999	10.0001	1.0000	.1001	CP	10-23	1000	74	44
100.0002	10.0002	1.0002	.0999	CP	10-24	1400	73	47
100.0002	10.0000	1.0001	.0998	CP	10-26	1700	74	40
100.0003	10.0001	1.0001	.0999	CP	10-27	0820	78	40
99.9999	10.0000	.9999	.0997	CP	10-28	1200	78	40
100.0000	9.9999	.9999	.0999	CP	10-29	1700	76	42
99.9998	9.9999	.9999	.1000	CP	10-30	1600	78	43
99.9997	10.0000	.9999	.0999	CP	11-16	1500	68	47
100.0001	10.0002	1.0000	.0999	CP	11-19	1730	73	40
100.0000	10.0002	.9999	.0999	CP	11-20	1100	64	44
99.9998	9.9999	.9999	.0998	CP	1-18-08	1230	76	45
100.0002	10.0002	.9999	.0999	CP	1-21-08	1430	65	48
99.9999	10.0002	1.0001	.0999	CP	1-22-08	1200	68	47
100.0002	9.9999	.9999	.0998	CP	1-23-08	1400	74	47
99.9999	10.0000	1.0002	.1000	CP	1-31-08	1900	74	44
100.0000	10.0003	1.0000	.0996	CP	2-1-08	1530	76	45
99.9997	9.9999	.9999	.0999	CP	2-16-08	1700	68	47
100.0001	10.0002	1.0000	.1000	CP	2-18-08	1400	72	46
99.9999	10.0001	.9999	.0998	CP	2-22-08	1800	68	47
99.9999	10.0001	1.0000	.0999	CP	2-23-08	1800	78	43
100.0000	10.0000	1.0000	.0999	CP	5-8-08	1030	78	43
100.0001	10.0001	1.0000	.0999	CP	5-9-08	0930	69	47
100.0000	10.0001	.9999	.0999	CP	5-10-08	1330	74	47
99.9998	9.9999	1.0000	.0998	CP	5-11-08	0900	74	44
100.0003	10.0001	.9999	.0998	CP	5-12	1400	70	48
99.9999	10.0001	1.0000	.1000	CP	5-13	1000	77	42
99.9999	9.9997	1.0000	.1000	CP	5-14	1230	77	42
99.9999	10.0001	.9999	.1000	CP	6-5-08	1430	72	46
100.0001	10.0000	1.0000	.0999	CP	6-9-08	1400	74	44
99.9999	9.9999	1.0000	.0999	CP	6-9-08	1800	73	47
100.0001	10.0001	.9999	.0998	CP	8-11-08	0930	77	42
100.0003	10.0000	1.0001	.0999	CP	8-12-08	1011	78	43
100.0000	10.0001	1.0000	.0999	CP	8-13-08	0950	76	49
100.0002	10.0000	1.0000	.0998	CP	8-18-08	0930	74	44
100.0001	9.9999	1.0000	.0998	CP	8-20-08	1110	76	45
100.0000	9.9999	.9999	.0998	CP	8-21-08	0915	75	48
100.0002	10.0000	1.0000	.1002	CP	8-22-08	0910	75	45
100.0000	10.0001	1.0001	.0999	CP	8-26-08	0900	78	43

2.58

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT: John TL RUN: 3 DATE: 8-27-10

BLANK CALCULATIONS

Acetone :	.0014	g ÷	200	ml =	.000007	g/ml
Dicholoromethane :	.0014	g ÷	75	ml =	.000019	g/ml
Distilled Water :	.0036	g ÷	200	ml =	.000018	g/ml

FRONT HALF CATCH

FILTERS : .0574 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0574 g

BEAKERS : .0368 (Total Catch) g - 75 (.0005) (ml Acetone) (.000007 g) (Blank Value / ml Acetone) = .0363 g

TOTAL FRONT HALF CATCH : .0937 g

BACK HALF CATCH

FILTERS : .0485 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0485 g

BEAKERS :

Acetone : .1043 (Total Catch) g - 100 (.0007) (ml Acetone) (.000007 g) (Blank Value / ml Acetone) = .1036 g

Extract : .0133 (Total Catch) g - 75 (.0014) (ml Dichloromethane) (.000019 g) (Blank Value / Dichloromethane) = .0119 g

Water : .0765 (Total Catch) g - 350 (.0003) (ml Water) (.000018 g) (Blank Value / Water) = .0702 g

TOTAL BACK HALF CATCH : .2342 g

TOTAL CATCH : .3279 g

% FRONT HALF : 28.6 %

CALCULATIONS DATA SHEET # 7

UNIT : Jotul TL RUN : 3 DATE : 8-27-2010

1) Vm (std) = $\dfrac{(75.008\ \text{Vm})(17.64)(.916\ \text{mcf})\left(30.06\ \text{" Hg} + \dfrac{.141\ \text{" } H_2O}{13.6}\right)}{(542\ \text{TmA})} = \dfrac{67.2421}{000.0000}$ dscf

2) Vw (std) = (.04707) (120.8 ml H_2O) = $\dfrac{5.6861}{00.0000}$ scf

3) Asw = $\dfrac{(5.686)\ \text{scf})}{(5.6861\ \text{scf} + 67.2421\ \text{dscf})} = \dfrac{.0780}{.0000}$ Bws × 100 = $\dfrac{7.7968}{00.0000}$ % H_2O

4) Cs = $\dfrac{(.3279\ \text{g.})}{(67.2421\ \text{dscf})}$ (15.43) = $\dfrac{.0752}{0.0000}$ gr / dscf

5) Estimated g / hr = $\dfrac{(.3279\ \text{g.})}{(67.2421\ \text{dscf})}$ ($\dfrac{10.476}{00.0000}$ dscfm) (60) = $\dfrac{3.0651}{00.0000}$ g / hr

Vm =	total cubic feet pulled on meter box during test	(p. 2)	(000.000 Vm)
mcf =	meter correction factor (Y factor) of meter box used for test	(p. 2)	(0.000 mcf)
" Hg =	average barometric pressure during test	(p. 2)	(00.00 " Hg)
" H_2O =	average delta H for test	(p. 2)	(.000 " H_2O)
TmA =	average meter temperature for test in degrees Absolute	(p. 2)	(000 TmA)
ml H_2O =	total water caught during test	(p. 3)	(000.0 ml H_2O)
g. =	total particulate catch for test	(p. 6)	(00.0000 g.)
dscfm =	average stack flow during test	(p. 2)	(00.000 dscf)

TEST DATA SHEET # 8

UNIT : Jotul TL RUN : 3 DATE : 8-27-2010

Test Chamber Air Velocity Start : Ø Stop : Ø Avg.: Ø

Wet Bulb / Dry Bulb

Pre : WB : 58 DB : 70 = 48.0 % RH 1.3 % H_2O

Post : WB : 63 DB : 81 = 36.0 % RH 1.3 % H_2O

Average : 42.0 % RH 1.3 % H_2O

Empty Stove Weight (lbs) : N/A w/ stack & oil seal : Wet : N/A Dry : 546.3

Kindling Weight (lbs) : Paper : .1 Wood : 1.4

Preburn Fuel Weight : 21.4 + 18.8 + 1.9 Total : 42.1

Kindling & Preburn Fuel Weight (wood only) (lbs) : **Total** : 43.5

Coal Bed Wt Range (lbs) : 4.4 - 3.6 **Scale** : 550.7 - 549.9

Upper : .25 x fuel weight : Always round DOWN to nearest tenth

Lower : .20 x fuel weight : Always round UP to nearest tenth **Actual Coal Bed Weight** : 3.7

Maximum Coal Bed Removal (lbs) : ((4.4 (Upper) + 3.6 (Lower)) ÷ 2) .25 = 1.0 (round down to nearest tenth)

Test Fuel (.75" x 1.5" x 5" spacers) = 20 pcs

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" x 4"	16.5	4	8.7	49.2
4" x 4"	16.5	2	9.0	50.8

Test Fuel Weight : 17.7 lbs

Estimated Dry Burn Rate :

$$\frac{17.7 - (17.7 \times .16143)}{2.2046} \times \frac{60}{\frac{245}{\text{TIME}}} = 1.649 \text{ kg / hr}$$

Estimated BTU's/hr : 19,140 x $\frac{63}{100}$ x $\frac{1.649}{\text{DBR}}$ = 19884. BTU's/hr

EPA Default Efficiencies : Non-cat : 63 Cat : 72 Pellet : 78

WOOD STOVE OPERATING DATA PAGE #9

Unit : Jotul TL Run : 3 Date : 8-27-2010

FIRE STARTED: 0745

WARM UP AND PREBURN:

PRIMARY AIR : Set wide open for all warm-up / preburn fuel charges. Then set to "Low" at start of preburn.

SECONDARY AIR : N/A CAT BYPASS : N/A

CHARCOAL BED PREPARATION :

Raked and leveled prior to each warm-up / preburn charge. At 1 ½ min. prior to loading last fuel, raked and leveled. In stove 15 sec.

TEST:

DOOR wide open during loading Ø min. 30 sec.

PRIMARY AIR : Opened full for first 5 min., then set to run setting of "Low".

SECONDARY AIR : N/A CAT BYPASS : N/A

FAN:

ON / OFF during warm-up

ON / OFF first 30 minutes of test

Fan speed set at Low

ON / OFF during preburn

ON / OFF balance of test run

WOOD DATA: KINDLING: A mix of the grades listed below:

	SIZE	MILL	GRADE	SPECIES
PREBURN:	2x4	Manke/Tacoma	Std. or better	s. grn D fir
TEST:	2x4	Packwood	# 2 or better	s. grn D fir
	4x4	Packwood	# 2 or better	s. grn D fir

PELLET FUEL MANUFACTURER : N/A BRAND : N/A

All Grades WCLB rules:

WARM UP INFORMATION:

All pre-burn / warm up fuel pieces were either 12 or 16 inches.

1st warm up / pre-burn fuel charge (21.4 lbs.) added at 0750

2nd warm up / pre-burn fuel charge (18.8 lbs.) added at 0923

3rd warm up / pre-burn fuel charge (1.9 lbs.) added at 1107

4th warm up / pre-burn fuel charge (_____ lbs.) added at _____

5th warm up / pre-burn fuel charge (_____ lbs.) added at _____

TEST DATA SHEET #10

Unit : Jotul TC Run : 3 Date : 8-27-2010

Room Temperature : 73 °F Temperature Correction Set? : (Yes) No

Calibration Check: 12.0% + or – 0.2%? (Yes) No

Time Test Fuel moisture reading taken : 0945

pc #	Dimen.	Use	TOP	BOTTOM	SIDE	Avg Corrected
1	2"×4"×8'	K	15.5	15.1	15.1	15.233
2						
3						
4	2"×4"×8'	P	20.6	22.9	22.3	21.9
5	2"×4"×8'	P	21.0	21.1	21.1	21.1
6	2"×4"×8'	P	18.1	17.9	18.0	18.0
7	2"×4"×8'	P				61.0
8	2"×4"×8'	P				
9						
10						
11	2×4×16.5"	T	14.1	18.0	16.0	18.0
12	"	T	19.0	16.0	16.0	18.3
13	"	T	22.6	21.8	21.0	21.8
14	"	T	20.9	20.3	20.3	20.5
15	4×4×16.5"	T	18.4	18.3	18.0	18.2
16	"	T	16.0	19.5	16.5	18.7
17						115.5
18						
19						
20	Spacers	T	22.3	21.9	22.0	22.1

Key for Use : K = Kindling P = Pretest Fuel T = Test Fuel

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	15.233 %	20.333 %	19.250 %
Wet Moisture % :	13.219 %	16.897 %	16.143 %

To obtain Wet from Dry : $\frac{100 \times \%\ \text{Dry Reading}}{100 + \%\text{Dry Reading}}$ = % Moisture, Wet Basis

Acceptable Ranges : 16 - 20 % wet: 19 - 25 % dry (17.5 - 22.5 on Meter Uncor. reading) at 70°

GAS DATA SHEET #12

WEIGHT: 550.0 DATE: 8-27-2016

UNIT: Jotul TC RUN: 3 PAGE: 1 OF 2

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
0 1140	567.7	17.7	—	.195	4.9	.590	14.8	.101	1.03	.049	.325
5 45	567.0	17.0	.7	.313	7.8	.495	12.4	.050	.52	.055	.275
10 50	566.4	16.4	.6	.165	4.1	.642	16.1	.053	.55	.050	.400
15 55	565.8	15.8	.6	.277	6.9	.514	12.9	.090	.92	.050	.475
20 1200	565.0	15.0	.8	.281	7.0	.511	12.8	.096	.98	.051	.475
25 05	564.2	14.2	.8	.395	9.8	.407	10.2	.069	.71	.056	.400
30 10	563.2	13.2	1.0	.515	12.8	.308	7.7	.019	.21	.060	.300
35 15	562.2	12.2	1.0	.489	12.2	.332	8.3	.020	.22	.060	.275
40 20	561.3	11.3	.9	.498	12.4	.324	8.1	.020	.22	.059	.275
45 25	560.4	10.4	.9	.498	12.4	.324	8.1	.021	.23	.061	.275
50 30	559.7	9.7	.7	.503	12.5	.320	8.0	.020	.22	.063	.275
55 35	558.8	8.8	.9	.476	11.9	.356	8.9	.005	.07	.061	.275
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.675	*****
60 40	558.0	8.0	.8	.500	12.5	.324	8.1	.010	.12	.060	.275
65 45	557.2	7.2	.8	.452	11.3	.371	9.3	.009	.11	.060	.275
70 50	556.6	6.6	.6	.433	10.8	.395	9.9	.005	.07	.060	.275
75 55	556.0	6.0	.6	.468	11.7	.356	8.9	.011	.13	.059	.300
80 1300	555.4	5.4	.6	.465	11.6	.363	9.1	.002	.04	.059	.300
85 05	554.8	4.8	.6	.373	9.3	.451	11.3	.014	.16	.057	.300
90 10	554.5	4.5	.3	.324	8.1	.491	12.3	.032	.34	.055	.325
95 15	554.1	4.1	.4	.297	7.4	.514	12.9	.039	.41	.054	.325
100 20	553.9	3.9	.2	.290	7.2	.522	13.1	.040	.42	.053	.325
105 25	553.6	3.6	.3	.288	7.2	.522	13.1	.042	.44	.053	.325
110 30	553.4	3.4	.2	.250	6.2	.550	13.8	.070	.72	.050	.350
115 35	553.2	3.2	.2	.191	4.8	.586	14.7	.125	1.27	.049	.375
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.669	*****
120 40	553.1	3.1	.1	.189	4.7	.578	14.5	.151	1.53	.049	.375
125 45	552.9	2.9	.2	.180	4.5	.570	14.3	.190	1.92	.047	.375
130 50	552.8	2.8	.1	.178	4.4	.574	14.4	.192	1.94	.046	.375
135 55	552.7	2.7	.1	.180	4.5	.566	14.2	.199	2.01	.046	.350
140 1400	552.6	2.6	.1	.183	4.6	.558	14.0	.212	2.14	.045	.350
145 05	552.4	2.4	.2	.182	4.5	.558	14.0	.220	2.22	.044	.350
150 10	552.3	2.3	.1	.180	4.5	.550	13.8	.240	2.42	.043	.350
155 15	552.1	2.1	.2	.208	5.2	.562	14.1	.140	1.42	.044	.350
160 20	552.0	2.0	.1	.208	5.2	.558	14.0	.155	1.57	.042	.350
165 25	551.8	1.8	.2	.225	5.6	.558	14.0	.118	1.20	.041	.350
170 30	551.7	1.7	.1	.215	5.4	.562	14.1	.120	1.22	.041	.350
175 35	551.6	1.6	.1	.209	5.2	.570	14.3	.125	1.27	.040	.350
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.528	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	1.872	*****

1 Fan?

GAS DATA SHEET #12

WEIGHT: 550.0 DATE: 8-28-2010

UNIT: Jotul T2 RUN: 3 PAGE: 2 OF 2

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
180 40	551.5	1.5	.1	.206	5.1	.574	14.4	.126	1.28	:040	.325
185 45	551.4	1.4	.1	.203	5.1	.570	14.3	.132	1.34	:040	.325
190 50	551.3	1.3	.1	.193	4.8	.574	14.4	.156	1.58	:040	.325
195 55	551.2	1.2	.1	.196	4.9	.582	14.6	.123	1.25	:040	.325
200 1500	551.0	1.0	.2	.194	4.8	.586	14.7	.120	1.22	:039	.325
205 05	550.9	.9	.1	.200	5.0	.566	14.2	.153	1.55	:040	.325
210 10	550.8	.8	.1	.196	4.9	.562	14.1	.170	1.72	:039	.325
215 15	550.7	.7	.1	.194	4.8	.566	14.2	.175	1.77	:038	.325
220 20	550.5	.5	.2	.186	4.6	.574	14.4	.175	1.77	:038	.325
225 25	550.4	.4	.1	.182	4.5	.578	14.5	.176	1.78	:039	.325
230 30	550.3	.3	.1	.183	4.7	.566	14.2	.184	1.86	:039	.375
235 35	550.2	.2	.1	.171	4.3	.586	14.7	.177	1.79	:038	.375
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.470	*****
240 40	550.1	.1	.1	.167	4.2	.590	14.8	.176	1.78	:037	.375
245 45	550.0	.0	.1	.162	4.1	.590	14.8	.184	1.86	:037	.375
250 50											
255 55											
260 1600											
265											
270											
275											
280											
285											
290											
295											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****		*****
300											
305											
310											
315											
320											
325											
330											
335											
340											
345											
350										.074	
355											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.544	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	2.416	*****

1/15C

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PREBURN DATA SHEET #13

UNIT JU RUN: DATE: 8- -2010 PAGE: 1 of 1

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
0 1010	551.7	—	635	645	884	522	765	517			76	.066	PREBURN START: @ 1.0 UP
5 15	551.5	.2	498	615	864	505	758	521			76	.055	COAL BED SCALE RANGE:
10 20	551.3	.2	439	580	827	498	729	522			74	.055	550.7 → 549.9
15 25	551.1	.2	396	548	786	485	696	518			74	.055	PRIMARY AIR:
20 30	550.9	.2	366	515	749	471	659	515			72	.056	SECONDARY AIR: N/A
25 35	550.7	.2	345	4181	720	458	633	510			73	.054	FAN: Low
30 40	550.5	.2	330	463	700	450	613	508			72	.052	PUMPS ON AT:
35 45	550.3	.2	315	446	671	444	588	504			72	.052	CHECK WB/DB: N/A
40 50	550.1	.2	303	425	646	432	566	503			72	.050	
45 55	550.0	.1	295	414	629	424	553	496			71	.049	
50 1100	5499	.1	285	397	610	418	538	493			71	.049	
55 05	549.8	.1	276	384	590	1137	522	485			70	.049	
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	
1.8 60 10	551.5	—	295	374	567	454	503	478			71	.052	
65 15	551.4	.3	336	391	560	447	495	474			70	.055	
70 20	550.5	.9	344	417	575	446	499	466			71	.056	
75 25	550.2	.3	324	428	588	443	500	457			71	.054	
80 30	550.2	.0	298	415	578	414	499	451			71	.053	
85 35	550.1	.1	277	401	563	394	491	448			71	.050	
90 40	550.0	.1	265	387	550	382	482	444			71	.049	
95 45													
100 50													
105 55													
1.10 1200													
115 05													

Jotul- Top Loader

Temperature Data Sheet 14

Run 3
8/27/10

Time	Stack	Top	LT Side	Back	Rt Side	Bottom	Firebox	Sec/Cat	Ambient	Tube Furn	Smpl Box	Smpl Out	C-Gas Box	C-Gas Out	SO2 Out
********	Chn 103	Chn 104	Chn 105	Chn 106	Chn 107	Chn 108	Chn 109	Chn 110	Chn 111	Chn 112	Chn 113	Chn 114	Chn 115	Chn 116	Chn 117
0	265	387	550	382	482	444	######	######	71	1348	231	69	239	37	34
5	381	388	523	379	460	440	######	######	71	1350	232	51	239	37	34
10	291	388	499	361	437	432	######	######	71	1353	231	51	242	37	35
15	309	384	478	347	416	420	######	######	71	1355	234	52	243	37	35
20	311	391	465	336	404	411	######	######	71	1359	236	53	245	38	36
25	353	389	463	330	397	398	######	######	72	1361	237	55	243	38	36
30	396	407	490	328	402	387	######	######	72	1362	236	56	241	38	36
35	404	432	525	331	425	378	######	######	71	1363	236	55	240	38	36
40	417	448	557	336	454	373	######	######	71	1364	236	54	240	38	37
45	418	469	587	344	485	362	######	######	73	1365	237	53	239	38	37
50	423	482	610	360	511	361	######	######	72	1366	237	54	239	38	37
55	419	503	632	374	535	356	######	######	72	1368	239	53	240	38	37
60	426	500	648	392	550	352	######	######	74	1370	241	53	241	39	37
65	421	509	661	415	563	349	######	######	74	1372	243	54	243	39	36
70	413	513	667	435	574	345	######	######	74	1374	245	54	244	39	37
75	414	511	673	448	579	344	######	######	74	1376	247	55	246	39	37
80	412	511	686	451	589	343	######	######	75	1378	248	55	247	39	37
85	395	509	686	455	596	342	######	######	75	1381	245	56	248	39	38
90	377	503	670	454	593	343	######	######	76	1383	244	56	247	39	38
95	364	493	652	451	584	343	######	######	75	1385	241	56	246	39	38
100	354	485	636	448	573	342	######	######	75	1386	238	57	246	39	38
105	345	473	627	444	556	341	######	######	75	1388	235	57	246	39	38
110	332	459	619	436	537	341	######	######	75	1389	237	58	245	39	38
115	310	438	604	427	519	341	######	######	76	1391	240	58	246	39	38
120	298	421	586	419	502	338	######	######	75	1393	242	59	247	39	38
125	288	403	568	413	487	339	######	######	75	1394	243	45	247	39	37
130	278	389	551	405	474	338	######	######	74	1395	244	41	248	39	38
135	270	374	536	399	465	337	######	######	75	1395	245	40	248	39	38
140	264	361	523	395	456	335	######	######	75	1396	245	40	248	39	38
145	259	355	513	394	446	334	######	######	75	1397	246	40	247	39	38
150	254	348	504	393	438	332	######	######	75	1397	246	41	246	39	38
155	254	342	497	395	432	330	######	######	74	1398	247	41	246	39	39
160	252	335	494	397	427	329	######	######	74	1398	247	41	244	39	39
165	251	336	492	394	423	329	######	######	74	1397	246	42	245	39	39
170	249	333	491	390	419	330	######	######	74	1397	246	42	244	38	39

175	247	331	490	387	416	330	######	######	74	1397	246	42	244	38	39
180	245	327	487	385	413	332	######	######	74	1398	245	43	244	38	39
185	245	326	485	383	410	333	######	######	74	1398	245	43	244	38	39
190	241	323	482	381	405	335	######	######	74	1399	245	44	243	38	39
195	239	319	478	378	401	337	######	######	74	1399	244	44	243	38	39
200	238	318	475	376	398	338	######	######	74	1399	244	45	243	38	39
205	236	315	472	373	394	340	######	######	75	1399	244	46	243	37	39
210	234	313	468	371	391	341	######	######	74	1399	244	47	243	37	39
215	233	312	464	371	389	341	######	######	75	1399	244	47	243	37	39
220	230	308	460	370	386	342	######	######	75	1399	244	48	243	37	38
225	228	306	456	368	383	343	######	######	75	1400	244	49	243	37	38
230	228	303	452	365	380	341	######	######	75	1400	244	50	243	37	38
235	225	301	448	365	377	344	######	######	75	1401	244	51	243	37	38
240	222	293	443	363	374	345	######	######	75	1400	243	52	242	37	38
245	219	295	437	360	370	347	######	######	75	1399	242	53	242	36	38

TEMPERATURE DATA SHEET #14A

		TEST TIME	245		
STACK AVG	307	TOP AVG	393	LT SIDE AVG	539
BACK AVG	389	RT SIDE AVG	462	BOTTOM AVG	353
FIREBOX AVG	########	SEC/CAT AVG	########	AMBIENT AVG	74

END	361.9	
START	449.2	
	-87.3	DELTA T

CIRCLE: **LOSS / GAIN**

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 8-27-2010 Analyte : CO_2 (15-1)

Unit : Jotul TL Run # : 3

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 % CO_2 Cyl. Press. : 420 PSI

Certified by : AIR LIQUIDE Date : 04-19-04

Span Cyl. # : 487905 Conc. : 12.20 % CO_2 Cyl. Press. : 1396 PSI

Certified by : AIR LIQUIDE Date : 11-1-07

Analyzer : Make : HORIBA Model : PIR-2000 SN : 407069

Range : 0 - 25.0 % CO_2 Analyzer Output : 0 - 1.0 v.

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % CO_2

EPA Control Limits = ± 2.5% of 25.0 % CO_2 = ± 0.625 % CO_2

Method 28 A = ± .2 % of 25.0 % CO_2 = ± .05 % CO_2

PRE RUN Audit : by : G Worthington Time : 0950 Temp : 72 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.2	.002	.118	.118	.474
SPAN	48.8	.488	12.20	49.0	.490	12.263	.063	.251

POST RUN Audit : by : G Worthington Time : 1620 Temp : 74 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.069	.069	.274
SPAN	48.8	.488	12.20	48.9	.489	12.238	.038	.152

± Conc. Difference = Act % - Exp (Std) %

Zero % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X 100

Span % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X100

ZERO / SPAN CHECK DATA SHEET #15-2

Date : 8-27-2010 Analyte : O_2 (15-2)

Unit : Total TL Run # : 3

Zero Cyl. # : 168TAC 3A Conc. : 0.00 % O_2 Cyl. Press. : 420 PSI

Certified by : AIR LIQUIDE Date : 04-19-04

Span Cyl. # : 487905 Conc. : 12.60 % O_2 Cyl. Press. : 1390 PSI

Certified by : AIR LIQUIDE Date : 11-1-07

Analyzer : Make : TELEDYNE Model : 320 A SN : 37400

Range : 0 - 25.0 % O_2 Analyzer Output : 0 - 1.0 v.

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % O_2

EPA Control Limits = ± 2.5% of 25.0 % O_2 = ± 0.625 % O_2

Method 28 A = ± .2 % of 25.0 % O_2 = ± .05 % O_2

PRE RUN Audit : by : C. Worthington Time : 0950 Temp : 72 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.001	-.021	-.021	-.082
SPAN	12.60	.504	12.6	12.6	.504	12.636	.036	.145

POST RUN Audit : by : C. Worthington Time : 1620 Temp : 74 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.002	.005	.005	.018
SPAN	12.60	.504	12.6	12.6	.503	12.611	.011	.044

± Conc. Difference = Act % - Exp (Std) %

Zero % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X 100

Span % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X100

ZERO / SPAN CHECK DATA SHEET #15-3

Date : 8-27-2010 Analyte : CO (15-3)

Unit : Jotul TL Run # : 3

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 % CO Cyl. Press. : 420 PSI

Certified by : AIR LIQUIDE Date : 04-19-04

Span Cyl. # : 487905 Conc. : 4.90 % CO Cyl. Press. : 1390 PSI

Certified by : AIR LIQUIDE Date : 11-1-07

Analyzer : Make : HORIBA Model : PIR-2000 SN : 408005

Range : 0 - 10.0 % CO Analyzer Output : 0 - 1.0 v.

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 10.0 % CO

EPA Control Limits = ± 2.5% of 10.0 % CO = ± 0. 25 % CO

Method 28 A = ± .2 % of 10.0 % CO = ± .02 % CO

PRE RUN Audit : by : G Wadsworth Time : 0950 Temp : 72 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.005	.005	.048
SPAN	49.0	.490	4.90	49.1	.491	4.921	.021	.214

POST RUN Audit : by : C. Wadsworth Time : 1620 Temp : 74 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.005	.005	.048
SPAN	49.0	.490	4.90	49.0	.490	4.911	.011	.114

± Conc. Difference = Act % - Exp (Std) %

Zero % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X 100

Span % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X100

ZERO / SPAN CHECK DATA SHEET #15-4

Date : 8-27-2010 Analyte : SO_2 (15-4)

Unit : Jotul TL Run # : 3

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 ppm SO_2 Cyl. Press. : 420 PSI

Certified by : AIR LIQUIDE Date : 04-19-04

Span Cyl. # : CC82089 Conc. : 1250 ppm SO_2 Cyl. Press. : 1700 PSI

Certified by : AIR LIQUIDE Date : 01-3-2007

Analyzer : Make : HORIBA Model : PIR-2000 SN : 403019

Range : 0 - 2500 ppm SO_2 Analyzer Output : 0 - 1.0 v.

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 2500 ppm SO_2

EPA Control Limits = ± 2.5% of 2500 ppm SO_2 = ± 62.5 ppm SO_2

PRE RUN Audit : by : C. Watson Time : 0950 Temp : 72 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	-.003	-6.175	-6.175	-.247
SPAN	50.0	.500	1250	50.2	.502	1253.0	3.000	.120

POST RUN Audit : by : C. Watson Time : 1620 Temp : 74 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.001	3.799	3.799	.152
SPAN	50.0	.500	1250	50.0	.500	1248.0	-2.000	-.080

± Conc. Difference = Act % - Exp (Std) %

Zero % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X 100

Span % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X100

QUALITY CHECKS DATA SHEET # 16

UNIT: Total TL RUN: 3 DATE: 8-27-2010

Thermocouple Check:

T/C # 1	— °F	T/C # 13	69.2 °F
T/C # 2	— °F	T/C # 14	68.0 °F
T/C # 3	68.4 °F	T/C # 15	69.4 °F
T/C # 4	66.5 °F	T/C # 16	56.6 °F
T/C # 5	66.3 °F	T/C # 17	52.2 °F
T/C # 6	66.3 °F	T/C # 18	71.4 °F
T/C # 7	66.2 °F	T/C # 19	— °F
T/C # 8	65.8 °F	T/C # 20	— °F
T/C # 9	— °F	T/C # 21	— °F
T/C # 10	— °F	T/C # 22	— °F
T/C # 11	64.3 °F	T/C # 23	— °F
T/C # 12	74.4 °F	T/C # 24	— °F

Thermocouple Readout:

Pretest zero and span check and calibration — post test zero and span — % difference

ZERO 1.4 °F Adj. to 0.0 °F ZERO 0.0 °F Difference 0 %

SPAN 2000.0 °F Adj. to 2000.0 °F SPAN 1999.7 °F Difference .015 %

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 200.3 °F	400	= 400.0 °F
600	= 599.9 °F	800	= 799.7 °F	1000	= 999.7 °F
1200	= 1199.6 °F	1400	= 1399.4 °F	1600	= 1599.4 °F
1800	= 1799.6 °F	2000	= 2000.0 °F		

Sample Train Leak Check	Pre ✓	Post ✓
C-gas Train Leak Check	Pre ✓	Post ✓
SO_2 Train Leak Check	Pre ✓	Post ✓
Static Gauge Zero Check	Pre ✓	Post ✓

Scale Check Pre: 560.3 − 550.3 = 10.0

Post: 560.0 − 550.0 = 10.0

Stack Cleaned Prior to Test Run: YES ____ NO X

TABLE 1 ----- RAW DATA

CLIENT : Jotul TEST No. : 1

MODEL: Top Load DATE: 25-Aug-10

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	903.500	0.150	87	0.17	7.50	325
5	905.000	0.080	88	0.57	7.30	425
10	906.192	0.140	88	0.14	11.90	325
15	907.751	0.140	88	0.05	12.10	325
20	909.310	0.140	89	0.07	13.70	325
25	910.874	0.140	89	0.06	14.00	325
30	912.438	0.110	90	0.07	15.10	375
35	913.799	0.120	90	0.13	14.10	350
40	915.257	0.170	90	0.09	11.60	300
45	916.957	0.120	90	0.08	12.00	350
50	918.415	0.120	90	0.06	10.70	350
55	919.873	0.120	90	0.04	10.50	350
60	921.331	0.120	91	0.04	12.20	350
65	922.797	0.120	91	0.05	13.40	350
70	924.263	0.120	93	0.04	10.50	350
75	925.739	0.140	93	0.10	8.60	325
80	927.329	0.120	93	0.25	7.50	350
85	928.805	0.140	93	0.19	7.50	325
90	930.395	0.140	93	0.26	7.20	325
95	931.985	0.140	93	0.24	7.40	325
100	933.575	0.140	93	0.32	6.70	325
105	935.165	0.140	93	0.39	6.50	325
110	936.755	0.140	93	0.44	6.20	325
115	938.345	0.160	93	0.45	6.40	300
120	940.067	0.160	94	0.50	5.90	300
125	941.795	0.160	94	0.58	5.60	300
130	943.523	0.160	94	0.62	5.40	300
135	945.251	0.160	94	0.68	5.20	300
140	946.979	0.160	94	0.67	5.20	300
145	948.707	0.160	94	0.66	4.90	300
150						

TABLE 2---RAW DATA

CLIENT : Jotul TEST No. 1

MODEL: Top Load DATE: 25-Aug-10

METER CAL. FACTOR (Y) -------	0.916		Wt. WOOD BURNED(LB) -------	17.4	Lbs
BAROMETRIC PRESS.(Pb) -------	29.92	in Hg	WET,FUEL MOISTURE % -------	16.516	%
LEAK RATE POST (Lp) -------	0.005	cfm	Wt. PART. COLLECTED -------	0.0937	
WATER VOL. (V1c) -------	82.5	Ml	METER VOLUME Vm -------	45.207	mcf
TEST TIME (MIN) -------	145	min	HC MOLE FRACTION -------	0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT : Jotul TEST No. 1

MODEL: Top Load DATE: 25-Aug-10

****

AVG DELTA H	-------	0.14	in H2O	AVG PRCNT CO	-------	0.27	%
AVG METER TEMP. Tm	-------	92	deg F	AVG PRCNT CO2	-------	9.09	%
AVG PPM SO2	-------	330	PPM	AVG BAL CO2/CO	-------	34.06	%

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul TEST No. 1

MODEL: Top Load DATE: 25-Aug-10

STD SAMPLE VOL. Vm(std) d) ------	39.67	dscf	STACK GAS FLOW Qsd -------	919.722	dscf/Hr
				&	
				15.33	dscf/min
VOL. WATER VAPOR Vw(s td) -----	3.883	scf	PARTICULATE CONCTRT. C s ------	0.0024	g/dscf
PRCNT MSTR Bws -------	8.92	%	PARTC.EMISS. RATE E -------	2.17	g/Hr
BURN RATE BR -------	2.73	Kg/Hr	MOLES OF GAS PER Lb WOOD Nt ----	0.40	Lb-mole/Lb
CO EMISSION RATE -------	82.24	g/Hr	PART.EMISS. RATE ------	0.80	g/Kgdry fuel
	&				
	30.16	g/Kgdry fuel			

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Jotul TEST No. : 1

MODEL: Top Load DATE: 25-Aug-10

TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR	PROPRTN RATE VAR. AVERAGE
5	430.9	96	100
10	447.3	99	
15	447.4	99	
20	447.0	99	
25	448.0	100	
30	447.6	99	
35	449.0	100	
40	448.9	100	
45	448.7	100	
50	448.9	100	
55	448.9	100	
60	448.5	100	
65	450.6	100	
70	449.8	100	
75	452.0	100	
80	452.2	101	
85	452.0	100	
90	452.2	101	
95	452.2	101	
100	452.2	101	
105	452.2	101	
110	452.2	101	
115	452.2	101	
120	451.7	100	
125	452.8	101	
130	452.8	101	
135	452.8	101	
140	452.8	101	
145	452.8	101	

COMPUTER INPUT DATA SHEET #1

Client: Jotul North America

Address: 55 Hutcherson

Gorham, ME 04038

Phone: 1-800-797-5912 Fax:

Run No.: 1 Date of Test: 8-25-2010 Burn Rate: 2.727 2.17

Model No.: Top Loader ☐ min ☐ min-1.25 ☐ fan

Stove Type: ☐ Cat ☒ Non Cat ☐ Pellet ☐ 1.25-1.9 ☒ max ☐ insert

Dry Gas Meter Y Factor: .916 (0.000) (Data Sheet #2) Post Leak Rate: .005 (.000) cfm (Data Sheet #2) Time: 145 (000) min. (Data Sheet #2)

Dry Gas Meter Volume: 45.207 (00.000) (Data Sheet #2) cf

Stack Flow: 10,313 (00.000) (Data Sheet #2) dscfm Δ H: .138 (.000) (Data Sheet #2) in. H_2O

Maximum Vac.: 2.0 (0.0) (Data Sheet #2) Barometric Pressure: 29.92 (00.00) (Data Sheet #2) in. Hg

H_2O Captured: 82.5 (00.0) (Data Sheet #3) g

Front Half Catch % Of Total: 45.5 (00.0) (Data Sheet #6) % Total Particulate Catch: .0937 (0.0000) (Data Sheet #6) g

Flue Gas Moisture: 8.9292 (00.000) (Data Sheet #7) %

Particulate Emission: .0365 (0.0000) (Data Sheet #7) gr/dscf

Relative Humidity: 42.0 (00.0) (Data Sheet #8) % RH Ambient Moisture: 1.85 (0.00) (Data Sheet #8) % H_2O

Preburn Fuel Wt.: 43.7 (00.0) (Data Sheet #8) lbs. Coal Bed Wt.: 4.2 (00.0) (Data sheet #8) lbs. Test Fuel Wt.: 17.4 (00.0) (Data sheet #8) lbs.

Heat Output (EPA Default): 32882.7 (00,000.0) (Data Sheet #8) BTU/hr

Kindling Fuel % Moisture (wet): 12.434% (00.000) (Data Sheet #10) Pretest Fuel % Moisture (wet): 16.295 (00.000) (Data Sheet #10) %

Test Fuel % Moisture (dry): 19.783% (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove]) Test Fuel % Moisture (wet): 16.516 %

Fuel Higher Heating Value (dry): N/A (0000) (Data Sheet #11) BTU/lb.

Stack Static Pressure: -.057 (+/- .000) (Data Sheet #12) in. H_2O

Average Ambient Temperature: 89.0 (00) (Data Sheet #14) °F Stove Temperature Change: -99.6 (+/- 000.0) (Data Sheet #14) °F

Time Start 1140
End 1405

Meter Temp 552

METER BOX DATA SHEET PAGE # 2

Page: 1 of 2

UNIT: Jotul TL RUN: 1 DATE: 8-25-2010

Meter Box: SH Y Factor: .916

Leak checks: 15 " Hg @ 1.001 cfm _____ " Hg @ _____ cfm

15 " Hg @ 1.005 cfm _____ " Hg @ _____ cfm

Inject SO^2 @ 100 cc/min. Nozzle: Probe @ 3/8 " od Initial Volume: 1,540

ROTO: PRESS: .18			SAMPLING RATIO: 35 : 1				BP: 29.95		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1140	903.500	—	10,506	.15	87	325	87	2.0
5	45	905.000	—	8,019	.08	88	425	88	2.0
10	50	906.192	906,192	10,486	.14	88	325	88	2.0
15	55	907.751	907,751	10.486	.14	88	325	88	2.0
20	1200	909.310	909,310	10.467	.14	89	325	89	2.0
25	05	910.874	910,874	10.467	.14	89	325	89	2.0
30	10	912.438	912,438	9.055	.11	90	375	90	2.0
35	15	913.799	913,799	9,702	.12	90	350	90	2.0
40	20	915.257	915,257	11,319	.17	90	300	90	2.0
45	25	916.957	916.957	9.702	.12	90	350	90	2.0
50	30	918.415	918.415	9.702	.12	90	350	90	2.0
55	35	919.873	919,873	9.702	.12	90	350	90	2.0
ROTO PRESS: .18			TOTALS:	119.613	1.55	1069	BP.: 29,90		
60	1240	921.331	921,331	9,648	.12	91	350	91	2.0
65	45	922.797	922.797	9.648	.12	91	350	91	2.0
70	50	924.263	924..263	9.633	.12	93	350	93	2.0
75	55	925.739	925.739	10,374	.14	93	325	93	2.0
80	1300	927.329	927.329	9.633	.12	93	350	93	2.0
85	05	928.805	928.805	10.374	.14	93	325	93	2.0
90	10	930.395	930,395	10.374	.14	93	325	93	2.0
95	15	931.985	931,985	10.374	.14	93	325	93	2.0
100	20	933.575	933.575	10.374	.14	93	325	93	2.0
105	25	935.165	935..165	10.374	.14	93	325	93	2.0
110	30	936.755	936,.755	10.374	.14	93	325	93	2.0
115	35	938.345	938.345	11.239	.16	93	300	93	2.0
			TOTALS:	122.459	1.62	1112	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	242.072	3.17	2181	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 2 of 2

UNIT: Jotul T2 RUN: 1 DATE: 8-25-2016

Meter Box: SH Y Factor: .916

Leak checks: 15 " Hg @ .001 cfm _____ " Hg @ _____ cfm

15 " Hg @ .005 cfm _____ " Hg @ _____ cfm

Inject SO^2 @ 100 cc/min. Nozzle : Probe @ 3/8 " od Initial Volume: 1,500

ROTO: PRESS: 18 SAMPLING RATIO: 35 : 1 BP: 29.90

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1340	940.067	940,067	11,218	.16	94	300	94	2.0
125	45	941.795	941,795	11,218	.16	94	300	94	2.0
130	50	943.523	943,523	11,218	.16	94	300	94	2.0
135	55	945.251	945,251	11,218	.16	94	300	94	2.0
140	1400	946.979	946,979	11,218	.16	94	300	94	2.0
145	05	948.707	948,707	11,218	.16	94	300	94	2.0
150									
155				67,308	.960	564			
160									
165									
170									
175									
ROTO PRESS:			TOTALS:				BP.:		
180									
185									
190									
195									
200									
205									
210									
215									
220									
225									
230									
235						2745			
			TOTALS:	309,380	4.13	92	MAX VACC =		2.0
TOTAL Cu Ft		45,207	TOTALS:	10,313	.138	552	AVG. BP:		29.92

1:30

WOODSTOVE DATA SHEET 2A

Unit: Jotul TL Run: 1 Date: 8-25-2010 Page: 1 of 1

Time	Volume	Time	Volume	Time	Volume	Time	Volume
0	—	120	1.722	240		360	
5	1.560	125	1.728	245		365	
10	1.192	130	1.728	250		370	
15	1.559	135	1.728	255		375	
20	1.559	140	1.728	260		380	
25	1.564	145	1.728	265		385	
30	1.564	150		270		390	
35	1.361	155		275		395	
40	1.458	160		280		400	
45	1.700	165		285		405	
50	1.458	170		290		410	
55	1.458	175		295		415	
60	1.458	180		300		420	
65	1.466	185		305		425	
70	1.466	190		310		430	
75	1.476	195		315		435	
80	1.590	200		320		440	
85	1.476	205		325		445	
90	1.590	210		330		450	
95	1.590	215		335		455	
100	1.590	220		340		460	
105	1.590	225		345		465	
110	1.590	230		350		470	
115	1.590	235		355		475	

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : John TL RUN : 1 DATE : 8-25-10

SCALE CHECK	LEVEL	ZEROED
INITIAL :	✓	✓
FINAL :	✓	✓

SCALE	WEIGHT
295.0 g	295.0
590.0 g	590.0
885.0 g	885.0

IMPINGER	#1	#2	#3	#4
FINAL WT	695.5	591.3	484.5	903.4
INITIAL WT	623.5	586.4	483.5	898.8
NET WT GRAMS	72.0	4.9	1.0	4.6

TOTAL CATCH : 82.5 GRAMS H_2O

FRONT HALF

FILTER #	195F	
FINAL WT g	.6841	
INITIAL WT g	.6602	
NET WT g	.0239	

BEAKER #	121
DESC.	ACETONE
FINAL WT g	106.3838
INITIAL WT g	106.3646
NET WT g	.0192
VOL. DESC. ml	75

BACK HALF

FILTER #	195B	
FINAL WT g	.3619	
INITIAL WT g	.3571	
NET WT g	.0048	

BEAKER #	122	123	124	125	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	107.0373	108.6586	106.2197	107.7630	
INITIAL WT g	107.0190	108.6488	106.2064	107.7489	
NET WT g	.0183	.0098	.0133	.0141	.0274
VOL. DESC ml	60	75	150	150	300

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 8-12-09 Time : 1205 By : AV

Manufacturer S & S Grade : # 25 Glass Front Size : 11 cm Lot No. :

Back Size: 8.2 cm Lot No. :

	DATE: 8-14-09	BY: AV	DATE: 8-19-09	BY: AV	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
191F	0.6645	0900	0.6647	0920		
192F	0.6630	0901	0.6631	0921		
193F	0.6621	0902	0.6623	0922		
194F	0.6568	0903	0.6568	0923		
195F	0.6602	0904	0.6602	0924	R-1	
196F	0 6578	0905	0.6579	0925		
197F	0.6600	0906	0.6601	0926		
198F	0.6615	0907	0.6615	0927		
199F	0.6575	0908	0.6574	0928		
200F	0.6618	0909	0.6618	0929		
191B	0.3600	0910	0.3601	0930		
192B	0.3597	0911	0.3599	0931		
193B	0.3594	0912	0.3593	0932		
194B	0.3596	0913	0.3596	0933		
195B	0.3570	0914	0.3571	0934	R-1	
196B	0.3630	0915	0.3631	0935		
197B	0.3598	0916	0.3598	0936		
198B	0.3640	0917	0.3640	0937		
199B	0.3602	0918	0.3602	0938		
200B	0.3605	0919	0.3605	0939		

Checked by: C. [signature] Date: 8-19-09 Time: 1410

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 6-25-2009 Time : 0945 By : AV

	DATE: 8-12-09	BY: AV	DATE: 8-14-09	BY: AV	DATE:	BY:
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
101	95.5804	1125	95.5889	0940		
102	96.3674	1126	96.3669	0941		
103	102.3520	1127	102.3515	0942		
104	106.2051	1128	106.2055	0943		
105	107.0592	1129	107.0592	0944		
106	96.7079	1130	96.7075	0945		
107	107.3393	1131	107.3398	0946		
108	104.9449	1132	104.9444	0947		
109	98.8627	1133	98.8633	0948		
110	104.0122	1134	104.0120	0949		
111	97.7395	1135	97.7390	0950		
112	104.8839	1136	104.8838	0951		
113	106.4399	1137	106.4392	0952		
114	106.1906	1138	106.1902	0953		
115	106.8157	1139	106.8153	0954		
116	105.9308	1140	105.9309	0955		
117	103.8852	1141	103.8851	0956		
118	107.1504	1142	107.1508	0957		
119	105.4996	1143	105.4996	0958		
120	106.0891	1144	106.0888	0959		
121	106.3650	1145	106.3646	1000	R-1	
122	107.0191	1146	107.0190	1001		
123	108.6493	1147	108.6488	1002		
124	106.2065	1148	106.2064	1003		
125	107.7493	1149	107.7489	1004		

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH	
		CW	-			Checked by :
		CW	-			Date :
		CW	-			Time :

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : Jotul TL **RUN :** 1 **DATE :** 8-25-10 **Page :** 1 **of** 1

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
121	8-26	0830	CP	106.3843	8-27	1010	CP	106.3838	8-28	1606	CP				
122	8-26	0830	CP	107.0378	8-27	1011	CP	107.0373	8-28	1607	CP				
123	8-26	0830	CP	108.6571	8-27	1012	CP	108.6566	8-28	1608	CP				
124	8-26	0830	CP	106.2201	8-27	1013	CP	106.2197	8-28	1609	CP				
125	8-26	0830	CP	107.7635	8-27	1014	CP	107.7630	8-28	1610	CP				

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
195F	8-25	1700	CP	.6868	8-26	0850	CP	.6842	8-27	1000	CP	.6841	8-28	1605	CP
195B	8-25	1700	CP	.3619	8-26	0851	CP	.3619	8-27	1001	CP				

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	8-26-10	0849	CP	78	49
2	8-27-10	0955	CP	78	43
3	8-28-10	1600	CP	73	47
4					
5					

Weighing Session	Date	Time	By	DB	%RH
6					
7					
8					
9					
10					

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 2-26-2010 Through	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0001	10.0004	.9999	.0999	CP	2-26-10	0840	72	46
100.0001	9.9999	.9999	.0999	CP	2-27-10	1045	72	46
100.0000	10.0000	1.0000	.0999	CP	2-28	1100	70	48
100.0000	10.0000	1.0000	.0999	CP	3-1	0900	66	49
100.0000	10.0002	.9998	.1002	CP	3-5	1200	70	48
100.0001	9.9999	.9999	.0998	CP	3-7	1330	68	47
100.0000	9.9999	.9999	.0999	CP	3-9	1130	70	41
100.0000	10.0001	1.0000	.0999	CP	3-10	1200	70	44
100.0000	10.0001	.9999	.0999	CP	3-11	0900	66	49
99.9999	9.9999	.9999	.0999	AV	3-15	1000	70	48
100.0000	10.0000	1.0000	.0998	CP	3-17	0900	72	46
100.0000	9.9998	1.0001	.1000	CP	4-8	1930	76	49
99.9999	10.0001	1.0000	.0999	CP	4-10	1630	73	47
99.9999	10.0001	1.0001	.1000	CP	4-11	1430	74	47
100.0000	10.0002	1.0000	.1000	CP	4-21	1830	77	49
100.0000	10.0000	1.0000	.0999	CP	4-22	1130	74	47
100.0000	10.0001	1.0000	.0999	CP	4-23	1015	74	44
100.0002	9.9999	1.0000	.1000	CP	4-24	0930	68	47
100.0000	9.9999	.9999	.1000	CP	4-25	0930	73	47
100.0000	9.9999	1.0001	.0999	CP	4-26	0900	76	42
100.0000	10.0002	1.0000	.0999	CP	4-30	1320	78	43
99.9998	10.0000	1.0002	.0999	CP	8-26	0845	78	49
100.0000	9.9998	1.0001	.0999	CP	8-27	0955	78	43
100.0000	10.0000	1.0000	.1000	CP	8-28	1600	73	47
99.9998	10.0000	.9999	.1000	CP	8-29	1400	70	48
100.0000	10.0000	1.0000	.0999	CP	8-31	0720	72	46
100.0001	10.0000	1.0000	.1000	CP	9-1	1330	76	49
100.0000	10.0001	1.0000	.0999	CP	9-2	1300	68	47
100.0000	10.0000	1.0000	.1000	CP	9-3	1130	72	46

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 5-10-2009 Through 2-25-2010	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0001	10.0002	1.0000	.0999	CP	5-10	1545	74	44
100.0001	10.0001	.9999	.0999	CP	6-19	1110	70	48
100.0001	10.0000	.9998	.0998	CP	6-22	0930	74	44
100.0001	10.0000	.9999	.0999	CP	6-24	1610	78	46
100.0001	10.0000	1.0000	.0999	CP	6-25	1000	78	46
100.0001	10.0001	1.0001	.0999	CP	6-26	0900	73	47
99.9998	10.0000	1.0001	.1000	CP	6-27	1300	76	45
100.0000	10.0002	1.0000	.0999	CP	6-28	1400	78	43
100.0000	10.0000	1.0000	.0999	CP	6-29	1130	74	47
100.0000	10.0000	1.0000	.0999	CP	7-1	1230	70	48
100.0000	9.9998	1.0000	.0998	CP	8-7	1310	75	48
99.9998	10.0000	1.0000	.0999	CP	8-8	1600	77	46
100.0000	10.0000	1.0000	.0999	CP	8-9	1720	78	46
100.0002	9.9999	1.0000	.0998	CP	8-10	0900	78	46
100.0000	10.0001	1.0001	.0998	CP	8-11	1126	78	46
100.0003	10.0001	1.0001	.1000	CP	8-12	0910	78	46
100.0000	10.0000	1.0001	.1000	CP	8-14	1630	78	46
100.0000	10.0000	1.0001	.0999	CP	8-19	0900	74	47
100.0002	10.0001	1.0000	.1000	CP	8-24	0900	72	42
100.0000	9.9999	.9999	.0999	CP	8-25	0900	70	48
100.0000	10.0000	1.0000	.0999	CP	8-26	1340	77	46
100.0003	10.0002	.9999	.1000	CP	9-5	1120	77	49
100.0000	10.0001	1.0000	.0999	CP	9-8	1410	78	41
100.0000	10.0001	1.0001	.0998	CP	9-11	1050	78	43
100.0000	10.0000	1.0000	.0999	CP	9-12	1220	78	46
100.0000	10.0001	1.0000	.0999	CP	9-13	1430	78	46
100.0000	10.0001	.9999	.1000	CP	9-14	1100	75	48
100.0000	10.0000	.9999	.0999	CP	1-29	1400	74	44
100.0000	10.0001	1.0000	.1000	CP	1-30	1800	78	46
100.0000	10.0001	1.0001	.1000	CP	2-1	0700	66	49
100.0000	9.9999	1.0001	.1000	CP	2-2	1100	72	46
100.0000	9.9997	1.0001	.1000	CP	2-4	1015	75	41
100.0000	10.0000	1.0000	.0998	CP	2-5	1015	78	43
100.0000	10.0001	1.0000	.1000	CP	2-7	1400	70	44
100.0002	10.0001	1.0000	.0999	CP	2-8	1200	78	46
100.0000	10.0000	1.0000	.1000	CP	2-9	1030	78	40
100.0000	10.0000	1.0000	.0999	CP	2-23	1830	77	49
100.0000	10.0001	1.0000	.0999	CP	2-24	0820	69	49
100.0000	10.0002	1.0000	.0999	CP	2-25	0940	69	47

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 8-27-2008 Through 5-9-2009	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9999	10.0000	1.0000	.0999	CP	8-27	0900	78	46
100.0001	10.0000	1.0000	.0999	CP	8-28	0930	78	46
100.0001	10.0001	1.0001	.0997	CP	8-29	1300	78	46
100.0000	10.0000	1.0000	.1000	CP	8-30	1030	78	46
100.0001	10.0003	1.0001	.0999	CP	8-31	1015	76	49
100.0000	10.0001	1.0000	.0997	CP	9-1	1100	74	44
100.0000	10.0001	.9999	.1000	CP	9-2	0845	75	48
99.9999	10.0000	.9999	.0998	CP	9-4	1000	77	47
99.9999	10.0002	1.0001	.0999	CP	9-8	0930	77	49
99.9999	9.9999	.9998	.0998	CP	9-9	1000	74	48
99.9997	9.9997	1.0000	.0999	CP	9-11	1500	76	45
100.0000	9.9997	.9999	.0999	CP	9-17	0930	77	49
100.0000	10.0000	1.0000	.0999	CP	9-18	0900	78	46
100.0000	10.0000	.9999	.0999	CP	9-19	0915	78	49
100.0000	10.0000	.9999	.0999	CP	9-22	1030	77	46
100.0000	10.0001	1.0000	.0998	CP	9-24	1330	78	49
100.0001	10.0001	1.0000	.0999	CP	9-25	0930	78	46
100.0000	9.9999	1.0001	.0998	CP	9-26	0920	78	46
100.0001	9.9999	1.0001	.0999	AV	9-29	0955	78	46
100.0000	10.0001	1.0000	.0998	CP	10-2	0945	75	44
100.0000	10.0000	1.0000	.0999	CP	10-3	0930	78	46
100.0000	9.9999	1.0000	.0999	CP	10-4	1530	78	46
100.0000	9.9999	.9999	.0999	CP	10-6	0930	77	49
100.0000	10.0001	1.0002	.1000	CP	10-7	1700	78	49
100.0000	10.0000	1.0000	.0999	CP	10-8	1000	78	49
99.9999	10.0000	1.0001	.0999	CP	10-9	1030	78	43
100.0000	9.9999	1.0001	.1000	CP	10-10	0930	78	40
100.0000	9.9998	.9999	.0997	CP	10-11	1430	74	47
100.0000	10.0001	1.0000	.1000	CP	10-13	0940	78	46
100.0000	10.0002	.9999	.0999	CP	10-14	2030	77	49
100.0000	10.0002	1.0000	.1000	CP	10-16	1220	78	43
100.0000	9.9999	1.0000	.0999	CP	10-18	1130	74	47
99.9998	10.0000	.9999	.0999	CP	5-3	1200	78	43
100.0000	10.0001	1.0000	.0999	CP	5-4	1000	72	42
100.0000	10.0001	1.0000	.0997	CP	5-5	1000	76	45
99.9998	10.0000	1.0000	.0999	CP	5-6	1100	77	49
100.0000	10.0001	1.0001	.1000	CP	5-7	1600	77	42
100.0000	10.0001	1.0000	.0999	CP	5-8	1600	76	45
100.0000	10.0003	1.0000	.1000	CP	5-9	1300	76	38

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 10-22-07 Through 8-26-2008	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0006	10.0001	1.0000	.0998	CP	10-22	1630	78	46
99.9999	10.0001	1.0000	.1001	CP	10-23	1000	74	44
100.0002	10.0002	1.0002	.0999	CP	10-24	1400	73	47
100.0002	10.0000	1.0001	.0998	CP	10-26	1700	74	40
100.0003	10.0001	1.0001	.0999	CP	10-27	0820	78	40
99.9999	10.0000	.9999	.0997	CP	10-28	1200	78	40
100.0000	9.9999	.9999	.0999	CP	10-29	1700	76	42
99.9998	9.9999	.9999	.1000	CP	10-30	1600	78	43
99.9997	10.0000	.9999	.0999	CP	11-16	1500	68	47
100.0001	10.0002	1.0000	.0999	CP	11-19	1730	73	40
100.0000	10.0002	.9999	.0999	CP	11-20	1100	64	44
99.9998	9.9999	.9999	.0998	CP	1-18-08	1230	76	45
100.0002	10.0002	.9999	.0999	CP	1-21-08	1430	65	48
99.9999	10.0002	1.0001	.0999	CP	1-22-08	1200	68	47
100.0002	9.9999	.9999	.0998	CP	1-23-08	1400	74	47
99.9999	10.0000	1.0002	.1000	CP	1-31-08	1900	74	44
100.0000	10.0003	1.0000	.0996	CP	2-1-08	1530	76	45
99.9997	9.9999	.9999	.0999	CP	2-16-08	1700	68	47
100.0001	10.0002	1.0000	.1000	CP	2-18-08	1400	72	46
99.9999	10.0001	.9999	.0998	CP	2-22-08	1800	68	47
99.9999	10.0001	1.0000	.0999	CP	2-23-08	1800	78	43
100.0000	10.0000	1.0000	.0999	CP	5-8-08	1020	78	43
100.0001	10.0001	1.0000	.0999	CP	5-9-08	0930	69	47
100.0000	10.0001	.9999	.0999	CP	5-10-08	1330	74	47
99.9998	9.9999	1.0000	.0998	CP	5-11-08	0900	74	44
100.0003	10.0001	.9999	.0998	CP	5-12	1400	70	48
99.9999	10.0001	1.0000	.1000	CP	5-13	1000	77	42
99.9999	9.9997	1.0000	.1000	CP	5-14	1230	77	42
99.9999	10.0001	.9999	.1000	CP	6-5-08	1430	72	46
100.0001	10.0000	1.0000	.0999	CP	6-9-08	1400	74	44
99.9999	9.9999	1.0000	.0999	CP	6-9-08	1800	73	47
100.0001	10.0001	.9999	.0998	CP	8-11-08	0930	77	42
100.0003	10.0000	1.0001	.0999	CP	8-12-08	1011	78	43
100.0000	10.0001	1.0000	.0999	CP	8-13-08	0950	76	49
100.0002	10.0000	1.0000	.0998	CP	8-18-08	0930	74	44
100.0001	9.9999	1.0000	.0998	CP	8-20-08	1110	76	45
100.0000	9.9999	.9999	.0998	CP	8-21-08	0915	75	48
100.0002	10.0000	1.0000	.1002	CP	8-22-08	0910	75	45
100.0000	10.0001	1.0001	.0999	CP	8-26-08	0900	78	43

BLANK PROCESSING DATA SHEET # 5

UNIT: Jotol TL RUN: 1 DATE: 8-25-10

BLANKS DONE: 10-30-2007

BEAKER	A	B	C
	200 ml ACETONE	75 ml DICHLOR	200 ml WATER
	FISHER OPTIMA LOT #023283	FISHER OPTIMA LOT #03 5941	DWNA Inc Sparklettes Distilled
FINAL WEIGHT	108.9009	106.3077	106.9680
TARE WEIGHT	108.8995	106.3063	106.9644
NET WEIGHT	.0014	.0014	.0036

TARE BEAKERS INTO DESC: TIME: 1700 DATE: 10-20-07

DATE: 1022 BY: Cp DATE: 1023 BY Cp DATE: BY:

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.8994	1700	108.8995	1027		
B	106.3060	1701	106.3063	1028		
C	106.9639	1702	106.9644	1029		

FINAL BEAKERS INTO DESC: TIME: 1040 DATE: 10-27-07

DATE: 1029 BY: Cp DATE: 1030 BY Cp DATE: BY:

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9011	1721	108.9009	1619		
B	106.3074	1722	106.3077	1621		
C	106.9678	1723	106.9680	1622		

TARE QC

DATE	TIME	BY	WB	DB	%
10-22	1630	Cp		78	46
10-23	1000	Cp		74	44

FINAL QC

DATE	TIME	BY	WB	DB	%
10-29	1700	Cp		76	42
10-30	1600	Cp		78	43

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT: Total TL RUN: 1 DATE: 8-25-10

BLANK CALCULATIONS

Acetone :	.0014	g +	200	ml =	.000007	g/ml
Dicholoromethane :	.0014	g +	75	ml =	.000019	g/ml
Distilled Water :	.0036	g +	200	ml =	.000018	g/ml

FRONT HALF CATCH

FILTERS : .0239 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0239 g

BEAKERS : .0192 (Total Catch) g - 75 (.0005) (ml Acetone) (.000007 g) (Blank Value / ml Acetone) = .0187 g

TOTAL FRONT HALF CATCH : .0426 g

BACK HALF CATCH

FILTERS : .0048 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0048 g

BEAKERS :

Acetone : .0183 (Total Catch) g - 60 (.0004) (ml Acetone) (.000007 g) (Blank Value / ml Acetone) = .0179 g

Extract : .0078 (Total Catch) g - 75 (.0014) (ml Dichloromethane) (.000019 g) (Blank Value / Dichloromethane) = .0064 g

Water : .0274 (Total Catch) g - 300 (.0054) (ml Water) (.000018 g) (Blank Value / Water) = .0220 g

TOTAL BACK HALF CATCH : .0511 g

TOTAL CATCH : .0937 g

% FRONT HALF : 45.5 %

CALCULATIONS DATA SHEET # 7

UNIT: Jotul TL RUN: 1 DATE: 8-25-2010

1) $Vm(std) = \dfrac{(45.207\ Vm)(17.64)(.916\ mcf)\left(29.92" Hg + \frac{.138" H_2O}{13.6}\right)}{(552\ TmA)} = \dfrac{39.6068}{000.0000}$ dscf

2) $Vw(std) = (.04707)(82.5\ ml\ H_2O) = \dfrac{3.8833}{00.0000}$ scf

3) $Asw = \dfrac{(3.8833\ scf)}{(3.8833\ scf + 39.6068\ dscf)} = \dfrac{.0893}{.0000}$ Bws × 100 = $\dfrac{8.9292}{00.0000}$ % H_2O

4) $Cs = \dfrac{(.0937\ g.)}{(39.6068\ dscf)}(15.43) = \dfrac{.0365}{0.0000}$ gr / dscf

5) Estimated g / hr = $\dfrac{(.0937\ g.)}{(39.6068\ dscf)}\left(\dfrac{10.313}{00.0000}\ dscfm\right)(60) = \dfrac{1.4639}{00.0000}$ g / hr

Vm =	total cubic feet pulled on meter box during test	(p. 2)	(000.000 Vm)
mcf =	meter correction factor (Y factor) of meter box used for test	(p. 2)	(0.000 mcf)
" Hg =	average barometric pressure during test	(p. 2)	(00.00 " Hg)
" H_2O =	average delta H for test	(p. 2)	(.000 " H_2O)
TmA =	average meter temperature for test in degrees Absolute	(p. 2)	(000 TmA)
ml H_2O =	total water caught during test	(p. 3)	(000.0 ml H_2O)
g. =	total particulate catch for test	(p. 6)	(00.0000 g.)
dscfm =	average stack flow during test	(p. 2)	(00.000 dscf)

TEST DATA SHEET # 8

UNIT: Jotul TL RUN: 1 DATE: 8-25-2010

Test Chamber Air Velocity Start: Ø Stop: Ø Avg.: Ø

Wet Bulb / Dry Bulb

Pre : WB: 69 DB: 86 = 44 % RH 1.7 % H_2O

Post : WB: 72 DB: 89 = 40 % RH 2.0 % H_2O

Average: 42 % RH 1.85 % H_2O

Empty Stove Weight (lbs): N/A w/ stack & oil seal : Wet: N/A Dry: 546.2

Kindling Weight (lbs): Paper: .1 Wood: 1.2

Preburn Fuel Weight: 21.8 + 20.7 Total: 42.5

Kindling & Preburn Fuel Weight (wood only) (lbs): **Total**: 43.7

Coal Bed Wt Range (lbs): 4.3 - 3.5 **Scale**: 550.5 - 549.7

Upper : .25 x fuel weight : Always round DOWN to nearest tenth

Lower : .20 x fuel weight : Always round UP to nearest tenth **Actual Coal Bed Weight**: 4.2

Maximum Coal Bed Removal (lbs): ((4.3 (Upper) + 3.5 (Lower)) ÷ 2) .25 = .9 (round down to nearest tenth)

Test Fuel (.75" x 1.5" x 5" spacers) = 20 pcs

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" x 4"	16.5	4	9.9	56.9
4" x 4"	16.5	2	7.5	43.1

Test Fuel Weight: 17.4 lbs

Estimated Dry Burn Rate:

$$\frac{17.4 - (17.4 \times .16516)}{2.2046} \times \frac{60}{\frac{145}{\text{TIME}}} = 2.727 \text{ kg / hr}$$

Estimated BTU's/hr: 19,140 x $\frac{63}{100}$ x $\frac{2.727}{\text{DBR}}$ = 32582.7 BTU's/hr

EPA Default Efficiencies: Non-cat: 63 Cat: 72 Pellet: 78

WOOD STOVE OPERATING DATA PAGE #9

Unit : Jotul TL Run : 1 Date : 8-25-2010

FIRE STARTED: 0830

WARM UP AND PREBURN:

PRIMARY AIR : Set wide open for all warm-up / preburn fuel charges. Then set to wide open at start of preburn.

SECONDARY AIR : N/A CAT BYPASS : N/A

CHARCOAL BED PREPARATION :

Raked and leveled prior to each warm-up / preburn charge. At 1 ½ min. prior to loading last fuel, raked and leveled. In stove 20 sec.

TEST:

DOOR wide open during loading Ø min. 25 sec.

PRIMARY AIR : Opened full for first 5 min., then set to run setting of wide open

SECONDARY AIR : N/A CAT BYPASS : N/A

FAN:

ON / (OFF) during warm-up (ON) / OFF during preburn

(ON) / OFF first ALL minutes of test ON / (OFF) balance of test run

Fan speed set at High

WOOD DATA: KINDLING: A mix of the grades listed below:

	SIZE	MILL	GRADE	SPECIES
PREBURN:	2x4	Manke/Tacoma	Std. or better	s. grn D fir
TEST:	2x4	Packwood	# 2 or better	s. grn D fir
	4x4	Packwood	# 2 or better	s. grn D fir

PELLET FUEL MANUFACTURER : N/A BRAND : N/A

All Grades WCLB rules:

WARM UP INFORMATION:

All pre-burn / warm up fuel pieces were either 12 or 16 inches.

1st warm up / pre-burn fuel charge (21.8 lbs.) added at 0850

2nd warm up / pre-burn fuel charge (20.7 lbs.) added at 1020

3rd warm up / pre-burn fuel charge (_____ lbs.) added at _____

4th warm up / pre-burn fuel charge (_____ lbs.) added at _____

5th warm up / pre-burn fuel charge (_____ lbs.) added at _____

TEST DATA SHEET #10

Unit : Jotul TC Run : 1 Date : 8-25-2010

Room Temperature : 73 °F Temperature Correction Set? : (Yes) No

Calibration Check: 12.0% + or – 0.2%? (Yes) No

Time Test Fuel moisture reading taken : 1000

pc #	Dimen.	Use	TOP	BOTTOM	SIDE	Avg Corrected
1	2"×4"×8'	K	14.7	13.9	14.0	14.200
2						
3						
4	2"×4"×8'	P	18.7	16.9	18.6	18.1
5	2"×4"×8'	P	21.3	22.9	22.1	22.1
6	2"×4"×8'	P	18.1	18.2	18.2	18.2
7	2"×4"×8'	P				58.4
8	2"×4"×8'	P				
9						
10						
11	2×4×16.5"	T	19.0	21.8	19.7	19.8
12	"	T	23.0	21.5	21.9	22.1
13	"	T	20.5	18.7	18.6	19.3
14	"	T	18.1	17.9	18.0	18.0
15	4×4×16.5"	T	19.1	21.5	22.0	20.9
16	"	T	18.8	17.8	19.3	18.6
17						118.7
18						
19						
20	Spacers	T	22.7	22.1	22.1	22.300

Key for Use : K = Kindling P = Pretest Fuel T = Test Fuel

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	14.200 %	19.467 %	19.783 %
Wet Moisture % :	12.434 %	16.295 %	16.516 %

To obtain Wet from Dry : $\frac{100 \times \%\ \text{Dry Reading}}{100 + \%\text{Dry Reading}}$ = % Moisture, Wet Basis

Acceptable Ranges : 16 - 20 % wet: 19 - 25 % dry (17.5 - 22.5 on Meter Uncor. reading) at 70°

GAS DATA SHEET #12

WEIGHT: 550.4 DATE: 8-25-2016

UNIT: Jotul TC RUN: 1 PAGE: 1 OF

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
0 1140	567.8	17.4	—	.249	7.5	.522	13.1	.015	.17	.055	325
5 45	567.1	16.7	.7	.292	7.3	.514	12.9	.055	.57	.056	425
10 50	566.0	15.6	1.1	.479	11.9	.348	8.7	.012	.14	.061	325
15 55	564.8	14.4	1.2	.487	12.1	.344	8.6	.003	.05	.062	325
20 1200	563.6	13.2	1.2	.550	13.7	.290	7.0	.005	.07	.064	325
25 05	562.2	11.8	1.4	.563	14.0	.268	6.7	.004	.06	.063	325
Fan? 30 10	560.9	10.5	1.3	.607	15.1	.224	5.6	.005	.07	.063	375
35 15	559.7	9.3	1.2	.564	14.1	.260	6.5	.011	.13	.061	350
40 20	558.6	8.2	1.1	.465	11.6	.363	9.1	.007	.09	.059	300
45 25	557.7	7.3	.9	.483	12.0	.348	8.7	.006	.08	.060	350
50 30	557.2	6.8	.5	.431	10.7	.399	10.0	.004	.06	.060	350
55 35	556.5	6.1	.7	.422	10.5	.407	10.2	.002	.04	.059	350
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.723	*****
60 40	555.7	5.3	.8	.490	12.2	.340	8.5	.002	.04	.060	350
65 45	554.8	4.4	.9	.536	13.4	.292	7.3	.003	.05	.060	350
70 50	554.0	3.6	.8	.422	10.5	.407	10.2	.002	.04	.060	350
75 55	553.6	3.2	.4	.345	8.6	.483	12.1	.008	.10	.059	325
80 1300	553.2	2.8	.4	.304	7.5	.518	13.0	.023	.25	.058	350
85 05	552.9	2.5	.3	.301	7.5	.522	13.1	.017	.19	.057	325
90 10	552.6	2.2	.3	.287	7.2	.530	13.3	.024	.26	.057	325
95 15	552.3	1.9	.3	.295	7.4	.522	13.1	.022	.24	.056	325
100 20	552.0	1.6	.3	.270	6.7	.546	13.7	.030	.32	.055	325
105 25	551.8	1.4	.2	.262	6.5	.554	13.9	.037	.39	.054	325
110 30	551.6	1.2	.2	.250	6.2	.562	14.1	.042	.44	.053	325
115 35	551.4	1.0	.2	.256	6.4	.554	13.9	.043	.45	.052	300
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.691	*****
120 40	551.2	.8	.2	.237	5.9	.574	14.4	.048	.50	.051	300
125 45	551.0	.6	.2	.224	5.6	.582	14.6	.056	.58	.050	300
130 50	550.8	.4	.2	.216	5.4	.586	14.7	.060	.62	.050	300
135 55	550.7	.3	.1	.209	5.2	.594	14.9	.066	.68	.051	300
140 1400	550.5	.1	.2	.208	5.2	.594	14.9	.065	.67	.050	300
145 05	550.4	.0	.1	.197	4.9	.606	15.2	.064	.66	.050	300
150 10											
155 15											
160 20											
165 25											
170 30											
175 35											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.302	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	1.706	*****

1.30

-057

PREBURN DATA SHEET #13

UNIT: SJ | RUN: 1 | DATE: 8-25-2010 | PAGE: 1 of 1

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
0 / 1020	569.4	—	405	450	620	491	533	413			78	.046	PREBURN START: # UP
5 / 25	568.9	.5	553	441	601	485	519	415			78	.057	COAL BED SCALE RANGE:
10 / 30	566.5	2.4	606	468	591	460	510	412			79	.060	550.5 → 549.7
15 / 35	564.3	2.2	625	503	612	461	522	407			80	.059	PRIMARY AIR: MAX
20 / 40	561.8	2.5	626	525	647	480	554	407			80	.060	SECONDARY AIR: N/A
25 / 45	560.0	1.8	634	552	676	497	585	404			80	.059	FAN:
30 / 50	558.2	1.8	629	572	710	486	623	407			83	.060	PUMPS ON AT:
35 / 55	556.4	1.8	612	597	746	491	660	407			83	.060	CHECK WB/DB: N/A
40 / 1100	555.3	1.1	565	589	764	473	689	405			84	.057	
45 / 05	554.4	.9	528	591	768	472	708	415			84	.056	
50 / 10	553.8	.6	503	583	765	466	709	417			84	.055	
55 / 15	553.3	.5	478	561	756	457	699	420			85	.055	
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	
60 / 20	552.7	.6	532	539	740	474	678	425			86	.054	
65 / 25	551.9	.8	527	522	733	502	666	430			85	.051	
70 / 30	551.1	.8	502	505	718	530	661	440			85	.052	
75 / 35	550.7	.4	474	491	710	542	656	447			86	.053	
80 / 40	550.4	.3	436	486	697	539	654	452			85	.055	
85 / 45													
90 / 50													
95 / 55													
100 / 1200													
105 / 05													
110 / 10													
115 / 15													

Jotul- Top Loader

Temperature Data Sheet 14

Run 1
8/25/10

Time	Stack	Top	LT Side	Back	Rt Side	Bottom	Firebox	Sec/Cat	Ambient	Tube Furn	Smpl Box	Smpl Out	C-Gas Box	C-Gas Out	SO2 Out
*********	Chn 103	Chn 104	Chn 105	Chn 106	Chn 107	Chn 108	Chn 109	Chn 110	Chn 111	Chn 112	Chn 113	Chn 114	Chn 115	Chn 116	Chn 117
0	436	486	697	539	654	452	######	######	87	1241	235	59	244	31	36
5	439	470	662	491	621	458	######	######	88	1259	235	45	245	32	36
10	513	469	649	441	595	456	######	######	89	1268	236	46	246	33	36
15	533	507	656	411	588	453	######	######	89	1279	236	45	247	34	37
20	553	528	669	390	602	440	######	######	90	1291	236	45	244	34	37
25	568	559	688	381	618	437	######	######	89	1301	237	45	242	34	38
30	576	581	721	385	637	431	######	######	90	1308	236	46	240	34	38
35	571	591	752	390	663	424	######	######	90	1317	236	49	239	34	38
40	502	574	765	393	672	415	######	######	90	1322	236	50	238	34	38
45	519	567	754	395	654	410	######	######	90	1328	235	53	237	33	38
50	507	559	764	395	651	405	######	######	90	1333	235	49	236	33	38
55	501	552	772	405	645	402	######	######	89	1337	235	48	235	33	38
60	514	554	775	417	646	402	######	######	90	1341	234	48	235	33	37
65	537	562	782	434	654	400	######	######	90	1345	234	48	234	33	37
70	526	569	797	454	666	399	######	######	90	1350	234	49	234	33	36
75	494	563	785	470	670	399	######	######	89	1354	235	49	234	33	37
80	463	541	764	481	657	405	######	######	89	1358	235	49	233	33	37
85	444	521	738	483	639	409	######	######	89	1362	235	50	238	33	36
90	433	502	717	486	629	406	######	######	90	1366	235	51	236	32	36
95	423	484	700	494	615	407	######	######	90	1368	236	52	236	32	36
100	410	471	687	498	603	404	######	######	89	1371	237	52	236	32	35
105	395	459	672	493	590	399	######	######	89	1373	237	53	237	32	35
110	385	445	656	490	580	412	######	######	89	1375	237	53	236	32	35
115	376	434	642	487	564	416	######	######	88	1377	238	52	235	32	34
120	368	425	627	484	556	418	######	######	88	1379	239	53	234	32	34
125	360	414	614	483	545	420	######	######	88	1386	239	53	233	31	34
130	351	403	602	477	537	421	######	######	88	1392	238	54	232	31	33
135	345	395	591	474	525	422	######	######	89	1397	238	54	231	31	33
140	338	382	580	468	512	425	######	######	89	1403	239	55	230	31	33
145	329	374	570	459	502	425	######	######	89	1407	239	54	230	31	32
150															

TEMPERATURE DATA SHEET #14A

		TEST TIME	145		
STACK AVG	457	TOP AVG	498	LT SIDE AVG	695
BACK AVG	452	RT SIDE AVG	610	BOTTOM AVG	419
FIREBOX AVG	########	SEC/CAT AVG	########	AMBIENT AVG	89

END	466.0	
START	565.6	
	-99.6	DELTA T

CIRCLE: **LOSS / GAIN**

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 8-25-2010 Analyte : CO_2 (15-1)

Unit : Jotul TL Run # : 1

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 % CO_2 Cyl. Press. : 420 PSI

Certified by : AIR LIQUIDE Date : 04-19-04

Span Cyl. # : 487905 Conc. : 12.20 % CO_2 Cyl. Press. : 1396 PSI

Certified by : AIR LIQUIDE Date : 11-1-07

Analyzer : Make : HORIBA Model : PIR-2000 SN : 407069

Range : 0 - 25.0 % CO_2 Analyzer Output : 0 - 1.0 v.

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % CO_2

EPA Control Limits = ± 2.5% of 25.0 % CO_2 = ± 0.625 % CO_2

Method 28 A = ± .2 % of 25.0 % CO_2 = ± .05 % CO_2

PRE RUN Audit : by : G Wurlington Time : 0920 Temp : 75 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.069	.069	.274
SPAN	48.8	.488	12.20	48.8	.488	12.213	.013	.052

POST RUN Audit : by : G Wurlington Time : 1430 Temp : 88 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	-.001	.044	.044	.175
SPAN	48.8	.488	12.20	48.5	.485	12.138	-.062	-.246

± Conc. Difference = Act % - Exp (Std) %

Zero % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X 100

Span % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X100

ZERO / SPAN CHECK DATA SHEET #15-2

Date : 8-25-2010 Analyte : O_2 (15-2)

Unit : Jotul TL Run # : 1

Zero Cyl. # : 168TAC 3A Conc. : 0.00 % O_2 Cyl. Press. : 420 PSI

Certified by : AIR LIQUIDE Date : 04-19-04

Span Cyl. # : 487905 Conc. : 12.60 % O_2 Cyl. Press. : 1390 PSI

Certified by : AIR LIQUIDE Date : 11-1-07

Analyzer : Make : TELEDYNE Model : 320 A SN : 37400

Range : 0 - 25.0 % O_2 Analyzer Output : 0 - 1.0 v.

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % O_2

EPA Control Limits = ± 2.5% of 25.0 % O_2 = ± 0.625 % O_2

Method 28 A = ± .2 % of 25.0 % O_2 = ± .05 % O_2

PRE RUN Audit : by : C. Worthington Time : 0920 Temp : 75 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-.046	-.046	-.183
SPAN	12.60	.504	12.6	12.6	.504	12.636	.036	.145

POST RUN Audit : by : C. Worthington Time : 1430 Temp : 88 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.002	.005	.005	.018
SPAN	12.60	.504	12.6	12.6	.503	12.611	.011	.044

± Conc. Difference = Act % - Exp (Std) %

Zero % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X 100

Span % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X100

ZERO / SPAN CHECK DATA SHEET #15-3

Date : 8-25-2010 Analyte : CO (15-3)

Unit : Jotul TL Run # : 1

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 % CO Cyl. Press. : 420 PSI

Certified by : AIR LIQUIDE Date : 04-19-04

Span Cyl. # : CA487905 Conc. : 4.90 % CO Cyl. Press. : 1390 PSI

Certified by : AIR LIQUIDE Date : 11-1-07

Analyzer : Make : HORIBA Model : PIR-2000 SN : 408005

Range : 0 - 10.0 % CO Analyzer Output : 0 - 1.0 v.

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 10.0 % CO

EPA Control Limits = ± 2.5% of 10.0 % CO = ± 0. 25 % CO

Method 28 A = ± .2 % of 10.0 % CO = ± .02 % CO

PRE RUN Audit : by : C Wathington Time : 0920 Temp : 75 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.005	.005	.048
SPAN	49.0	.490	4.90	49.0	.490	4.911	.011	.114

POST RUN Audit : by : C Wathington Time : 1430 Temp : 88 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.005	.005	.048
SPAN	49.0	.490	4.90	49.1	.491	4.921	.021	.214

± Conc. Difference = Act % - Exp (Std) %

Zero % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X 100

Span % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X100

ZERO / SPAN CHECK DATA SHEET #15-4

Date : 8-25-2010 Analyte : SO_2 (15-4)

Unit : Jotul TL Run # : 1

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 ppm SO_2 Cyl. Press. : 420 PSI

Certified by : AIR LIQUIDE Date : 04-19-04

Span Cyl. # : CC82089 Conc. : 1250 ppm SO_2 Cyl. Press. : 1720 PSI

Certified by : AIR LIQUIDE Date : 01-3-2007

Analyzer : Make : HORIBA Model : PIR-2000 SN : 403019

Range : 0 - 2500 ppm SO_2 Analyzer Output : 0 - 1.0 v.

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 2500 ppm SO_2

EPA Control Limits = ± 2.5% of 2500 ppm SO_2 = ± 62.5 ppm SO_2

PRE RUN Audit : by : C. Watson Time : 0920 Temp : 75 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	1,305	1,305	,052
SPAN	50.0	.500	1250	50.0	.500	1248.0	-1.960	-,078

POST RUN Audit : by : C. Watson Time : 1430 Temp : 88 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.2	.002	6,292	6,292	,252
SPAN	50.0	.500	1250	49.8	.498	1243.1	-6.900	-,276

± Conc. Difference = Act % - Exp (Std) %

Zero % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X 100

Span % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X100

QUALITY CHECKS DATA SHEET # 16

UNIT: Total TL RUN: 1 DATE: 8-25-2010

Thermocouple Check:

T/C # 1	— °F	T/C # 13	70.7 °F
T/C # 2	— °F	T/C # 14	70.4 °F
T/C # 3	72.1 °F	T/C # 15	69.4 °F
T/C # 4	68.8 °F	T/C # 16	61.0 °F
T/C # 5	66.6 °F	T/C # 17	57.8 °F
T/C # 6	65.5 °F	T/C # 18	73.8 °F
T/C # 7	66.0 °F	T/C # 19	— °F
T/C # 8	65.1 °F	T/C # 20	— °F
T/C # 9	— °F	T/C # 21	— °F
T/C # 10	— °F	T/C # 22	— °F
T/C # 11	69.0 °F	T/C # 23	— °F
T/C # 12	68.8 °F	T/C # 24	— °F

Thermocouple Readout:

Pretest zero and span check and calibration — post test zero and span — % difference

ZERO 0.4 °F Adj. to 0.0 °F ZERO 0.0 °F Difference 0 %

SPAN 1998.6 °F Adj. to 2000.0 °F SPAN 1999.9 °F Difference .005 %

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 200.2 °F	400	= 400.6 °F
600	= 599.8 °F	800	= 799.7 °F	1000	= 999.8 °F
1200	= 1199.7 °F	1400	= 1399.4 °F	1600	= 1599.6 °F
1800	= 1799.8 °F	2000	= 2000.0 °F		

	Pre	Post
Sample Train Leak Check	✓	✓
C-gas Train Leak Check	✓	✓
SO_2 Train Leak Check	✓	✓
Static Gauge Zero Check	✓	✓

Scale Check Pre: 560.5 − 550.5 = 10.0

Post: 560.0 − 550.0 = 10.0

Stack Cleaned Prior to Test Run: YES X NO ____

TABLE 1 ----- RAW DATA

CLIENT : Jotul TEST No. : 5

MODEL: Top Load DATE: 31-Aug-10

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	307.000	0.150	75	0.82	3.70	425
5	308.500	0.430	75	0.91	8.90	250
10	311.065	0.150	79	0.37	2.80	425
15	312.599	0.130	80	0.52	2.60	450
20	314.053	0.120	80	0.58	3.20	475
25	315.431	0.130	80	0.52	4.80	450
30	316.885	0.130	80	0.63	6.80	450
35	318.339	0.130	80	0.77	7.80	450
40	319.793	0.190	80	0.46	9.70	375
45	321.538	0.210	80	0.29	9.90	350
50	323.407	0.250	80	0.15	11.70	325
55	325.419	0.250	80	0.22	13.00	325
60	327.431	0.210	82	0.42	10.00	350
65	329.314	0.210	83	0.36	10.30	350
70	331.204	0.180	83	0.35	9.60	375
75	332.967	0.180	84	0.49	8.30	375
80	334.738	0.160	84	0.53	8.20	400
85	336.398	0.160	84	0.67	6.90	400
90	338.058	0.160	84	0.73	6.80	400
95	339.718	0.160	84	0.67	7.40	400
100	341.378	0.160	84	0.61	7.90	400
105	343.038	0.180	84	0.47	8.80	375
110	344.808	0.180	84	0.30	9.30	375
115	346.579	0.210	84	0.18	9.80	350
120	348.475	0.180	85	0.18	9.70	375
125	350.252	0.140	85	0.65	7.10	425
130	351.821	0.130	85	0.86	6.30	450
135	353.302	0.110	85	0.99	5.60	475
140	354.705	0.130	85	0.92	5.30	450
145	356.186	0.110	85	1.22	5.60	475
150	357.590	0.130	85	1.16	5.50	450
155	359.071	0.130	85	1.13	5.40	450
160	360.552	0.130	85	1.22	5.20	450
165	362.033	0.140	85	1.25	5.00	425
170	363.601	0.140	85	1.25	5.10	425
175	365.170	0.140	85	1.13	5.10	425

180	366.738	0.140	85	1.18	5.10	425
185	368.306	0.140	85	1.15	5.10	425
190	369.874	0.140	85	1.23	5.00	425
195	371.443	0.140	85	1.11	5.10	425
200	373.011	0.140	85	1.19	5.00	425
205	374.579	0.140	85	1.14	5.10	425
210	376.147	0.140	85	1.14	5.10	425
215	377.715	0.140	85	1.08	5.50	425
220	379.284	0.140	85	1.28	5.20	425
225	380.852	0.140	85	1.34	5.00	425
230	382.420	0.140	85	1.47	4.90	425
235	383.988	0.140	85	1.46	4.80	425
240	385.557	0.140	85	1.42	4.80	425
245	387.130	0.140	85	1.49	4.80	425
250	388.703	0.140	85	1.52	4.60	425
255	390.277	0.140	85	1.54	4.60	425
260	391.850	0.140	85	1.61	4.70	425
265	393.424	0.140	85	1.63	4.70	425
270	394.997	0.140	85	1.16	4.70	425
275	396.571	0.140	85	1.37	4.70	425
280	398.144	0.140	85	1.23	4.60	425
285	399.718	0.140	85	1.24	4.50	425
290	401.291	0.140	85	1.24	4.50	425
295	402.865	0.140	85	1.29	4.20	425
300	404.438	0.140	85	1.33	4.00	425
305	406.011	0.140	85	1.51	4.00	425
310	407.585	0.140	85	1.49	3.90	425
315	409.158	0.140	85	1.70	3.80	425
320	410.732	0.140	85	1.72	3.70	425

TABLE 2---RAW DATA

CLIENT : Jotul TEST No. 5

MODEL: Top Load DATE: 31-Aug-10

METER CAL. FACTOR (Y)	-------	0.916	Wt. WOOD BURNED(LB)	-------	17.5 Lbs
BAROMETRIC PRESS.(Pb)	-------	30.07 in Hg	WET,FUEL MOISTURE %	-------	16.667 %
LEAK RATE POST (Lp)	-------	0.015 cfm	Wt. PART. COLLECTED	-------	0.5811 g
WATER VOL. (V1c)	-------	153.6 Ml	METER VOLUME Vm	-------	103.732 mcf
TEST TIME (MIN)	-------	320 min	HC MOLE FRACTION	-------	0.0132

TABLE 3 -----FIELD DATA AVERAGES

CLIENT : Jotul TEST No. 5

MODEL: Top Load DATE: 31-Aug-10

****

AVG DELTA H	-------	0.16 in H2O	AVG PRCNT CO	-------	0.97
AVG METER TEMP. Tm	-------	84 deg F	AVG PRCNT CO2	-------	6.07
AVG PPM SO2	-------	414 PPM	AVG BAL CO2/CO	-------	6.24

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul TEST No. 5

MODEL: Top Load DATE: 31-Aug-10

****

STD SAMPLE VOL. Vm(std) d) ------	92.80	dscf	STACK GAS FLOW Qsd -------	533.851	dscf/Hr
					&
				8.90	dscf/min
VOL. WATER VAPOR Vw(s td) -----	7.230	scf	PARTICULATE CONCTRT. C s ------	0.0063	g/dscf
PRCNT MSTR Bws -------	7.23	%	PARTC.EMISS. RATE E -------	3.34	g/Hr
BURN RATE BR -------	1.24	Kg/Hr	MOLES OF GAS PER Lb WOOD Nt ----	0.51	Lb-mole/Lb
CO EMISSION RATE -------	173.94	g/Hr	PART.EMISS. RATE ------	2.70	g/Kgdry fuel
	&				
	140.27	g/Kgdry fuel			

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Jotul TEST No. : 5

MODEL: Top Load DATE: 31-Aug-10

TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR	PROPRTN RATE VAR. AVERAGE
5	579.5	98	100
10	581.1	98	
15	587.7	99	
20	589.2	99	
25	589.5	99	
30	589.2	99	
35	589.2	99	
40	589.2	99	
45	589.4	99	
50	589.2	99	
55	589.1	99	
60	588.0	99	
65	590.9	100	
70	592.6	100	
75	591.6	100	
80	593.8	100	
85	593.6	100	
90	593.6	100	
95	593.6	100	
100	593.6	100	
105	593.6	100	
110	593.4	100	
115	593.8	100	
120	592.8	100	
125	594.7	100	
130	595.0	100	
135	594.7	100	
140	594.6	100	
145	594.7	100	
150	595.1	100	
155	594.7	100	
160	594.7	100	
165	594.7	100	
170	594.6	100	
175	595.0	100	
180	594.6	100	

185	594.6	100
190	594.6	100
195	595.0	100
200	594.6	100
205	594.6	100
210	594.6	100
215	594.6	100
220	595.0	100
225	594.6	100
230	594.6	100
235	594.6	100
240	595.0	100
245	596.5	101
250	596.5	101
255	596.9	101
260	596.5	101
265	596.9	101
270	596.5	101
275	596.9	101
280	596.5	101
285	596.9	101
290	596.5	101
295	596.9	101
300	596.5	101
305	596.5	101
310	596.9	101
315	596.5	101
320	596.9	101

COMPUTER INPUT DATA SHEET #1

3,3y

Client: Jotul North America

Address: 55 Hutcherson

Gorham, ME 04038

Phone: 1-800-797-5912 Fax:

Run No.: 5 Date of Test: 8-31-2010 Burn Rate: 1,240

Model No.: Top Loader ☐ min ☐ min-1.25 ☒ fan

Stove Type: ☐ Cat ☒ Non Cat ☐ Pellet ☐ 1.25-1.9 ☐ max ☐ insert

Dry Gas Meter Y Factor: .916 (0.000) (Data Sheet #2) Post Leak Rate: .015 cfm (.000) (Data Sheet #2) Time: 320 min. (000) (Data Sheet #2)

Dry Gas Meter Volume: 103.732 cf (00.000) (Data Sheet #2)

Stack Flow: 8,427 dscfm (00.000) (Data Sheet #2) Δ H: .155 in. H_2O (.000) (Data Sheet #2)

Maximum Vac.: 3.0 (0.0) (Data Sheet #2) Barometric Pressure: 30.07 in. Hg (00.00) (Data Sheet #2)

H_2O Captured: 153.6 g (00.0) (Data Sheet #3)

Front Half Catch % Of Total: 25.4 % (00.0) (Data Sheet #6) Total Particulate Catch: .5811 g (0.0000) (Data Sheet #6)

Flue Gas Moisture: 6.5476 % (00.000) (Data Sheet #7)

Particulate Emission: .0869 gr/dscf (0.0000) (Data Sheet #7)

Relative Humidity: 59.0 % RH (00.0) (Data Sheet #8) Ambient Moisture: 1.55 % H_2O (0.00) (Data Sheet #8)

Preburn Fuel Wt.: 45.9 lbs. (00.0) (Data Sheet #8) Coal Bed Wt.: 43 lbs. (00.0) (Data sheet #8) Test Fuel Wt.: 175 lbs. (00.0) (Data sheet #8)

Heat Output (EPA Default): 14952.2 BTU/hr (00,000.0) (Data Sheet #8)

Kindling Fuel % Moisture (wet): 11.739 % (00.000) (Data Sheet #10) Pretest Fuel % Moisture (wet): 16.458 % (00.000) (Data Sheet #10)

Test Fuel % Moisture (dry): 20.000 % (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove]) Test Fuel % Moisture (wet): 16.667 %

Fuel Higher Heating Value (dry): N/A BTU/lb. (0000) (Data Sheet #11)

Stack Static Pressure: -.040 in. H_2O (+/- .000) (Data Sheet #12)

Average Ambient Temperature: 74 °F (00) (Data Sheet #14) Stove Temperature Change: -68.1 °F (+/- 000.0) (Data Sheet #14)

Time Start 1015
End 1535

Meter Temp 544

METER BOX DATA SHEET PAGE # 2

Page: 1 of 3

UNIT: Jotul TL RUN: 5 DATE: 8-31-2010

Meter Box: 5H Y Factor: .9916

Leak checks: 15 " Hg @ .010 cfm _____ " Hg @ _____ cfm

15 " Hg @ .015 cfm _____ " Hg @ _____ cfm

Inject SO^2 @ 100 cc/min. Nozzle: Probe @ 3/8 " od Initial Volume: 1,500

ROTO: PRESS: .18			SAMPLING RATIO: 275 : 1				BP: 30.10		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1015	307.000	—	8.255	.15	75	425	75	2.0
5	20	308.500	—	14.033	.43	75	250	75	3.0
10	25	311.065	311.065	8.194	.15	79	425	79	2.0
15	30	312.599	312.599	7.724	.13	80	450	80	2.0
20	35	314.053	314.053	7.318	.12	80	475	80	2.0
25	40	315.431	315.431	7.724	.13	80	450	80	2.0
30	45	316.885	316.885	7.724	.13	80	450	80	2.0
35	50	318.339	318.339	7.724	.13	80	450	80	2.0
40	55	319.793	319.793	9.269	.19	80	375	80	2.0
45	1100	321.538	321.538	9.931	.21	80	350	80	2.0
50	05	323.407	323.407	10.695	.25	80	325	80	2.0
55	10	325.419	325.419	10.695	.25	80	325	80	2.0
ROTO PRESS: .18			TOTALS:	109.286	2.27	949	BP.: 30.10		
60	1115	327.431	327.431	9.894	.21	82	350	82	2.0
65	20	329.314	329.314	9.876	.21	83	350	83	2.0
70	25	331.204	331.204	9.218	.18	83	375	83	2.0
75	30	332.967	332.967	9.201	.18	84	375	84	2.0
80	35	334.738	334.738	8.626	.16	84	400	84	2.0
85	40	336.398	336.398	8.626	.16	84	400	84	2.0
90	45	338.058	338.058	8.626	.16	84	400	84	2.0
95	50	339.718	339.718	8.626	.16	84	400	84	2.0
100	55	341.378	341.378	8.626	.16	84	400	84	2.0
105	1200	343.038	343.038	9.201	.18	84	375	84	2.0
110	05	344.808	344.808	9.201	.18	84	375	84	2.0
115	10	346.579	346.579	9.858	.21	84	350	84	2.0
			TOTALS:	109.579	2.15	1004	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	218.865	4.42	1953	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 2 of 3

UNIT: Jotul TL RUN: 5 DATE: 8-31-2010

Meter Box: SH Y Factor: .916

Leak checks: 15 " Hg @ .010 cfm _____ " Hg @ _____ cfm

15 " Hg @ .015 cfm _____ " Hg @ _____ cfm

Inject SO^2 @ 100 cc/min. Nozzle : Probe @ 3/8 " od Initial Volume: 1,500

ROTO: PRESS: .18			SAMPLING RATIO: 27.5			: 1	BP: 30.10		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1215	348.475	348.475	9,184	.18	85	375	85	2.0
125	20	350.252	350.252	8,103	.14	85	425	85	2.0
130	25	351.824	351.824	7.653	.13	85	450	85	2.0
135	30	353.302	353.302	7,250	.11	85	475	85	2.0
140	35	354.705	354.705	7.653	.13	85	450	85	2.0
145	40	356.186	356.186	7,250	.11	85	475	85	2.0
150	45	357.590	357.590	7.653	.13	85	450	85	2.0
155	50	359.071	359.071	7.653	.13	85	450	85	2.0
160	55	360.552	360.552	7.653	.13	85	450	85	2.0
165	1300	362.033	362.033	8,103	.14	85	425	85	2.0
170	05	363.601	363.601	8.103	.14	85	425	85	2.0
175	10	365.170	365.170	8.103	.14	85	425	85	2.0
ROTO PRESS: .18			TOTALS:	94.361	1.61	1070	BP.: 30.10		
180	1315	366.738	366.738	8,103	.14	85	425	85	2.0
185	20	368.306	368.306	8.103	.14	85	425	85	2.0
190	25	369.874	369.874	8.103	.14	85	425	85	2.0
195	30	371.443	371.443	8.103	.14	85	425	85	2.0
200	35	373.011	373.011	8.103	.14	85	425	85	2.0
205	40	374.579	374.579	8.103	.14	85	425	85	2.0
210	45	376.147	376.147	8.103	.14	85	425	85	2.0
215	50	377.715	377.715	8.103	.14	85	425	85	2.0
220	55	379.284	379.284	8.103	.14	85	425	85	2.0
225	1400	380.852	380.852	8.103	.14	85	425	85	2.0
230	05	382.420	382.420	8.103	.14	85	425	85	2.0
235	10	383.988	383.988	8.103	.14	85	425	85	2.0
			TOTALS:	97.236	1.68	1070	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	191.597	3.29	2040	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 3 of 3

UNIT: Total TL RUN: 5 DATE: 8-31-2010

Meter Box: SH Y Factor: .916

Leak checks: 15 " Hg @ .010 cfm _____ " Hg @ _____ cfm

15 " Hg @ .015 cfm _____ " Hg @ _____ cfm

Inject SO^2 @ 100 cc/min. Nozzle: Probe @ 3/8 " od Initial Volume: 1.500

ROTO: PRESS: .18			SAMPLING RATIO: 27.5 : 1				BP: 30.00		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
240	1415	385.557	385.557	8.077	.14	85	425	85	2.0
245	20	387.130	387.130	8.077	.14	85	425	85	2.0
250	25	388.703	388.703	8.077	.14	85	425	85	2.0
255	30	390.277	390.277	8.077	.14	85	425	85	2.0
260	35	391.850	391.850	8.077	.14	85	425	85	2.0
265	40	393.424	393.424	8.077	.14	85	425	85	2.0
270	45	394.997	394.997	8.077	.14	85	425	85	2.0
275	50	396.571	396.571	8.077	.14	85	425	85	2.0
280	55	398.144	398.144	8.077	.14	85	425	85	2.0
285	1500	399.718	399.718	8.077	.14	85	425	85	2.0
290	05	401.291	401.291	8.077	.14	85	425	85	2.0
295	10	402.865	402.865	8.077	.14	85	425	85	2.0
ROTO PRESS: .18			TOTALS:	96.924	1.68	1020	BP.: 30.00		
300	1515	404.438	404.438	8.077	.14	85	425	85	2.0
305	20	406.011	406.011	8.077	.14	85	425	85	2.0
310	25	407.585	407.585	8.077	.14	85	425	85	2.0
315	30	409.158	409.158	8.077	.14	85	425	85	2.0
320	35	410.732	410.732	8.077	.14	85	425	85	2.0
325				40.385	.70	(425)			
330				(137.309)	(2.38)	(1445)			
335									
340									
345									
350						5438			
355				547.771	10.09				
			TOTALS:			(84)	MAX VACC =		3.0
TOTAL Cu Ft.		103.732	TOTALS:	(8.427)	(.155)	+460	AVG. BP: 30.07		

(544)

1.65

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : Joul TL RUN : 5 DATE : 8-31-10

SCALE CHECK	LEVEL	ZEROED
INITIAL :	✓	✓
FINAL :	✓	✓

SCALE	WEIGHT
295.0 g	295.0
590.0 g	590.0
885.0 g	885.0

IMPINGER	#1	#2	#3	#4
FINAL WT	742.5	601.8	486.8	930.0
INITIAL WT	612.0	595.4	484.6	915.5
NET WT GRAMS	130.5	6.4	2.2	14.5

TOTAL CATCH : 153.6 GRAMS H_2O

FRONT HALF

FILTER #	199F	
FINAL WT g	.7300	
INITIAL WT g	.6574	
NET WT g	.0726	

BEAKER #	141
DESC.	ACETONE
FINAL WT g	102.3554
INITIAL WT g	102.2800
NET WT g	.0754
VOL. DESC. ml	75

BACK HALF

FILTER #	199B	
FINAL WT g	.4405	
INITIAL WT g	.3602	
NET WT g	.0803	

BEAKER #	142	143	144	145	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	107.9972	105.4420	106.4268	101.5767	
INITIAL WT g	107.8121	105.5701	106.3779	101.5195	
NET WT g	.1851	.0719	.0489	.0572	.1056
VOL. DESC ml	130	75	175 +	200	= 375

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 8-12-09 Time : 1205 By : AV

Manufacturer S & S Grade : # 25 Glass Front Size : 11 cm Lot No. :

Back Size: 8.2 cm Lot No. :

	DATE: 8-14-09	BY: AV	DATE: 8-19-09	BY: AV	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
191F	0.6645	0900	0.6647	0920		
192F	0.6630	0901	0.6631	0921		
193F	0.6621	0902	0.6623	0922		
194F	0.6568	0903	0.6568	0923		
195F	0.6602	0904	0.6602	0924		
196F	0.6578	0905	0.6579	0925		
197F	0.6600	0906	0.6601	0926		
198F	0.6615	0907	0.6615	0927		
199F	0.6575	0908	0.6574	0928		
200F	0.6618	0909	0.6618	0929		
191B	0.3600	0910	0.3601	0930		
192B	0.3597	0911	0.3599	0931		
193B	0.3594	0912	0.3593	0932		
194B	0.3596	0913	0.3596	0933		
195B	0.3570	0914	0.3571	0934		
196B	0.3630	0915	0.3631	0935		
197B	0.3598	0916	0.3598	0936		
198B	0.3640	0917	0.3640	0937		
199B	0.3602	0918	0.3602	0938		
200B	0.3605	0919	0.3605	0939		

Checked by: Date: 8-13-09 Time: 1410

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 2-2-2010 Time : 1100 By : CP

	DATE: 2-5-10	BY: AV	DATE: 2-8-10	BY: CP	DATE:	BY:
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
126	105.7659	1145	105.7661	1210	✓	
127	104.0748	1146	104.0753	1211	✓	
128	105.6080	1147	105.6083	1212	✓	
129	106.4284	1148	106.4289	1213	✓	
130	106.5014	1149	105.5019	1214	✓	
131	106.8439	1150	106.8443	1215	✓	
132	105.3817	1151	105.3821	1216	✓	
133	106.5026	1152	106.5027	1217	✓	
134	107.6880	1153	107.6880	1218	✓	
135	104.5925	1154	104.5921	1219	✓	
136	107.0827	1155	107.0824	1220	✓	
137	104.1624	1156	104.1626	1221	✓	
138	105.2433	1157	105.2430	1222	✓	
139	104.1290	1158	104.1285	1223	✓	
140	106.9612	1159	106.9613	1224	✓	
141	102.2799	1200	102.2800	1225	✓	
142	107.8126	1201	107.8121	1226	✓	
143	105.5706	1202	105.5701	1227	✓ R-5	
144	106.3782	1203	106.3779	1228	✓	
145	101.5199	1204	101.5195	1229	✓	
146	101.3681	1205	101.3676	1230	✓	
147	106.9558	1206	106.9554	1231	✓	
148	104.7562	1207	104.7560	1232	✓	
149	107.5443	1208	107.5442	1233	✓	
150	106.7042	1209	106.7037	1234	✓	

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH	
2-5-10	1015	CP	(	78	43	Checked by : CP
2-9-10	1030	CP	(	78	40	Date : 2-10-10
						Time : 1317

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : Jotul TL **RUN :** 5 **DATE :** 8-31-10 **Page :** 1 **of** 1

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
141	9-1	1400	CP	102.3551	9-2	1340	CP	102.3554	9-3	1135	CP				
142	9-1	1400	CP	107.9970	9-2	1341	CP	107.9972	9-3	1136	CP				
143	9-1	1400	CP	105.6423	9-2	1342	CP	105.6420	9-3	1137	CP				
144	9-1	1400	CP	106.4263	9-2	1343	CP	106.4268	9-3	1138	CP				
145	9-1	1400	CP	101.5763	9-2	1344	CP	101.5767	9-3	1139	CP				

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
199T	8-31	1800	CP	.7296	9-1	1340	CP	.7300	9-2	1346	CP				
199B	8-31	1800	CP	.4408	9-1	1341	CP	.4405	9-2	1347	CP				

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	9-1-10	1330	CP	76	49
2	9-2-10	1300	CP	68	47
3	9-3-10	1130	CP	72	46
4			CP		
5					

Weighing Session	Date	Time	By	DB	%RH
6					
7					
8					
9					
10					

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 2-26-2010 Through	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0001	10.0004	.9999	.0999	CP	2-26-10	0840	72	46
100.0001	9.9999	.9999	.0999	CP	2-27-10	1045	72	46
100.0000	10.0000	1.0000	.0999	CP	2-28	1100	70	48
100.0000	10.0000	1.0000	.0999	CP	3-1	0900	66	49
100.0000	10.0002	.9998	.1002	CP	3-5	1200	70	48
100.0001	9.9999	.9999	.0998	CP	3-7	1330	68	47
100.0000	9.9999	.9999	.0999	CP	3-9	1130	70	41
100.0000	10.0001	1.0000	.0999	CP	3-10	1200	70	44
100.0000	10.0001	.9999	.0999	CP	3-11	0900	66	49
99.9999	9.9999	.9999	.0999	AV	3-15	1000	70	48
100.0000	10.0000	1.0000	.0998	CP	3-17	0900	72	46
100.0000	9.9999	1.0001	.1000	CP	4-8	1430	76	49
99.9999	10.0001	1.0000	.0999	CP	4-10	1430	73	42
99.9999	10.0001	1.0001	.1000	CP	4-11	1430	74	41
100.0000	10.0002	1.0000	.1000	CP	4-21	1830	77	49
100.0000	10.0000	1.0000	.0999	CP	4-22	1130	74	47
100.0000	10.0001	1.0000	.0999	CP	4-23	1015	74	44
100.0002	9.9999	1.0000	.1000	CP	4-24	0930	68	47
100.0000	9.9999	.9999	.1000	CP	4-25	0930	73	47
100.0000	9.9999	1.0001	.0999	CP	4-26	0900	76	42
100.0000	10.0002	1.0000	.0999	CP	4-30	1320	78	43
99.9998	10.0000	1.0002	.0999	CP	8-26	0845	78	49
100.0000	9.9998	1.0001	.0999	CP	8-27	0955	78	43
100.0000	10.0000	1.0000	.1000	CP	8-28	1600	73	47
99.9998	10.0000	.9999	.1000	CP	8-29	1400	70	48
100.0000	10.0000	1.0000	.0999	CP	8-31	0720	72	46
100.0001	10.0000	1.0000	.1000	CP	9-1	1330	76	49
100.0000	10.0001	1.0000	.0999	CP	9-2	1300	68	47
100.0000	10.0000	1.0000	.1000	CP	9-3	1130	72	46

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 5-10-2009 Through 2-25-2010	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0001	10.0002	1.0000	.0999	CP	5-10	1545	74	44
100.0001	10.0001	.9999	.0999	CP	6-19	1110	70	48
100.0001	10.0000	.9998	.0998	CP	6-22	0930	74	44
100.0001	10.0000	.9999	.0999	CP	6-24	1610	78	46
100.0001	10.0000	1.0000	.0999	CP	6-25	1000	78	46
100.0001	10.0001	1.0001	.0999	CP	6-26	0900	73	47
99.9998	10.0000	1.0001	.1000	CP	6-27	1300	76	45
100.0000	10.0002	1.0000	.0999	CP	6-28	1400	78	43
100.0000	10.0000	1.0000	.0999	CP	6-29	1130	74	47
100.0000	10.0000	1.0000	.0999	CP	7-1	1230	70	48
100.0000	9.9998	1.0000	.0998	CP	8-7	1310	75	48
99.9998	10.0000	1.0000	.0999	CP	8-8	1600	77	44
100.0000	10.0000	1.0000	.0999	CP	8-9	1720	78	46
100.0002	9.9999	1.0000	.0998	CP	8-10	0900	78	46
100.0000	10.0001	1.0001	.0998	CP	8-11	1126	78	46
100.0003	10.0001	1.0001	.1000	CP	8-12	0910	78	46
100.0000	10.0000	1.0001	.1000	CP	8-14	1630	78	46
100.0000	10.0000	1.0001	.0999	CP	8-19	0900	74	47
100.0002	10.0001	1.0000	.1000	CP	8-24	0900	72	42
100.0000	9.9999	.9999	.0999	CP	8-25	0900	70	48
100.0000	10.0000	1.0000	.0999	CP	8-26	1340	77	46
100.0003	10.0000	.9999	.1000	CP	9-5	1120	77	49
100.0000	10.0001	1.0000	.0999	CP	9-8	1410	78	41
100.0000	10.0001	1.0001	.0998	CP	9-11	1050	78	43
100.0000	10.0000	1.0000	.0999	CP	9-12	1220	78	46
100.0000	10.0001	1.0000	.0999	CP	9-13	1430	78	46
100.0000	10.0001	.9999	.1000	CP	9-14	1100	75	48
100.0000	10.0000	.9999	.0999	CP	1-29	1400	74	44
100.0000	10.0001	1.0000	.1000	CP	1-30	1800	78	46
100.0000	10.0001	1.0001	.1000	CP	2-1	0700	64	49
100.0000	9.9999	1.0001	.1000	CP	2-2	1100	72	46
100.0000	9.9997	1.0001	.1000	CP	2-4	1015	75	41
100.0000	10.0000	1.0000	.0998	CP	2-5	1015	78	43
100.0000	10.0001	1.0000	.1000	CP	2-7	1400	70	44
100.0002	10.0001	1.0000	.0999	CP	2-8	1200	78	46
100.0000	10.0000	1.0000	.1000	CP	2-9	1030	78	40
100.0000	10.0000	1.0000	.0999	CP	2-23	1830	77	49
100.0000	10.0001	1.0000	.0999	CP	2-24	0820	69	49
100.0000	10.0002	1.0000	.0999	CP	2-25	0940	69	47

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 8-27-2008 Through 5-9-2009	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9999	10.0000	1.0000	.0999	CK	8-27	0900	78	46
100.0001	10.0000	1.0000	.0999	CK	8-28	0930	78	46
100.0001	10.0001	1.0001	.0997	CK	8-29	1300	78	46
100.0000	10.0000	1.0000	.1000	CK	8-30	1030	78	46
100.0001	10.0003	1.0001	.0999	CK	8-31	1015	76	49
100.0000	10.0001	1.0000	.0997	CK	9-1	1100	74	44
100.0000	10.0001	.9999	.1000	CK	9-2	0845	75	48
99.9999	10.0000	.9999	.0998	CK	9-4	1000	77	47
99.9999	10.0002	1.0001	.0999	CK	9-8	0930	77	49
99.9999	9.9999	.9998	.0998	CK	9-9	1000	74	48
99.9997	9.9997	1.0000	.0999	CK	9-11	1500	74	45
100.0000	9.9997	.9999	.0999	CK	9-17	0930	77	49
100.0000	10.0000	1.0000	.0999	CK	9-18	0900	78	46
100.0000	10.0000	.9999	.0999	CK	9-19	0915	78	49
100.0000	10.0000	.9999	.0999	CK	9-22	1030	77	46
100.0000	10.0001	1.0000	.0998	CK	9-24	1330	78	49
100.0001	10.0001	1.0000	.0999	CK	9-25	0930	78	46
100.0000	9.9999	1.0001	.0998	CK	9-26	0920	78	46
100.0001	9.9999	1.0001	.0999	AV	9-29	0955	78	46
100.0000	10.0001	1.0000	.0998	CK	10-2	0945	75	44
100.0000	10.0000	1.0000	.0999	CK	10-3	0930	78	46
100.0000	9.9999	1.0000	.0999	CK	10-4	1530	78	46
100.0000	9.9999	.9999	.0999	CK	10-6	0930	77	49
100.0000	10.0001	1.0002	.1000	CK	10-7	1700	78	49
100.0000	10.0000	1.0000	.0999	CK	10-8	1000	78	49
99.9999	10.0000	1.0001	.0999	CK	10-9	1030	78	43
100.0000	9.9999	1.0001	.1000	CK	10-10	0930	78	40
100.0000	9.9998	.9999	.0997	CK	10-11	1430	74	47
100.0000	10.0001	1.0000	.1000	CK	10-13	0940	78	46
100.0000	10.0002	.9999	.0999	CK	10-14	2030	77	49
100.0000	10.0002	1.0000	.1000	CK	10-16	1220	78	43
100.0000	9.9999	1.0000	.0999	CK	10-18	1130	74	47
99.9998	10.0000	.9999	.0999	CK	5-3	1700	78	43
100.0000	10.0001	1.0000	.0999	CK	5-4	1000	72	47
100.0000	10.0001	1.0000	.0997	CK	5-5	1000	76	45
99.9998	10.0000	1.0000	.0999	CK	5-6	1100	77	49
100.0000	10.0001	1.0001	.1000	CK	5-7	1600	77	42
100.0000	10.0001	1.0000	.0999	CK	5-8	1600	76	45
100.0000	10.0003	1.0000	.1000	CK	5-9	1300	76	38

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 10-22-07 Through 8-26-2008	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0006	10.0001	1.0000	.0998	CP	10-22	1630	78	46
99.9999	10.0001	1.0000	.1001	CP	10-23	1000	74	44
100.0002	10.0002	1.0002	.0999	CP	10-24	1400	73	47
100.0002	10.0000	1.0001	.0998	CP	10-26	1700	74	40
100.0003	10.0001	1.0001	.0999	CP	10-27	0820	78	40
99.9999	10.0000	.9999	.0997	CP	10-28	1200	78	40
100.0000	9.9999	.9999	.0999	CP	10-29	1700	76	42
99.9998	9.9999	.9999	.1000	CP	10-30	1600	78	43
99.9997	10.0000	.9999	.0999	CP	11-16	1500	68	47
100.0001	10.0002	1.0000	.0999	CP	11-19	1730	73	40
100.0000	10.0002	.9999	.0999	CP	11-20	1100	69	44
99.9998	9.9999	.9999	.0998	CP	1-18-08	1230	76	45
100.0002	10.0002	.9999	.0999	CP	1-21-08	1430	65	48
99.9999	10.0002	1.0001	.0999	CP	1-22-08	1200	68	47
100.0002	9.9999	.9999	.0998	CP	1-23-08	1400	74	47
99.9999	10.0000	1.0002	.1000	CP	1-31-08	1900	74	44
100.0000	10.0003	1.0000	.0996	CP	2-1-08	1530	76	45
99.9997	9.9999	.9999	.0999	CP	2-16-08	1700	68	47
100.0001	10.0002	1.0000	.1000	CP	2-18-08	1400	72	46
99.9999	10.0001	.9999	.0998	CP	2-22-08	1800	68	47
99.9999	10.0001	1.0000	.0999	CP	2-23-08	1800	78	43
100.0000	10.0000	1.0000	.0999	CP	5-8-08	1030	78	43
100.0001	10.0001	1.0000	.0999	CP	5-9-08	0930	69	47
100.0000	10.0001	.9999	.0999	CP	5-10-08	1330	74	47
99.9998	9.9999	1.0000	.0998	CP	5-11-08	0900	74	44
100.0003	10.0001	.9999	.0998	CP	5-12	1400	70	48
99.9999	10.0001	1.0000	.1000	CP	5-13	1000	77	42
99.9999	9.9997	1.0000	.1000	CP	5-14	1230	77	42
99.9999	10.0001	.9999	.1000	CP	6-5-08	1430	72	46
100.0001	10.0000	1.0000	.0999	CP	6-9-08	1400	74	44
99.9999	9.9999	1.0000	.0999	CP	6-9-08	1800	73	47
100.0001	10.0001	.9999	.0998	CP	8-11-08	0930	77	42
100.0003	10.0000	1.0001	.0999	CP	8-12-08	1011	78	43
100.0000	10.0001	1.0000	.0999	CP	8-13-08	0950	76	49
100.0002	10.0000	1.0000	.0998	CP	8-18-08	0930	74	44
100.0001	9.9999	1.0000	.0998	CP	8-20-08	1110	76	45
100.0000	9.9999	.9999	.0998	CP	8-21-08	0915	75	48
100.0002	10.0000	1.0000	.1002	CP	8-22-08	0910	75	45
100.0000	10.0001	1.0001	.0999	CP	8-26-08	0900	78	43

BLANK PROCESSING DATA SHEET # 5

UNIT: Jotul TL RUN: 5 DATE: 8-31-10

BLANKS DONE: 10-30-2007

BEAKER	A	B	C
	200 ml ACETONE	75 ml DICHLOR	200 ml WATER
	FISHER OPTIMA LOT #023283	FISHER OPTIMA LOT #035941	DW NA Inc Sparklettes Distilled
FINAL WEIGHT	108.9009	106.3077	106.9680
TARE WEIGHT	108.8995	106.3063	106.9644
NET WEIGHT	.0014	.0014	.0036

TARE BEAKERS INTO DESC: TIME: 1700 DATE: 10-20-07

DATE: 10-22 BY: Cp DATE: 10-23 BY Cp DATE: BY:

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.8994	1700	108.8995	1027		
B	106.3060	1701	106.3063	1028		
C	106.9639	1702	106.9644	1029		

FINAL BEAKERS INTO DESC: TIME: 1040 DATE: 10-27-07

DATE: 10-29 BY: Cp DATE: 10-30 BY Cp DATE: BY:

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9011	1721	108.9009	1619		
B	106.3074	1722	106.3077	1621		
C	106.9678	1723	106.9680	1622		

TARE QC

DATE	TIME	BY	WB	DB	%
10-22	1630	Cp		78	46
10-23	1000	Cp		74	44

FINAL QC

DATE	TIME	BY	WB	DB	%
10-29	1700	Cp		76	42
10-30	1600	Cp		78	43

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT: Total TL RUN: 5 DATE: 8-3-10

BLANK CALCULATIONS

Acetone: .0014 g ÷ 200 ml = .000007 g/ml

Dicholoromethane: .0014 g ÷ 75 ml = .000019 g/ml

Distilled Water: .0036 g ÷ 200 ml = .000018 g/ml

FRONT HALF CATCH

FILTERS: .0726 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0726 g

BEAKERS: .0754 (Total Catch) g - 75 (ml Acetone) (.000007 g) (Blank Value / ml Acetone) = .0749 g
.0005

TOTAL FRONT HALF CATCH : .1475 g

BACK HALF CATCH

FILTERS: .0803 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0803 g

BEAKERS:

Acetone: .1851 (Total Catch) g - 150 (ml Acetone) (.000007 g) (Blank Value / ml Acetone) = .1840 g
.0014

Extract: .0719 (Total Catch) g - 75 (ml Dichloromethane) (.000019 g) (Blank Value / Dichloromethane) = .0705 g
(.0014)

Water: .1056 (Total Catch) g - 375 (ml Water) (.000018 g) (Blank Value / Water) = .0988 g
.0068

TOTAL BACK HALF CATCH: .4336 g

TOTAL CATCH: .5811 g

% FRONT HALF: 25.4 %

CALCULATIONS DATA SHEET # 7

UNIT : Jotul TL RUN : 5 DATE : 8-31-2010

1) Vm (std) = $\dfrac{(103.732\ \text{Vm})(17.64)(.916\ \text{mcf})\left(30.07\ \text{" Hg} + \dfrac{.155\ \text{" } H_2O}{13.6}\right)}{(544\ \text{TmA})} = \dfrac{103.1927}{000.0000}$ dscf

2) Vw (std) = (.04707) (153.6 ml H_2O) = $\dfrac{7.2300}{00.0000}$ scf

3) Asw = $\dfrac{(7.2300\ \text{scf})}{(7.2300\ \text{scf} + 103.1927\ \text{dscf})} = \dfrac{.0655}{.0000}$ Bws × 100 = $\dfrac{6.5476}{00.0000}$ % H_2O

4) Cs = $\dfrac{(.5811\ \text{g.})}{(103.1927\ \text{dscf})}$ (15.43) = $\dfrac{.0869}{0.0000}$ gr / dscf

5) Estimated g / hr = $\dfrac{(.5811\ \text{g.})}{(103.1927\ \text{dscf})}$ ($\dfrac{8.427}{00.0000}$ dscfm) (60) = $\dfrac{2.8473}{00.0000}$ g / hr

Vm =	total cubic feet pulled on meter box during test	(p. 2)	(000.000 Vm)
mcf =	meter correction factor (Y factor) of meter box used for test	(p. 2)	(0.000 mcf)
" Hg =	average barometric pressure during test	(p. 2)	(00.00 " Hg)
" H_2O =	average delta H for test	(p. 2)	(.000 " H_2O)
TmA =	average meter temperature for test in degrees Absolute	(p. 2)	(000 TmA)
ml H_2O =	total water caught during test	(p. 3)	(000.0 ml H_2O)
g. =	total particulate catch for test	(p. 6)	(00.0000 g.)
dscfm =	average stack flow during test	(p. 2)	(00.000 dscf)

TEST DATA SHEET # 8

UNIT : Jotul TL RUN : 5 DATE : 8-31-2010

Test Chamber Air Velocity Start : Ø Stop : Ø Avg.: Ø

Wet Bulb / Dry Bulb

Pre : WB : 62 DB : 75 = 48.0 % RH 1.4 % H_2O

Post : WB : 65 DB : 75 = 50.0 % RH 1.7 % H_2O

Average : 49.0 % RH 1.55 % H_2O

Empty Stove Weight (lbs) : N/A w/ stack & oil seal : Wet : N/A Dry : 546.4

Kindling Weight (lbs) : Paper : .1 Wood : 1.8

Preburn Fuel Weight : 21.7 + 22.4 Total : 44.1

Kindling & Preburn Fuel Weight (wood only) (lbs) : **Total :** 45.9

Coal Bed Wt Range (lbs) : 4.3 - 3.5 **Scale :** 550.7 - 549.9

Upper : .25 × fuel weight : Always round DOWN to nearest tenth

Lower : .20 × fuel weight : Always round UP to nearest tenth **Actual Coal Bed Weight :** 4.3

Maximum Coal Bed Removal (lbs) : ((4.3 (Upper) + 3.5 (Lower)) ÷ 2) .25 = .975 (round down to nearest tenth)

Test Fuel (.75" × 1.5" × 5" spacers) = 20 pcs

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" × 4"	16.5	4	9.5	54.3
4" × 4"	16.5	2	8.0	45.7

Test Fuel Weight : 17.5 lbs

Estimated Dry Burn Rate :

$$\frac{17.5 - (17.5 \times .1667)}{2.2046} \times \frac{60}{320\ \text{TIME}} = 1.240 \text{ kg / hr}$$

Estimated BTU's/hr : 19,140 × $\frac{63}{100}$ × $\frac{1.240}{\text{DBR}}$ = 14952.2 BTU's/hr

EPA Default Efficiencies : Non-cat : 63 Cat : 72 Pellet : 78

WOOD STOVE OPERATING DATA PAGE #9

Unit : Jotul TL Run : 5 Date : 8-31-2010

FIRE STARTED: 0620

WARM UP AND PREBURN:

PRIMARY AIR : Set wide open for all warm-up / preburn fuel charges. Then set to .375" at start of preburn.

SECONDARY AIR : N/A CAT BYPASS : N/A

CHARCOAL BED PREPARATION :

Raked and leveled prior to each warm-up / preburn charge. At 1 1/2 min. prior to loading last fuel, raked and leveled. In stove 15 sec.

TEST:

DOOR wide open during loading 0 min. 40 sec.

PRIMARY AIR : Opened full for first 5 min., then set to run setting of .375".

SECONDARY AIR : N/A CAT BYPASS : N/A

FAN:

ON / OFF during warm-up

ON / OFF first ALL minutes of test

Fan speed set at OFF

ON / OFF during preburn

ON / OFF balance of test run

WOOD DATA: KINDLING: A mix of the grades listed below:

	SIZE	MILL	GRADE	SPECIES
PREBURN:	2x4	Manke/Tacoma	Std. or better	s. grn D fir
TEST:	2x4	Packwood	# 2 or better	s. grn D fir
	4x4	Packwood	# 2 or better	s. grn D fir

PELLET FUEL MANUFACTURER : N/A BRAND : N/A

All Grades WCLB rules:

WARM UP INFORMATION:

All pre-burn / warm up fuel pieces were either 12 or 16 inches.

1st warm up / pre-burn fuel charge (21.7 lbs.) added at 0627

2nd warm up / pre-burn fuel charge (22.4 lbs.) added at 0740

3rd warm up / pre-burn fuel charge (lbs.) added at

4th warm up / pre-burn fuel charge (lbs.) added at

5th warm up / pre-burn fuel charge (lbs.) added at

TEST DATA SHEET #10

Unit : Jotul TC Run : 5 Date : 8-31-2010

Room Temperature : 71 °F Temperature Correction Set? : (Yes) No

Calibration Check: 12.0% + or – 0.2%? (Yes) No

Time Test Fuel moisture reading taken : 0810

pc #	Dimen.	Use	TOP	BOTTOM	SIDE	Avg Corrected
1	2"×4"×8'	K	12.7	14.0	13.2	13.300
2						
3						
4	2"×4"×8'	P	21.7	21.5	21.5	21.6
5	2"×4"×8'	P	18.3	18.1	18.5	18.3
6	2"×4"×8'	P	12.6	20.2	19.8	19.2
7	2"×4"×8'	P				59.1
8	2"×4"×8'	P				
9						
10						
11	2×4×16.5"	T	18.0	18.1	18.0	18.0
12	11	T	18.2	18.1	18.1	18.1
13	11	T	22.9	22.4	22.3	22.5
14	11	T	22.5	22.4	22.5	22.5
15	4×4×16.5"	T	21.2	21.0	20.5	20.9
16	11	T	18.1	17.9	18.1	18.0
17						120.0
18						
19						
20	Spacers	T	21.9	22.6	22.4	22.3

Key for Use : K = Kindling P = Pretest Fuel T = Test Fuel

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	13.300 %	19.700 %	20.000 %
Wet Moisture % :	11.739 %	16.458 %	16.667 %

To obtain Wet from Dry : $\frac{100 \times \%\ \text{Dry Reading}}{100 + \%\text{Dry Reading}}$ = % Moisture, Wet Basis

Acceptable Ranges : 16 - 20 % wet: 19 - 25 % dry (17.5 - 22.5 on Meter Uncor. reading) at 70°

GAS DATA SHEET #12

WEIGHT: 550.7 DATE: 8-31-2016

UNIT: Jotul TC RUN: 5 PAGE: 1 OF 2

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
0 1015	568.2	17.5	—	.149	3.7	.646	16.2	.080	.82	.037	.425
5 20	566.8	16.1	1.4	.355	8.9	.435	10.9	.089	.91	.048	.250
10 25	566.6	15.9	.2	.110	2.8	.701	17.6	.035	.37	.041	.425
15 30	566.3	15.6	.3	.104	2.6	.701	17.6	.050	.52	.040	.450
20 35	566.0	15.3	.3	.127	3.2	.677	17.0	.056	.56	.038	.475
25 40	565.6	14.9	.4	.191	4.8	.614	15.4	.050	.52	.040	.450
30 45	565.0	14.3	.6	.272	6.8	.530	13.3	.061	.63	.045	.450
35 50	564.3	13.6	.7	.314	7.8	.487	12.2	.075	.77	.046	.450
40 55	563.6	12.9	.7	.386	9.7	.423	10.6	.044	.46	.050	.375
45 1100	562.9	12.2	.7	.399	9.9	.423	10.6	.027	.29	.051	.350
50 05	562.1	11.4	.8	.470	11.7	.356	8.9	.013	.15	.053	.325
55 10	561.3	10.6	.8	.521	13.0	.300	7.5	.020	.22	.055	.325
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.544	*****
60 15	560.6	9.9	.7	.400	10.0	.411	10.3	.040	.42	.052	.350
65 20	560.0	9.3	.6	.413	10.3	.403	10.1	.034	.36	.051	.350
70 25	559.3	8.6	.7	.385	9.6	.431	10.8	.033	.35	.050	.375
75 30	558.8	8.1	.5	.334	8.3	.479	12.0	.047	.49	.050	.375
80 35	558.3	7.6	.5	.327	8.2	.479	12.0	.051	.53	.049	.400
85 40	558.0	7.3	.3	.277	6.9	.526	13.2	.065	.67	.048	.400
90 45	557.6	6.9	.4	.273	6.8	.526	13.2	.071	.73	.047	.400
95 50	557.2	6.5	.4	.298	7.4	.507	12.7	.065	.67	.046	.400
100 55	556.8	6.1	.4	.318	7.9	.487	12.2	.059	.61	.046	.400
105 1200	556.3	5.6	.5	.353	8.8	.459	11.5	.045	.47	.046	.375
110 05	555.9	5.2	.4	.371	9.3	.447	11.2	.028	.30	.048	.375
115 10	555.5	4.8	.4	.393	9.8	.431	10.8	.016	.18	.049	.350
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.582	*****
120 15	555.0	4.3	.5	.391	9.7	.435	10.9	.016	.18	.050	.375
125 20	554.7	4.0	.3	.285	7.1	.518	13.0	.063	.65	.046	.425
130 25	554.5	3.8	.2	.252	6.3	.542	13.6	.084	.86	.045	.450
135 30	554.2	3.5	.3	.225	5.6	.566	14.2	.097	.99	.045	.475
140 35	554.0	3.3	.2	.211	5.3	.578	14.5	.090	.92	.044	.450
145 40	553.9	3.2	.1	.225	5.6	.554	13.9	.120	1.22	.044	.475
150 45	553.7	3.0	.2	.221	5.5	.562	14.1	.114	1.16	.042	.450
155 50	553.6	2.9	.1	.215	5.4	.566	14.2	.111	1.13	.040	.450
160 55	553.5	2.8	.1	.210	5.2	.570	14.3	.120	1.22	.040	.450
165 1300	553.3	2.6	.2	.199	5.0	.578	14.5	.123	1.25	.039	.425
170 05	553.2	2.5	.1	.206	5.1	.574	14.4	.123	1.25	.038	.425
175 10	553.1	2.4	.1	.206	5.1	.578	14.5	.111	1.13	.036	.425
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.509	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	1.635	*****

Fan?

GAS DATA SHEET #12

WEIGHT: 550.7 DATE: 8-31-2010

UNIT: Total TL RUN: 5 PAGE: 2 OF 2

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
180 15	553.0	2.3	.1	.204	5.1	.578	14.5	.116	1.18	.036	.425
185 20	552.9	2.2	.1	.203	5.1	.578	14.5	.113	1.15	.036	.425
190 25	552.8	2.1	.1	.201	5.0	.578	14.5	.121	1.23	.036	.425
195 30	552.7	2.0	.1	.203	5.1	.578	14.5	.109	1.11	.037	.425
200 35	552.6	1.9	.1	.200	5.0	.582	14.6	.117	1.19	.036	.425
205 40	552.5	1.8	.1	.205	5.1	.578	14.5	.112	1.14	.035	.425
210 45	552.4	1.7	.1	.204	5.1	.578	14.5	.112	1.14	.035	.425
215 50	552.3	1.6	.1	.219	5.5	.566	14.2	.106	1.08	.034	.425
220 55	552.2	1.5	.1	.209	5.2	.570	14.3	.126	1.28	.034	.425
225 1400	552.1	1.4	.1	.201	5.0	.574	14.4	.132	1.34	.034	.425
230 05	552.0	1.3	.1	.197	4.9	.574	14.4	.145	1.47	.034	.425
235 10	551.9	1.2	.1	.194	4.8	.578	14.5	.144	1.46	.034	.425
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.421	*****
240 15	551.8	1.1	.1	.193	4.8	.578	14.5	.140	1.42	.034	.425
245 20	551.7	1.0	.1	.192	4.8	.578	14.5	.147	1.49	.034	.425
250 25	551.6	.9	.1	.186	4.6	.582	14.6	.150	1.52	.034	.425
255 30	551.5	.8	.1	.186	4.6	.582	14.6	.152	1.54	.034	.425
260 35	551.4	.7	.1	.187	4.7	.574	14.4	.159	1.61	.034	.425
265 40	551.3	.6	.1	.187	4.7	.574	14.4	.161	1.63	.034	.425
270 45	551.2	.5	.1	.189	4.7	.574	14.4	.114	1.16	.033	.425
275 50	551.1	.4	.1	.187	4.7	.586	14.7	.135	1.37	.033	.425
280 55	551.1	.4	.0	.184	4.6	.594	14.9	.121	1.23	.033	.425
285 1500	551.1	.4	.0	.181	4.5	.598	15.0	.122	1.24	.033	.425
290 05	551.0	.3	.1	.182	4.5	.598	15.0	.122	1.24	.033	.425
295 10	551.0	.3	.0	.169	4.2	.610	15.3	.127	1.29	.033	.425
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.402	*****
300 15	551.0	.3	.0	.160	4.0	.614	15.4	.131	1.33	.032	.425
305 20	550.9	.2	.1	.158	4.0	.606	15.2	.149	1.51	.032	.425
310 25	550.8	.1	.1	.155	3.9	.614	15.4	.147	1.49	.032	.425
315 30	550.8	.1	.0	.150	3.8	.610	15.3	.168	1.70	.032	.425
320 35	550.7	.0	.1	.146	3.7	.610	15.3	.170	1.72	.032	.425
325 40											
330 45											
335 50										.160	
340											
345											
350											
355											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.983	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	2.618	*****

- .0402

PREBURN DATA SHEET #13

UNIT: JU

RUN: 5 DATE: 8-31-2010 PAGE: 1 of 1

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
0 / 0915	551.6	—	368	462	676	485	609	485			70	.050	PREBURN START: # 1.0 UP
5 / 20	551.5	.1	302	446	655	496	591	485			69	.048	COAL BED SCALE RANGE:
10 / 25	551.4	.1	285	426	628	489	565	478			69	.046	550.7 → 549.9
15 / 30	551.3	.1	276	413	610	481	553	474			68	.045	PRIMARY AIR:
20 / 35	551.2	.1	268	400	592	471	535	469			68	.044	SECONDARY AIR: N/A
25 / 40	551.1	.1	257	383	567	458	513	460			68	.043	FAN: OFF
30 / 45	551.0	.1	249	370	547	447	495	453			68	.041	PUMPS ON AT:
35 / 50	550.9	.1	239	353	526	434	476	444			67	.040	CHECK WB/DB: N/A
40 / 55	550.9	.0	232	344	509	422	459	438			66	.040	
45 / 1000	550.8	.1	227	335	497	413	448	433			67	.039	
50 / 05	550.8	.0	222	328	485	404	437	428			66	.038	4116
53 / 10	550.7	.1	217	317	471	397	423	419			66	.038	
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	
60 / 15	550.7	.0	216	307	459	387	412	413			66	.037	3915
65 / 20													
70 / 25													
75 / 30													
80 / 35													
/													
/													
/													
/													
/													
/													
/													

Jotul- Top Loader

Temperature Data Sheet 14

Run 5
8/31/10

Time	Stack	Top	LT Side	Back	Rt Side	Bottom	Firebox	Sec/Cat	Ambient	Tube Furn	Smpl Box	Smpl Out	C-Gas Box	C-Gas Out	SO2 Out
********	Chn 103	Chn 104	Chn 105	Chn 106	Chn 107	Chn 108	Chn 109	Chn 110	Chn 111	Chn 112	Chn 113	Chn 114	Chn 115	Chn 116	Chn 117
0	216	307	459	387	412	413	######	######	69	1329	240	60	233	34	35
5	459	305	440	375	397	404	######	######	70	1316	241	43	234	35	35
10	260	314	429	357	391	398	######	######	70	1303	242	43	236	35	36
15	234	303	410	340	374	385	######	######	71	1293	242	45	235	35	37
20	224	293	392	325	358	379	######	######	71	1284	243	45	236	35	37
25	229	291	377	312	346	369	######	######	71	1276	243	45	237	35	38
30	256	303	366	302	343	360	######	######	71	1268	243	46	237	36	38
35	271	330	363	294	346	351	######	######	71	1262	243	45	237	36	38
40	314	356	371	291	351	342	######	######	71	1255	244	46	238	36	38
45	326	384	399	290	357	334	######	######	71	1250	244	46	238	36	38
50	359	411	437	292	370	327	######	######	72	1254	245	46	240	36	38
55	377	440	471	298	402	320	######	######	72	1270	246	47	241	36	38
60	360	465	499	305	434	316	######	######	72	1286	247	47	242	37	38
65	362	471	518	313	454	311	######	######	73	1300	248	47	243	37	39
70	354	471	537	324	465	309	######	######	73	1311	248	47	243	37	39
75	342	466	545	334	466	305	######	######	74	1321	248	47	243	37	39
80	326	457	549	343	460	303	######	######	74	1329	248	47	244	37	39
85	310	449	550	350	454	300	######	######	72	1336	247	47	243	37	39
90	302	431	547	357	447	299	######	######	74	1343	247	47	243	37	39
95	297	421	545	363	442	297	######	######	74	1349	247	47	243	38	39
100	297	412	547	371	440	294	######	######	74	1355	247	48	244	38	39
105	305	415	554	377	442	296	######	######	74	1359	246	49	244	38	39
110	311	417	563	385	446	295	######	######	74	1362	246	49	244	38	39
115	323	424	566	392	456	294	######	######	74	1366	246	49	244	38	39
120	331	434	573	399	472	292	######	######	75	1369	247	50	245	38	39
125	312	437	574	405	485	291	######	######	75	1372	247	51	245	38	39
130	297	426	565	413	485	288	######	######	75	1375	247	51	245	39	39
135	285	416	551	425	480	291	######	######	75	1378	247	52	245	39	39
140	275	404	535	427	473	290	######	######	74	1382	246	52	244	39	39
145	269	397	524	422	464	289	######	######	75	1384	246	52	244	39	39
150	261	388	517	416	455	290	######	######	75	1387	246	53	244	39	39
155	253	379	512	413	445	291	######	######	75	1390	247	54	244	38	39
160	245	368	508	413	436	292	######	######	75	1392	246	54	244	38	38
165	240	356	503	410	428	291	######	######	75	1394	246	54	243	38	38
170	236	347	498	409	422	293	######	######	75	1396	245	54	243	37	38

175	231	340	494	409	415	294	######	######	75	1396	244	54	242	37	38
180	228	336	490	409	409	296	######	######	75	1397	244	54	243	37	38
185	225	329	486	410	404	296	######	######	75	1398	244	54	242	37	37
190	223	324	481	410	400	295	######	######	75	1398	243	53	241	37	37
195	220	319	477	411	396	298	######	######	75	1398	243	53	241	37	37
200	218	315	472	410	392	299	######	######	75	1400	243	53	241	37	37
205	217	313	467	409	389	298	######	######	75	1401	243	54	242	37	37
210	216	309	463	408	386	298	######	######	75	1402	243	54	241	36	36
215	217	308	460	406	385	297	######	######	75	1402	242	55	240	36	36
220	216	308	457	405	385	298	######	######	75	1402	242	55	241	36	36
225	215	307	454	403	384	298	######	######	75	1402	242	55	240	36	36
230	214	305	451	401	383	297	######	######	75	1402	242	55	240	36	36
235	213	302	448	399	381	297	######	######	75	1403	242	55	240	36	36
240	211	300	444	398	378	297	######	######	75	1403	242	55	240	36	35
245	210	296	440	396	376	297	######	######	75	1403	242	56	240	36	35
250	208	296	437	394	374	297	######	######	75	1403	242	56	239	36	35
255	207	292	434	393	373	296	######	######	75	1404	242	56	240	35	35
260	206	292	431	391	370	296	######	######	75	1405	242	56	240	35	35
265	205	289	428	390	368	295	######	######	75	1406	242	56	240	35	35
270	204	287	425	389	366	295	######	######	75	1408	242	56	240	35	34
275	202	285	422	387	364	294	######	######	75	1409	242	57	239	35	34
280	201	282	419	386	361	294	######	######	75	1408	242	57	240	35	34
285	200	282	416	387	359	294	######	######	75	1407	242	57	240	35	34
290	198	280	413	387	358	294	######	######	75	1407	242	57	240	34	34
295	196	278	410	385	355	292	######	######	76	1406	242	57	240	34	34
300	195	275	405	380	353	291	######	######	75	1406	243	57	240	34	33
305	194	272	400	374	350	290	######	######	75	1406	243	57	241	34	33
310	192	271	394	368	348	288	######	######	75	1406	243	58	241	33	33
315	191	269	389	362	346	288	######	######	75	1406	243	57	241	33	33
320	190	266	384	358	343	287	######	######	75	1406	244	57	241	33	33

TEMPERATURE DATA SHEET #14A

		TEST TIME	320		
STACK AVG	257	TOP AVG	348	LT SIDE AVG	469
BACK AVG	376	RT SIDE AVG	402	BOTTOM AVG	308
FIREBOX AVG	########	SEC/CAT AVG	########	AMBIENT AVG	74

END	327.5	
START	395.6	
	-68.1	DELTA T

CIRCLE: **LOSS / GAIN**

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 8-31-2010 Analyte : CO_2 (15-1)

Unit : Jotul TL Run # : 5

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 % CO_2 Cyl. Press. : 420 PSI

Certified by : AIR LIQUIDE Date : 04-19-04

Span Cyl. # : 487905 Conc. : 12.20 % CO_2 Cyl. Press. : 1396 PSI

Certified by : AIR LIQUIDE Date : 11-1-07

Analyzer : Make : HORIBA Model : PIR-2000 SN : 407069

Range : 0 - 25.0 % CO_2 Analyzer Output : 0 - 1.0 v.

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % CO_2

EPA Control Limits = ± 2.5% of 25.0 % CO_2 = ± 0.625 % CO_2

Method 28 A = ± .2 % of 25.0 % CO_2 = ± .05 % CO_2

PRE RUN Audit : by : G Wurtinger Time : 0850 Temp : 70 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.069	.069	.274
SPAN	48.8	.488	12.20	48.9	.489	12.238	.038	.152

POST RUN Audit : by : G Wurtinger Time : 1610 Temp : 75 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	-.001	.044	.044	.175
SPAN	48.8	.488	12.20	48.6	.486	12.163	-.037	-.147

± Conc. Difference = Act % - Exp (Std) %

Zero % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X 100

Span % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X100

ZERO / SPAN CHECK DATA SHEET #15-2

Date : 8-31-2010 Analyte : O_2 (15-2)

Unit : Jotul TL Run # : 5

Zero Cyl. # : 168TAC 3A Conc. : 0.00 % O_2 Cyl. Press. : 420 PSI

Certified by : AIR LIQUIDE Date : 04-19-04

Span Cyl. # : 487905 Conc. : 12.60 % O_2 Cyl. Press. : 1390 PSI

Certified by : AIR LIQUIDE Date : 11-1-07

Analyzer : Make : TELEDYNE Model : 320 A SN : 37400

Range : 0 - 25.0 % O_2 Analyzer Output : 0 - 1.0 v.

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % O_2

EPA Control Limits = ± 2.5% of 25.0 % O_2 = ± 0.625 % O_2

Method 28 A = ± .2 % of 25.0 % O_2 = ± .05 % O_2

PRE RUN Audit : by : C. Wardington Time : 0850 Temp : 70 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-.046	-.046	-.183
SPAN	12.60	.504	12.6	12.6	.504	12.636	.036	.145

POST RUN Audit : by : C. Wardington Time : 1610 Temp : 75 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-.046	-.046	-.183
SPAN	12.60	.504	12.6	12.6	.506	12.687	.087	.346

± Conc. Difference = Act % - Exp (Std) %

Zero % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X 100

Span % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X100

ZERO / SPAN CHECK DATA SHEET #15-3

Date : 8-31-2010 Analyte : CO (15-3)

Unit : Jotul TL Run # : 5

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 % CO Cyl. Press. : 420 PSI

Certified by : AIR LIQUIDE Date : 04-19-04

Span Cyl. # : CA87905 Conc. : 4.90 % CO Cyl. Press. : 1390 PSI

Certified by : AIR LIQUIDE Date : 11-1-07

Analyzer : Make : HORIBA Model : PIR-2000 SN : 408005

Range : 0 - 10.0 % CO Analyzer Output : 0 - 1.0 v.

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 10.0 % CO

EPA Control Limits = ± 2.5% of 10.0 % CO = ± 0. 25 % CO

Method 28 A = ± .2 % of 10.0 % CO = ± .02 % CO

PRE RUN Audit : by : C Watmough Time : 0850 Temp : 70 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.005	.005	.048
SPAN	49.0	.490	4.90	49.0	.490	4.911	.011	.114

POST RUN Audit : by : C Watmough Time : 1610 Temp : 75 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.005	.005	.048
SPAN	49.0	.490	4.90	48.9	.489	4.901	.001	.014

± Conc. Difference = Act % - Exp (Std) %

Zero % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X 100

Span % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X100

ZERO / SPAN CHECK DATA SHEET #15-4

Date : 8-31-2010 Analyte : SO_2 (15-4)

Unit : Jotul TL Run # : 5

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 ppm SO_2 Cyl. Press. : 1700 PSI

Certified by : AIR LIQUIDE Date : 04-19-04

Span Cyl. # : CC82089 Conc. : 1250 ppm SO_2 Cyl. Press. : _____ PSI

Certified by : AIR LIQUIDE Date : 01-3-2007

Analyzer : Make : HORIBA Model : PIR-2000 SN : 403019

Range : 0 - 2500 ppm SO_2 Analyzer Output : 0 - 1.0 v.

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 2500 ppm SO_2

EPA Control Limits = ± 2.5% of 2500 ppm SO_2 = ± 62.5 ppm SO_2

PRE RUN Audit : by : C. Walton Time : 0850 Temp : 70 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.2	.002	6.292	6.292	.252
SPAN	50.0	.500	1250	50.0	.500	1248.04	-1.960	-.078

POST RUN Audit : by : C. Walton Time : 1610 Temp : 75 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	1.305	1.305	.052
SPAN	50.0	.500	1250	50.2	.502	1253.0	3.000	.120

± Conc. Difference = Act % - Exp (Std) %

Zero % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X 100

Span % Difference = $\frac{\text{Act \% (ppm) - Exp \% (ppm)}}{\text{Full Scale Value}}$ X100

QUALITY CHECKS DATA SHEET # 16

UNIT : Jotul TL RUN : 5 DATE : 8-31-2010

Thermocouple Check:

T/C # 1	— °F	T/C # 13	66.1 °F
T/C # 2	— °F	T/C # 14	65.2 °F
T/C # 3	65.3 °F	T/C # 15	66.1 °F
T/C # 4	63.9 °F	T/C # 16	54.5 °F
T/C # 5	63.7 °F	T/C # 17	50.2 °F
T/C # 6	63.8 °F	T/C # 18	67.4 °F
T/C # 7	63.6 °F	T/C # 19	— °F
T/C # 8	63.3 °F	T/C # 20	— °F
T/C # 9	— °F	T/C # 21	— °F
T/C # 10	— °F	T/C # 22	— °F
T/C # 11	61.6 °F	T/C # 23	— °F
T/C # 12	70.5 °F	T/C # 24	— °F

Thermocouple Readout:

Pretest zero and span check and calibration — post test zero and span — % difference

ZERO .2 °F Adj. to 0.0 °F ZERO .8 °F Difference .040 %

SPAN 1998.4 °F Adj. to 2000.0 °F SPAN 2000.2 °F Difference .010 %

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 200.3 °F	400	= 400.0 °F
600	= 599.9 °F	800	= 799.8 °F	1000	= 999.8 °F
1200	= 1199.7 °F	1400	= 1399.4 °F	1600	= 1599.5 °F
1800	= 1799.8 °F	2000	= 2000.0 °F		

Sample Train Leak Check	Pre ✓	Post ✓
C-gas Train Leak Check	Pre ✓	Post ✓
SO_2 Train Leak Check	Pre ✓	Post ✓
Static Gauge Zero Check	Pre ✓	Post ✓

Scale Check Pre : 660.8 − 560.8 = 10.0

Post : 650.7 − 550.7 = 10.0

Stack Cleaned Prior to Test Run : YES ____ NO X

INSPECTION CERTIFICATE

Phillips Morris Scale Company
Partners in Weighing Systems
934 Elliott Avenue W.
Seattle, WA 98119
Ph#(206)284-6090
Fax#(206)282-6612

CUSTOMER: LOKEE TESTING

ADDRESS: 13235 Prarie Circle
Sumner WA 98390

TECHNICIAN: Patrick McLellan

AUTHORIZATION SIGNATURE: _____

DATE OF INSPECTION: 11-26-02

NEXT INSPECTION DUE: 5-03

CERTIFICATION TYPE
- ✓ STANDARD
- __ ISO 9000
- __ MIL STD-45662

EQUIPMENT TESTED

INDICATOR

MAKE: Weightronix
MODEL: WI-110
SR#: 16409
CLASS: III
CAP.: 1000 lbs

BASE

OPTIONS INSTALLED

PRINTER: _____
SCORE BOARD: _____
COMPUTER: _____
OTHER: _____

PRE-TEST	POST-TEST	MANUFACTURER TOLERANCE
Ø	Ø	
	499.9	
998.7	1000.0	

CORNER TEST: P ✓ F __
SHIFT TEST: P ✓ F __
STATIC TEST: 2 MIN. __ ✓ 5 MIN. __

WEIGHT KIT#: _____ NIST#: _____

SERIAL NUMBERS OF WEIGHTS USED (OR COPY OF CERTIFICATE)

T23-13	T23-14			

ANY CHANGES TO DOCUMENT OR SCALE NOT AUTHORIZED BY PHILLIPS & MORRIS SCALE COMPANY VOIDS THIS CERTIFICATE.

WASHINGTON STATE DEPARTMENT OF AGRICULTURE

METROLOGY LABORATORY

Receipt Date:	January 29, 2002	State Test Number:	L2017-1
Test Date:	February 13, 2002	Group ID:	SHOP
Report Date:	February 13, 2002	Due Date:	February 13, 2004

CALIBRATION REPORT

Phillips Morris Scale Company
934 Elliott Ave. W
Seattle, WA 98119-3608
Contact: Todd Mackie
Phone: 206-284-6090
PO Number: 2-2-009237
SOP: 8

Item(s) Submitted:	See Table Below
Specification:	NIST HB 105-1, Class F
Condition:	Good
Temperature:	21.0 °C
Pressure:	762.0 mmHg
Humidity:	35 % RH
Technician ID:	DW

Description	Value / Range	Qty	Material	Manufacture	Serial Number
Test Weight	1000 lb	5	Cast Iron	Rice Lake	OFT0, OFT1, OFT2, ~~OFSY, OFSZ~~
Test Weight	500 lb	12	Cast Iron	Rice Lake	T23-13 to T23-16, T23-20 T23-24, T23-26, T23-28 tc T23-32
Test Weight	50 lb	30	Cast Iron	Rice Lake	877B, N1039, N1041, T23 1 to T23-10, T23-19 to T23-28, WA171-0, WA1712-0 to WA172-2, WA173-2, WA237, X694
Test Weight	25 lb	2	Cast Iron	Rice Lake	WA238, T23-11
Weight Set, 7 pc	10 lb - 8 oz	1	Stainless Steel	Rice Lake	WA177-7
Weight Set, 12 pc	5 kg - 200 g	1	Stainless Steel	Rice Lake	SK

The item(s) listed above have been found and/or left within the stated tolerances for the specification stated above, except as noted. The item(s) listed above have been compared to the Standards of the State of Washington, which are currently in control. These standards values are traceable to the National Institute of Standards and Technology (NIST through NIST Test Numbers 822/264514-01 and Minnesota Metrology Laboratory Report Number 307 430. Calibration processes were monitored and found to be in control. The expanded uncertainty (k=2) for each item listed in this report is less than 1/3 of the appropriate tolerance. Results apply to items identified in this report only. This report may not be reproduced, except in full, unless permission for the publication of an abstract is obtained in writing from the calibrating organization issuing this report.

LABORATORY SERVICES DIVISION
WEIGHTS AND MEASURES PROGRAM

Dan Wright

DAN WRIGHT
STATE METROLOGIST

MAR 0 8 2002

NVLAP

NVLAP LAB CODE 200446-

W98MR42-01, 11/98

2747 29th Avenue Southwest ▼ Tumwater, Washington 98512 ▼ (360) 753-5042 ▼ (360) 586-4728 fax

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QUALITY CONTROL SERVICES

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Lokee Testing Labs
13235 Prairie Circle East
Sumner, WA 98390

Report Number: LOKT0137010004100616

CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Balance	Sartorius	A120S	37010004	N/A	Lab
Units	**Readability**	**SOP**	**Cal Date**	**Last Cal Date**	**Cal Due Date**
g	0.0001	QC012	6/16/10	12/3/09	12/2010

FUNCTIONAL CHECKS

ECCENTRICITY		LINEARITY		REPEATABILITY	
Test Wt:	Tol:	Test Wt:	Tol:	Test Wt:	Tol:
100	0.0003	50x2	0.0004	100	0.0001
As-Found:		As-Found:		As-Found:	
Pass: ☑	Fail: ☐	Pass: ☑	Fail: ☐	Pass: ☑	Fail: ☐
As-Left:		As-Left:		As-Left:	
Pass: ☑	Fail: ☐	Pass: ☑	Fail: ☐	Pass: ☑	Fail: ☐

CALIBRATION DATA

Standard	As-Found	As-Left
100	99.9999	99.9999
70	70.0000	70.0000
50	50.0000	50.0000
20	20.0000	20.0000
10	10.0000	10.0000
5	5.0000	5.0000

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Weight Set	R.L./Troemner	1MG-25KG	A45	10/12/09	10/2010	822/274334-07

Permanent Information Concerning this Equipment:

Comments/Info Concerning this Calibration:

Technician: D. Deleasa

Signature: D. Deleasa

Instruments listed above were calibrated using standards traceable to the National Institute of Standards and Technology (NIST). Calibration data reflect results at the time and location of calibration. Calibration data should be reviewed to insure that the instrument is performing to its required accuracy. Calibrations comply with ISO/IEC 17025 and ANSI/Z540-1-1994 quality standards.

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Lokee Testing Labs
13235 Prairie Circle East
Sumner, WA 98390

Report Number: LOKT0137010004091203

CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Balance	Sartorius	A120S	37010004	N/A	Lab
Units	**Readability**	**SOP**	**Cal Date**	**Last Cal Date**	**Cal Due Date**
g	0.0001	QC012	12/3/09	6/12/09	6/2010

FUNCTIONAL CHECKS

ECCENTRICITY		LINEARITY		REPEATABILITY	
Test Wt:	Tol:	Test Wt:	Tol:	Test Wt:	Tol:
100	0.0003	50x2	0.0004	100	0.0001
As-Found:		As-Found:		As-Found:	
Pass: ☑	Fail: ☐	Pass: ☑	Fail: ☐	Pass: ☑	Fail: ☐
As-Left:		As-Left:		As-Left:	
Pass: ☑	Fail: ☐	Pass: ☑	Fail: ☐	Pass: ☑	Fail: ☐

CALIBRATION DATA

Standard	As-Found	As-Left
100	100.0002	99.9998
70	70.0001	69.9999
50	50.0001	49.9999
20	20.0000	20.0000
10	10.0000	10.0000
5	5.0000	5.0000

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Weight Set	R.L./Troemner	1MG-25KG	A45	10/12/09	10/2010	822/274334-07

Permanent Information Concerning this Equipment:

Comments/Info Concerning this Calibration:

echnician: D. Deleasa

Signature: D. Deleasa

struments listed above were calibrated using standards traceable to the National Institute of Standards and Technology (NIST). Calibration data reflect results at the time and cation of calibration. Calibration data should be reviewed to insure that the instrument is performing to its required accuracy. Calibrations comply with ISO/IEC 17025 and ANSI/Z540-1-1994 quality standards.

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Lokee Testing Labs
13235 Prairie Circle East
Sumner, WA 98390

Report Number: LOKT0137010004090612

CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Balance	Sartorius	A120S	37010004	N/A	Lab
Units	**Readability**	**SOP**	**Cal Date**	**Last Cal Date**	**Cal Due Date**
g	0.0001	QC012	6/12/09	11/18/08	12/2009

FUNCTIONAL CHECKS

ECCENTRICITY		LINEARITY		REPEATABILITY	
Test Wt:	Tol:	Test Wt:	Tol:	Test Wt:	Tol:
100	0.0003	50x2	0.0004	100	0.0001
As-Found:		As-Found:		As-Found:	
Pass: ☑	Fail: ☐	Pass: ☑	Fail: ☐	Pass: ☑	Fail: ☐
As-Left:		As-Left:		As-Left:	
Pass: ☑	Fail: ☐	Pass: ☑	Fail: ☐	Pass: ☑	Fail: ☐

CALIBRATION DATA

Standard	As-Found	As-Left
100	100.0002	100.0000
70	70.0001	70.0000
50	50.0001	50.0000
20	20.0000	20.0000
10	10.0000	10.0000
5	5.0000	5.0000

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Weight Set	R.L./Troemner	1MG-25KG	A45	10/6/08	10/2009	822/274334-07

Permanent Information Concerning this Equipment:

Comments/Info Concerning this Calibration:

Technician: D. Deleasa

Signature: D. Deleasa

Instruments listed above were calibrated using standards traceable to the National Institute of Standards and Technology (NIST). Calibration data reflect results at the time and location of calibration. Calibration data should be reviewed to insure that the instrument is performing to its required accuracy. Calibrations comply with ISO/IEC 17025 and ANSI/Z540-1-1994 quality standards.

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Lokee Testing Labs
13235 Prairie Circle East
Sumner, WA 98390

Report Number: LOKT0137010004081118

CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Balance	Sartorius	A120S	37010004	N/A	Lab
Units	**Readability**	**SOP**	**Cal Date**	**Last Cal Date**	**Cal Due Date**
g	0.0001	QC012	11/18/08	5/5/08	11/2009

FUNCTIONAL CHECKS

ECCENTRICITY	LINEARITY	REPEATABILITY
Test Wt: 100	Test Wt: 50x2	Test Wt: 100
Tol: 0.0003	Tol: 0.0004	Tol: 0.0001
As-Found: Pass: ☑ Fail: ☐	As-Found: Pass: ☑ Fail: ☐	As-Found: Pass: ☑ Fail: ☐
As-Left: Pass: ☑ Fail: ☐	As-Left: Pass: ☑ Fail: ☐	As-Left: Pass: ☑ Fail: ☐

CALIBRATION DATA

Standard	As-Found	As-Left
100	100.0002	100.0001
70	70.0001	70.0001
50	50.0001	50.0000
20	20.0000	20.0000
10	10.0000	10.0000
5	5.0000	5.0000

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Weight Set	R.L./Troemner	1MG-25KG	A45	10/6/08	10/2009	822/274334-07

Permanent Information Concerning this Equipment:

Comments/Info Concerning this Calibration:

Technician: D. Deleasa

Signature: D. Deleasa

Instruments listed above were calibrated using standards traceable to the National Institute of Standards and Technology (NIST). Calibration data reflect results at the time and location of calibration. Calibration data should be reviewed to insure that the instrument is performing to its required accuracy. Calibrations comply with ISO/IEC 17025 and ANSI/Z540-1-1994 quality standards.

Established 1974

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Lokee Testing Labs
13235 Prairie Circle East
Sumner, WA 98390

Report Number: LOKT0137010004080505

CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Balance	Sartorius	A120S	37010004	N/A	Lab
Units	**Readability**	**SOP**	**Cal Date**	**Last Cal Date**	**Cal Due Date**
g	0.0001	QC012	5/5/08	11/27/07	11/2008

FUNCTIONAL CHECKS

ECCENTRICITY	LINEARITY	REPEATABILITY
Test Wt: 100	Test Wt: 50x2	Test Wt: 100
Tol: 0.0003	Tol: 0.0004	Tol: 0.0001
As-Found: Pass: ☑ Fail: ☐	As-Found: Pass: ☑ Fail: ☐	As-Found: Pass: ☑ Fail: ☐
As-Left: Pass: ☑ Fail: ☐	As-Left: Pass: ☑ Fail: ☐	As-Left: Pass: ☑ Fail: ☐

CALIBRATION DATA

Standard	As-Found	As-Left
100	100.0002	100.0001
70	70.0002	70.0001
50	50.0001	50.0001
20	20.0000	20.0000
10	10.0000	10.0000
5	5.0000	5.0000

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Weight Set	R.L./Troemner	1MG-25KG	A45	5/7/07	8/2008	822/274334-07

ermanent Information Concerning this Equipment:

Comments/Info Concerning this Calibration:

chnician: D. Deleasa

Signature: D. Deleasa

truments listed above were calibrated using standards traceable to the National Institute of Standards and Technology (NIST). Calibration data reflect results at the time and ...ation of calibration. Calibration data should be reviewed to insure that the instrument is performing to its required accuracy. Calibrations comply with ISO/IEC 17025 and ANSI/Z540-1-1994 quality standards.

Established 1974

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Lokee Testing Labs
13235 Prairie Circle East
Sumner, WA. 98390
Chip Wadington

Report Number: EESPC37010004071127

CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Balance	Sartorius	A120S	37010004	N/A	Lab

Units	Readability	SOP Used	Cal. Date	Last Cal.	Cal. Due
Grams	0.0001	QC004	11/27/2007	05/14/2007	05/2008

FUNCTIONAL CHECKS

ECCENTRICITY: Test Wt: 100 Tol: 0.0003	LINEARITY: Test Wt: 50x2 Tol: 0.0004	REPEATABILITY: Test Wt: 100 Tol: 0.0001
AS FOUND: Pass: ☑ Fail: ☐	AS FOUND: Pass: ☑ Fail: ☐	AS FOUND: Pass: ☑ Fail: ☐
AS LEFT: Pass: ☑ Fail: ☐	AS LEFT: Pass: ☑ Fail: ☐	AS LEFT: Pass: ☑ Fail: ☐

CALIBRATION DATA

Standards	As Found	As Left
100	100.0006	100.0002
70	70.0004	70.0001
50	50.0003	50.0001
20	20.0000	20.0000
10	10.0000	10.0001
5	5.0000	5.0000

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal. Date	Cal. Due	Traceable ID#
Weight Set	R.L./Troemner	1MG-25KG	A45	05/07/2007	08/2008	822/274334-07

Comments / Info Concerning This Calibration:

Permanent Information Concerning This Instrument:

Technician: D.Deleasa

Signature: D. Deleasa

Established 1974

QUALITY CONTROL SERVICES

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P.O. Box 14831 • Portland, Oregon 97293 • (503) 236-2712 • FAX: (503) 235-2535

Lokee Testing Labs
13235 Prairie Circle East
Sumner, WA. 98390
Chip Wadington

Report Number: EESPC37010004070514

CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Balance	Sartorius	A120S	37010004	N/A	Lab

Units	Readability	SOP Used	Cal. Date	Last Cal.	Cal. Due
Grams	0.0001	QC004	05/14/2007	12/08/2006	11/2007

FUNCTIONAL CHECKS

ECCENTRICITY:	LINEARITY:	REPEATABILITY:
Test Wt: 100 Tol: 0.0003	Test Wt: 50x2 Tol: 0.0004	Test Wt: 100 Tol: 0.0001
AS FOUND: Pass: ☑ Fail: ☐	AS FOUND: Pass: ☑ Fail: ☐	AS FOUND: Pass: ☑ Fail: ☐
AS LEFT: Pass: ☑ Fail: ☐	AS LEFT: Pass: ☑ Fail: ☐	AS LEFT: Pass: ☑ Fail: ☐

CALIBRATION DATA

Standards	As Found	As Left
100	100.0008	100.0001
70	70.0005	70.0001
50	50.0004	50.0001
20	20.0001	20.0000
10	10.0001	10.0001
5	5.0000	5.0000

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal. Date	Cal. Due	Traceable ID#
Weight Set	R.L./Troemner	1MG-25KG	A45	06/14/2006	09/2007	822/272027-5

Comments / Info Concerning This Calibration:

Permanent Information Concerning This Instrument:

Technician: D.Deleasa

Signature: D. Deleasa

INSTRUMENT(S) LISTED ABOVE WERE CALIBRATED USING STANDARDS TRACEABLE TO THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (N.I.S.T.).

Thermocouple Calibration Record Semi-Annual

Thermocouples Check against
Reference Thermometer serial number 9123454
Ice Water Bath 32.0
Boiling Water 212.0
Room Temperature 67
Barometric Pressure 30.64
DATE: 5-10-10

TC	Location	Ice Bath Temp	Boiling Water Temp
1	Wet Bulb	32.0	212.0
2	Dry Bulb	32.0	212.0
3	Stack	31.8	211.4
4	Stove Top	32.1	212.3
5	Left Side	32.6	211.7
6	Back	31.9	211.9
7	Right Side	32.2	211.1
8	Bottom	32.0	211.8
9	Firebox	32.1	211.7
10	Secondary/Cat	32.0	211.9
11	Ambient	32.3	211.8
12	Tube Furnace	31.4	212.7
13	Sample Box	32.2	212.0
14	Impinger Out	32.0	211.5
15	C. Gas Box	32.1	211.7
16	C. Gas Out	32.0	211.9
17	SO2 Out	32.0	211.4
18	Upper Ambient	32.1	211.8
19			
20			
21			
22			
23	Calibrator		
24	Oven		

Thermocouple Readout Semi-Annual Calibration Data Sheet

Date: 5-10-10
Ambient Temperature: 67
Technician: C. Wadington

Thermocouple Number: T/C Readout
Barometric Pressure: _____
Reference: Mercury in glass FISHER #9123454
Other: OMEGA CL-300

Reference Point No. [a]	Source [b]	Reference Thermometer Temperature °F	Thermocouple Potentiometer Temperature °F	Difference (%)[c]
32	Ice Water	32.0	32.0	0
212	Boiling Water	212.0	212.0	0
250	Omega	250.0	249.9	.04
300	Omega	300.0	299.9	.033
400	Omega	400.0	399.9	.025
500	Omega	500.0	499.8	.040
600	Omega	600.0	599.8	.033
700	Omega	700.0	699.9	.014
800	Omega	800.0	799.8	.025
900	Omega	900.0	899.8	.022
1000	Omega	1000.0	999.8	.020
1200	Omega	1200.0	1199.7	.025
1400	Omega	1400.0	1399.7	.021
1600	Omega	1600.0	1599.8	.013
1800	Omega	1800.0	1799.8	.011
2000	Omega	2000.0	2000.0	0

[a] Every 50°F for each reference point
[b] Type of Calibration System Used
[c] $\frac{\text{(reference temperature)} - \text{(thermocouple temperature)}}{\text{reference temperature}} * 100$

TRACEABILITY DOCUMENTATION Semi-Annual

S02 INJECTION ROTAMETER, DRY GAS METER AND SLING PSYCHROMETER THERMOMETERS IN LAB. CHECKED AGAINST FISHER SN 9123454 (NIST).

DATE: 5-10-10

SO^2 INJECTION ROTAMETER FISHER SN 9123454

NIST Traceable

Actual	°C = °F	°F
0.0	32.0	32.0
21.8	71.2	71.2
37.4	99.3	99.3
51.2	124.2	124.2

DRY GAS METER THERMOCOUPLES

Actual	°C = °F	5H in	5H out	KK
0.0	32.0	32.0	32.0	32.0
21.6	70.9	70.9	70.8	70.9
36.6	97.9	97.9	97.9	97.9
50.4	122.7	122.8	122.8	122.7

SLING PSYCHROMETER

Actual	°C = °F	Wet Bulb	Dry Bulb
0.0	32.0	32.0	32.0
21.2	70.2	70.2	70.2
35.8	96.4	96.4	96.4
48.6	119.5	119.5	119.5

Conversions = °F = (°C × 1.8) + 32 °C = (°F-32)÷1.8

VANEOMETER CALIBRATION

LoKee Testing Lab uses a Dwyer Model #480 Vaneometer to measure test chamber air velocity. The manufacturer's specifications for accuracy are ± 5.0% to 100 FPM and ± 10% from FPM to top of scale. LoKee Testing Lab insures that the instrument is level and clean prior to taking each reading. According to EPA personnel (Westlin, RTP) no further calibration of the instrument is necessary.

DRAFT GAUGE CALIBRATION

LoKee Testing Lab uses a Dwyer model 115-AV 0-0.25" inclined water manometer (readability resolution ± 0.001" of water) to measure the static pressure in the stack. Once leveled and zeroed as per the manufacturer's written operating instructions, the Dwyer manometer is a primary standard and requires no additional calibration.

The manometer is leveled and zeroed at the start of each test run, checked as necessary during the run to verify the settings have not changed and again at the end of each test run. The results of each check are recorded on Data Sheet #16 in each test run.

BAROMETER CALIBRATION

LoKee Testing Lab uses a Princo Model 469 NOVA Mercury Barometer to measure barometric pressure. When installed and maintained as per the manufacturer's written operating instruction, the Princo Model 469 Mercury Barometer is a primary standard and needs no further calibration.

MOISTURE METER CALIBRATION

The Delmhorst Model RC-1C, SN 16152 Moisture Meter is calibrated each time the meter is used by adjusting the zero and span calibration. The potentiometers of each calibration point (X = zero, Y = span) are adjusted until the meter is calibrated correctly. The meter is then checked against a calibration block (Delmhorst Model MCS-1, moisture content standard at 12.0% and 22.0%) in its normal operating range of 11-25%.

LoKee Testing Lab also has a second moisture meter, Delmhorst Model G-30, SN 2477 to use as a backup.

DRY GAS METER CALIBRATION

DATE : May 12, 2010 DRY GAS METER : H BOX : 5

BAROMETRIC PRESSURE 30.18 in. Hg.				Wet Test Meter Correction Factor Y= 1.019			
Orifice Manometer Setting, ΔH, in. H_2O		.1	.2	.3	.5	.75	1.0
Gas Volume Wet Test Meter Vw ft^3	Final	877.500	882.900	887.900	892.900	897.900	902.900
	Initial	872.500	877.500	882.900	887.900	892.900	897.900
	Vw ft^3	5.000	5.400	5.000	5.000	5.000	5.000
Gas Volume Dry Test Meter Vd ft^3	Final	169.018	173.958	178.547	183.150	187.771	192.390
	Initial	164.542	169.018	173.958	178.547	183.150	187.771
	Vw ft^3	4.478	4.940	4.589	4.603	4.621	4.619
Wet Test Meter Temperature tw	Initial	74	84	84	84	84	80
	Middle	79	84	84	84	82	80
	Final	84	84	84	84	80	80
	Average	539	544	544	544	542	540
Dry Test Meter Temperature tm	Initial	68	70	71	72	74	75
	Middle	69	71	72	73	75	76
	Final	70	77	72	74	75	76
	Average	529	531	532	533	535	536
$Y = \frac{(W_{mcf})(Vw)\,(Pb)\,(tm)}{Vd\left(Pb + \frac{\Delta H}{13.6}\right)(tw)}$		72850.6 81354.9 .895	80670.5 88700.0 .909	75220.9 82149.6 .916	75450.4 82189.6 .918	75848.7 81937.2 .926	76138.8 81684.5 .932

Average Y= .916

POST TEST METER BOX AUDIT DATA SHEET # 32

UNIT: Total TL DATE: 9-10-10

TEST DATA

RUN #	1	2	3	4	5	6	7	8	9	10
AVG. ΔH	.138	.132	.141	.179	.155					
MAX VAC	2.0	3.0	3.0	3.0	3.0					

Avg. Test Series Δ H: .149 in H_2O Test Series Max Vac: 3.0 in Hg

Audit Dry Gas Meter: H Correction (Y) Factor: .916 (mcf)

Test Dry Gas Meter: K2 Correction (Y) Factor: 1.008 (mcf)

AUDIT DATA

		Audit # 1	Audit #2	Audit #3
BP		30.10	30.10	30.10
VAC		3.0	3.0	3.0
AUDIT METER :				
VOL.	Final	219.043	223.562	228.077
(Vw)	Initial	214.550	219.043	223.562
	Vol.	4.493	4.519	
TEMP (°F)	Initial	83	83	83
(Tw)	Mid	83	83	83
	Final	83	83	83
(°F / °A)	**Avg.**	83 (543)	83 (543)	543
Δ H	Initial	.149	.149	.149
	Mid	.149	.149	.149
	Final	.149	.149	.149
	Avg.	.149	.149	.149
DRY GAS METER :				
VOL.	Final	441.500	446.500	451.500
(Vd)	Initial	436.500	441.500	446.500
	Vol.	5.000	5.000	5.000
TEMP (°F)	Initial	71	73	74
(Tm)	Mid	72	74	74
	Final	73	74	74
(°F / °A)	**Avg.**	(532)	74 (534)	534

$$Y = \frac{(Vw)(mcf)(BP)(Tm)}{(Vd)\left(BP + \frac{DH}{13.6}\right)(Tw)} \qquad \text{Y Factor \% Diff.} = \frac{\text{Act} - \text{Exp}}{\text{Exp}} \times 100$$

NOTE : mcf = meter correction (Y) factor for Dry Gas Meter used as a transfer standard

RUN 1

$$Y = \frac{(4.493)(1.006)(30.10)(532)}{(5.000)\left(30.10 + \frac{.149}{13.6}\right)(543)} = \frac{72379.0}{81751.2} = .885$$

$$\Delta\% = \frac{(.885 - .902)}{.902} \times 100 = -1.885\ \%$$

RUN 2

$$Y = \frac{(4.519)(1.006)(30.10)(534)}{(5.000)\left(30.10 + \frac{.149}{13.6}\right)(543)} = \frac{73071.5}{81751.2} = .894$$

$$\Delta\% = \frac{(.894 - .902)}{.902} \times 100 = -.887\ \%$$

RUN 3

$$Y = \frac{(4.515)(1.006)(30.10)(532)}{(5.000)\left(30.10 + \frac{.149}{13.6}\right)(543)} = \frac{72733.4}{81751.2} = .890$$

$$\Delta\% = \frac{(.892 - .902)}{.902} \times 100 = -1.109\ \%$$

NOTE : The Y factor % difference must be < ± 5.0 % to be acceptable

INTERPOLATED Y FACTOR

$\underset{(A)}{.1}$ inch H_2O $\Delta H = \underset{(C)}{.895}$ Calculated calibration Y factor from calibrations

$\underset{(B)}{.2}$ inch H_2O $\Delta H = \underset{(D)}{.909}$ Calculated calibration Y factor from calibrations

$\underset{(B)}{.2} - \underset{(A)}{.1} = .1 \times 100 = \underset{(E)}{10}$

$\underset{(D)}{.909} - \underset{(C)}{.895} = .014 + \underset{(E)}{10}\ \underset{(F)}{.0014}$

$\underset{\text{Avg } \Delta H}{.149} - \underset{(A)}{.1} = .049 \times 100 = \underset{(G)}{4.90}$

$\left[\underset{(F)}{.0014} \times \underset{(G)}{4.90}\right] + \underset{(C)}{.895} = \underset{\text{Interpolated Y factor}}{.902}$

Volume Metering System Leak Check : 0.000 inch H_2O in one minute

METER BOX CALIBRATION

Date : 04/17/10
Calibrated By : JG
Dry Gas Meterbox ID : K2

Barometric Pressure, Pb = 27.55 in. Hg
Vacuum = 0.0 in. Hg

Orifice Manometer Setting, Delta H in. H20		0.10	0.20	0.30	0.50	0.75	1.00
Gas Volume Wet Test Meter Vw, cu. ft.		10.000	10.000	10.000	10.000	10.000	10.000
Gas Volume Dry Gas Meter							
M Final		9.955	19.917	29.861	39.832	49.783	59.728
M Initial		0.000	9.955	19.917	29.861	39.832	49.783
Vd, cu. ft.		9.955	9.962	9.944	9.971	9.951	9.945
Wet Test Meter							
tw Deg F		75	75	75	75	76	76
tw Deg A		535	535	535	535	536	536
Dry Gas Meter Outlet, tmo	**1)**	75	76	76	77	79	81
	2)	75	76	77	78	80	82
	3)	76	76	77	79	81	83
Dry Gas Meter Inlet tmi	**1)**	75	75	76	76	76	76
	2)	75	75	76	76	76	76
	3)	75	75	76	76	76	76
Mean tm, Deg F		75	76	76	77	78	79
Mean tm, Deg A		535	536	536	537	538	539

Results :

	Y =	1.004	1.004	1.007	1.005	1.007	1.008

Averages :

Y = **1.006**

WET TEST METER CALIBRATION LOG

Wet Test Meter Serial Number AA455 Date 4-10-10

Range of Wet Test Meter Flow Rate 0 - 0.25

Volume of Test Flask Vs 37.850

Satisfactory Leak Check? Yes

Ambient Temperature of Equilibrate Liquid in Wet Test Meter and Reservoir 74

TEST #	MANOMETER READING, *a* mm H_2O	FINAL VOLUME (Vf), l	INITIAL VOLUME (Vi), l	TOTAL VOLUME (Vm), *b* l	FLASK VOLUME (Vs), l	PERCENT ERROR, *c* %
1	Ø	3.0	Ø ALL RESET	3.0	3.002	-.067
2	Ø	3.0	Ø	3.0	3.002	-.067
3	Ø	3.0	Ø	3.0	3.001	-.033

a - Must be less than 10 mm H_2O (0.4 ' H_2O)

Calculations:

b - Vm - Vf - Vi

c - % error = $\frac{100\,(V_m - V_s)}{V_s}$ = _____ (± 1 %)

SO_2 ROTAMETER CALIBRATION

Last Cal. : 12-7-2009 By : CW Date : 5-10-10 By : CW

Manufacturer : SKC-WEST
SKC ACCUFLOW Digital Flow Calibrator: Model 712 SN : 311325

Barometric Pressure : 30.06 " Hg Temperature : 69

RUN #	50 CC/MINUTE DIGICAL VOLUME	100 CC/MINUTE DIGICAL VOLUME	150 CC/MINUTE DIGICAL VOLUME
1	55.2	122.7	171.7
2	56.0	123.0	171.3
3	55.3	122.1	176.4
4	55.6	122.6	170.2
5	55.0	122.4	171.6
6	54.6	121.6	171.4
7	55.4	122.0	171.9
8	55.0	122.9	171.8
9	56.0	122.0	171.7
10	55.4	121.8	171.4
AVERAGE	55.4 cc/min	122.3 cc/min	171.4 cc/min

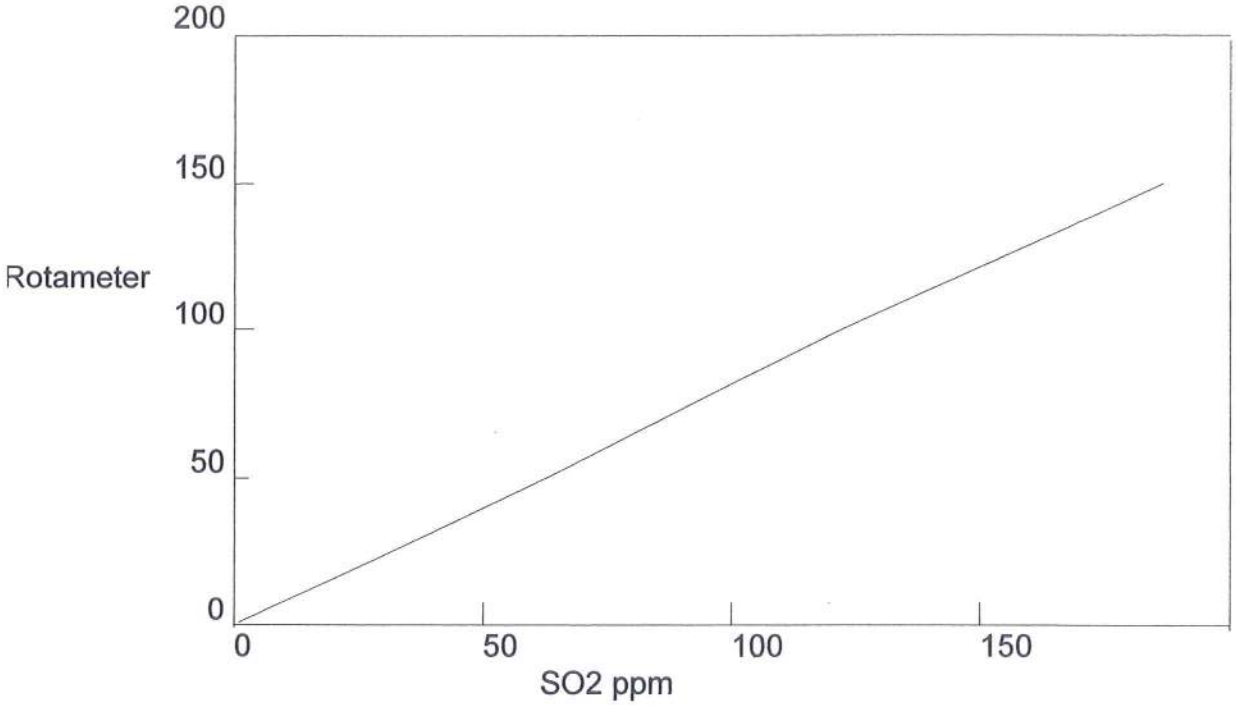
SETTING	cc/min
0	0.0
50	55.4
100	122.3
150	171.4

Rotometer setting for 100 cc/minute based on regression with this data.

100 CC / MINUTE = 85.9

SO2 Rotameter

05/11/10



Regression Output:

Constant	0.11
Std Err of Y Est	5.1403793634
R Squared	0.9968797359
No. of Observations	4
Degrees of Freedom	2
X Coefficient(s)	1.1622
Std Err of Coef.	0.0459769507

range-analyze-regression

0	0
50	55.4
100	122.3
150	171.4

TRACER GAS TRAIN RESPONSE TIME

DATE: 5-10-10

Elapsed Time	SO_2 Conc. (v.)	SO_2 Conc. (v.)	SO_2 Conc. (v.)
00 sec	.500	.499	.499
15	.417	.410	.432
30	.207	.205	.222
45	.090	.085	.095
60	.030	.022	.031
75	.014	.010	.012
90	.005	.003	.004
105	.001	Ø	.001
120	Ø		Ø
135			
150			
165			
180			
Initial Response	10	9	11
95 % Response	45	55	45
Flow Rate	1.5	1.5	1.5

CEM GAS TRAIN RESPONSE TIME

Elapsed Time	CO_2 Conc. (v.)	CO_2 Conc. (v.)	CO_2 Conc. (v.)	O_2 Conc. (v.)	O_2 Conc. (v.)	O_2 Conc. (v.)	CO Conc. (v.)	CO Conc. (v.)	CO Conc. (v.)
00 sec	.488	.485	.485	.002	.003	.002	.490	.491	.491
15	.487	.485	.484	.395	.210	.410	.187	.185	.175
30	.420	.425	.425	.730	.735	.742	.059	.057	.056
45	.162	1.55	.165	.800	.805	.810	.007	.010	.008
60	.080	.084	.081	.817	.820	.815	.001	.002	.001
75	.039	.035	.037	.824	.827	.823	Ø	Ø	Ø
90	.020	.018	.020	.828	.828	.827			
105	.008	.006	.007						
120	.004	.002	.004						
135	.001	.000	.001						
150	Ø		Ø						
165									
180									
Initial Response	20	20	20	5	5	5	5	5	5
95 % Response	85	80	85	40	40	40	40	40	40
Flow Rate	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5

CO_2 ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Date: 8-24-2010

Analyzer: Make: HORIBA Model: PIR 2000 SN: 407069

Calibration by: C. Watling

Cal Gas Flow: 1.5 SCFH Measured by: Rotameter

BP: 30.18 Instrument ID: PRINCO

Temp: 68 Instrument ID: TR

Cylinders:

1. # 168TAC 3-A Concentration: 00.00 % CO_2 Cyl. Press.: 420 PSI
   Certified by: AIR LIQUIDE Date: 04-19-04
2. # 487905 Concentration: 12.20 % CO_2 Cyl. Press.: 1390 PSI
   Certified by: AIR LIQUIDE Date: 11-1-07
3. # CA06641 Concentration: 21.1 % CO_2 Cyl. Press.: 1430 PSI
   Certified by: AIR LIQUIDE Date: 1-5-2007
4. # CC-12731 Concentration: 6.22 % CO_2 Cyl. Press.: 1120 PSI
   Certified by: AIR LIQUIDE Date: 03-13-03

Analyzer: **Calibrated Range:** 0-25.0 % **Output:** 0-1.0 V.
Flow: 1.5 SCFH **Measured by:** Rotameter

Calibration Results

Point #	CYL. #	% CO2	EXPECTED METER	EXPECTED DVM	ACTUAL METER	ACTUAL DVM	ADJ. METER	ADJ. DVM
1	1	0.00	00.0	.000	00.0	.000	00.0	.000
2	2	12.20	48.8	.488	48.0	.480	48.8	.488
3	3	21.1	84.4	.844	84.6	.846		
4	4	6.22	24.9	.249	24.3	.243		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 12.512

CO_2 Linear Regression Results:

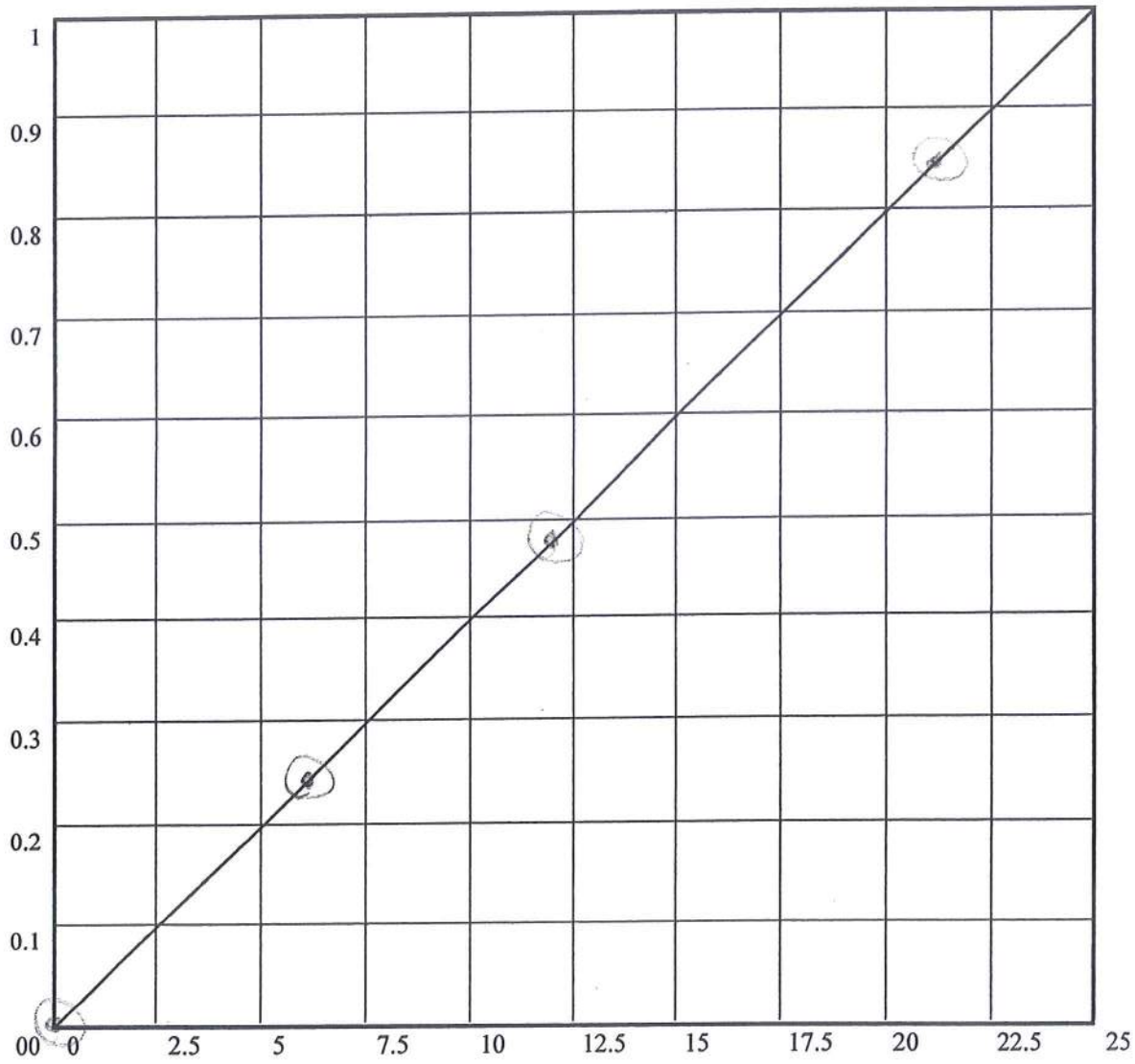
Y = MX +B

Slope (M) = -.0027307

Y Intercept (B) = .0401802

Correlation Coefficient (r) = .9999666

r^2 = .9999331

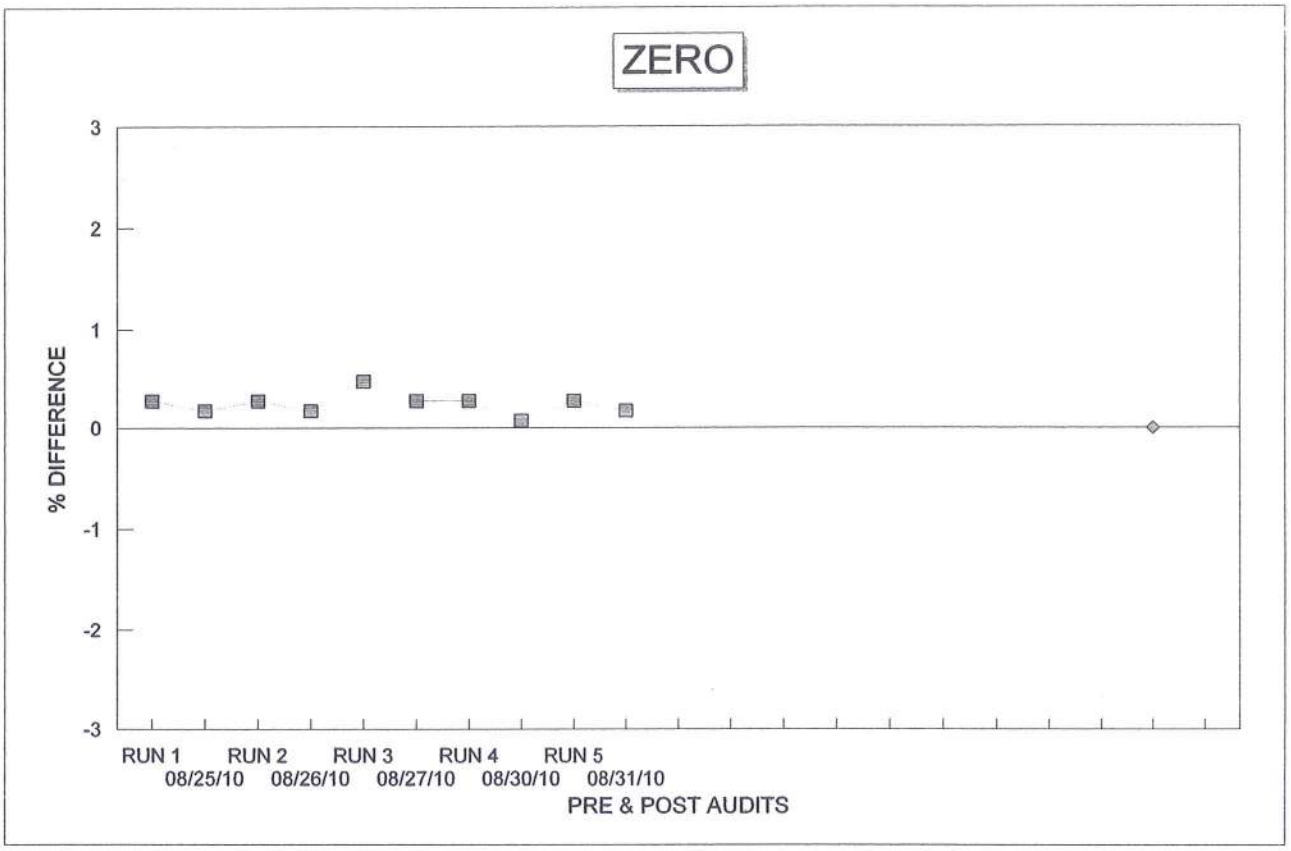


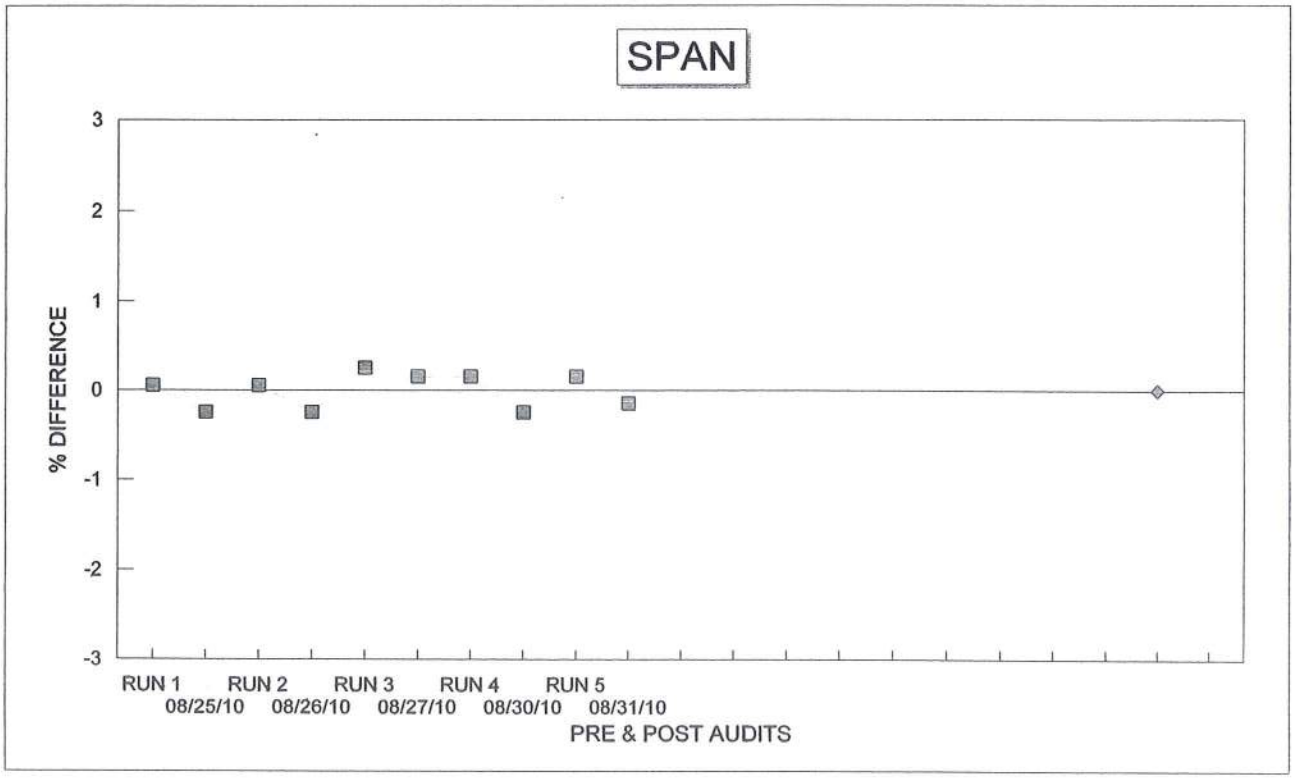
EPA Span Value = ± 2.0% of 25% CO_2 = ± .5%

Cal Volts = Cal Volt Conc - Std Conc = ± Conc Diff = ± Δ %

HIGH VOLTS .846 = 21.15 - 21.10 = .050 = .200

LOW VOLTS .243 = 6.08 - 6.22 = -.120 = -.480


ZERO
3
2
1
0
-1
-2
-3
% DIFFERENCE
RUN 1 08/25/10
RUN 2 08/26/10
RUN 3 08/27/10
RUN 4 08/30/10
RUN 5 08/31/10
PRE & POST AUDITS


SPAN
3
2
1
0
-1
-2
-3
% DIFFERENCE
RUN 1 08/25/10
RUN 2 08/26/10
RUN 3 08/27/10
RUN 4 08/30/10
RUN 5 08/31/10
PRE & POST AUDITS

O_2 ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Date: 8-24-2010

Analyzer: Make: TELEDYNE Model: 320A SN: 37400

Calibration by: C. Wielington

Cal Gas Flow: 1.5 SCFH Measured by: Rotameter

BP: 30.18 Instrument ID: PRINCO

Temp: 68 Instrument ID: TR

Cylinders:

1. # 168TAC 3-A Concentration: 00.00 % O_2 Cyl. Press.: 420 PSI
   Certified by: AIR LIQUIDE Date: 04-19-04
2. # 487905 Concentration: 12.0 % O_2 Cyl. Press.: 1390 PSI
   Certified by: AIR LIQUIDE Date: 11-1-07
3. # CA0666 41 Concentration: 20.9 % O_2 Cyl. Press.: 1430 PSI
   Certified by: AIR LIQUIDE Date: 1-5-2007
4. # CC-12731 Concentration: 6.25 % O_2 Cyl. Press.: 1120 PSI
   Certified by: AIR LIQUIDE Date: 03-13-03

Analyzer: **Calibrated Range:** 0-25.0 % **Output:** 0-1.0 V.
Flow: 1.5 SCFH **Measured by:** Rotameter

Calibration Results

Point #	CYL. #	% O2	EXPECTED METER	EXPECTED DVM	ACTUAL METER	ACTUAL DVM	ADJ. METER	ADJ. DVM
1	1	0.00	00.0	.000	00.0	.000	00.0	.000
2	2	12.60	12.60	.504	12.7	.508	12.6	.504
3	3	20.9	20.9	.836	20.8	.831		
4	4	6.25	6.25	.250	6.3	.252		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 12.536

O_2 Linear Regression Results:

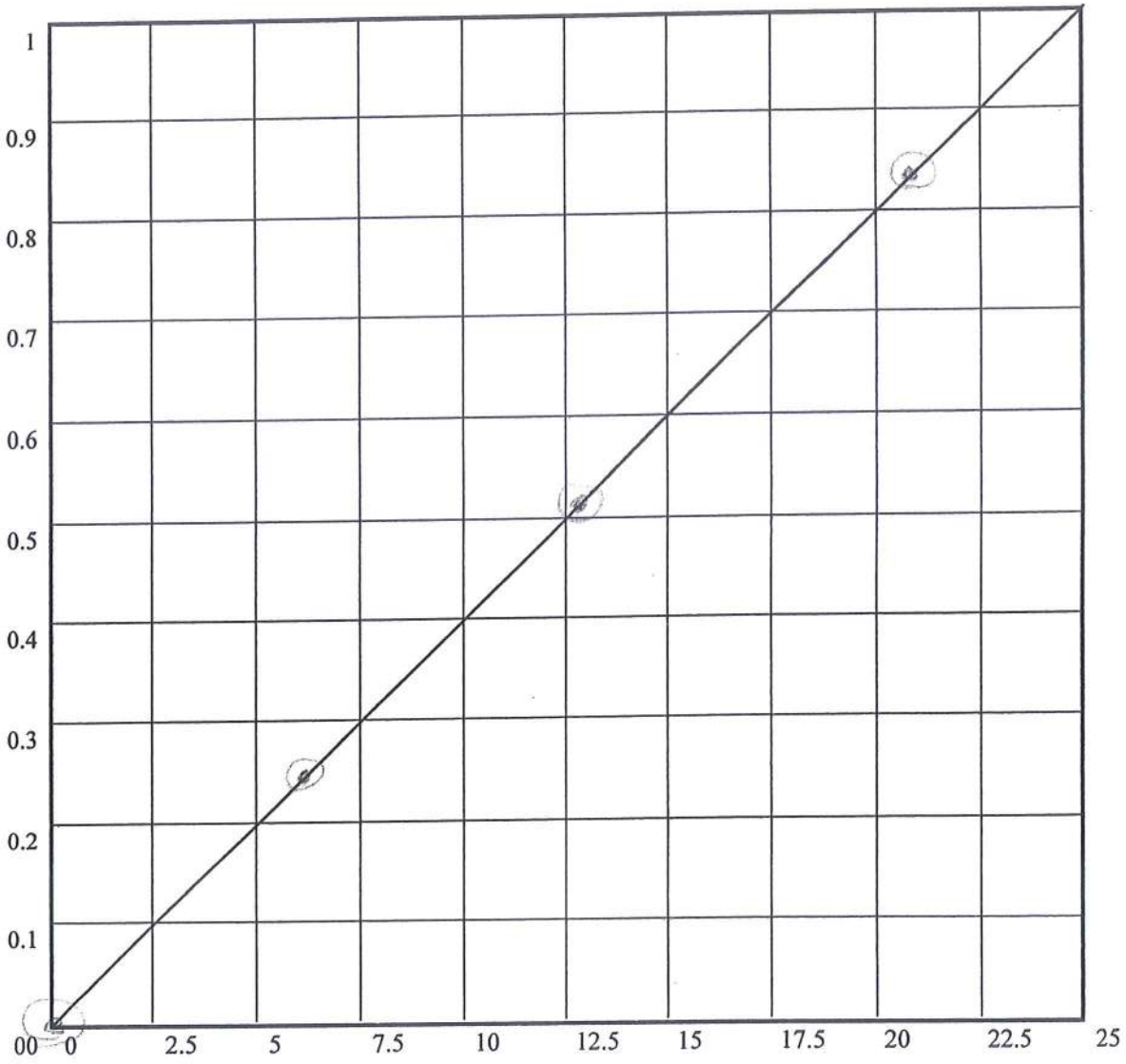
Y = MX +B

Slope (M) = .0018291

Y Intercept (B) = .0347405

Correlation Coefficient (r) = .9999860

r^2 = .9999720

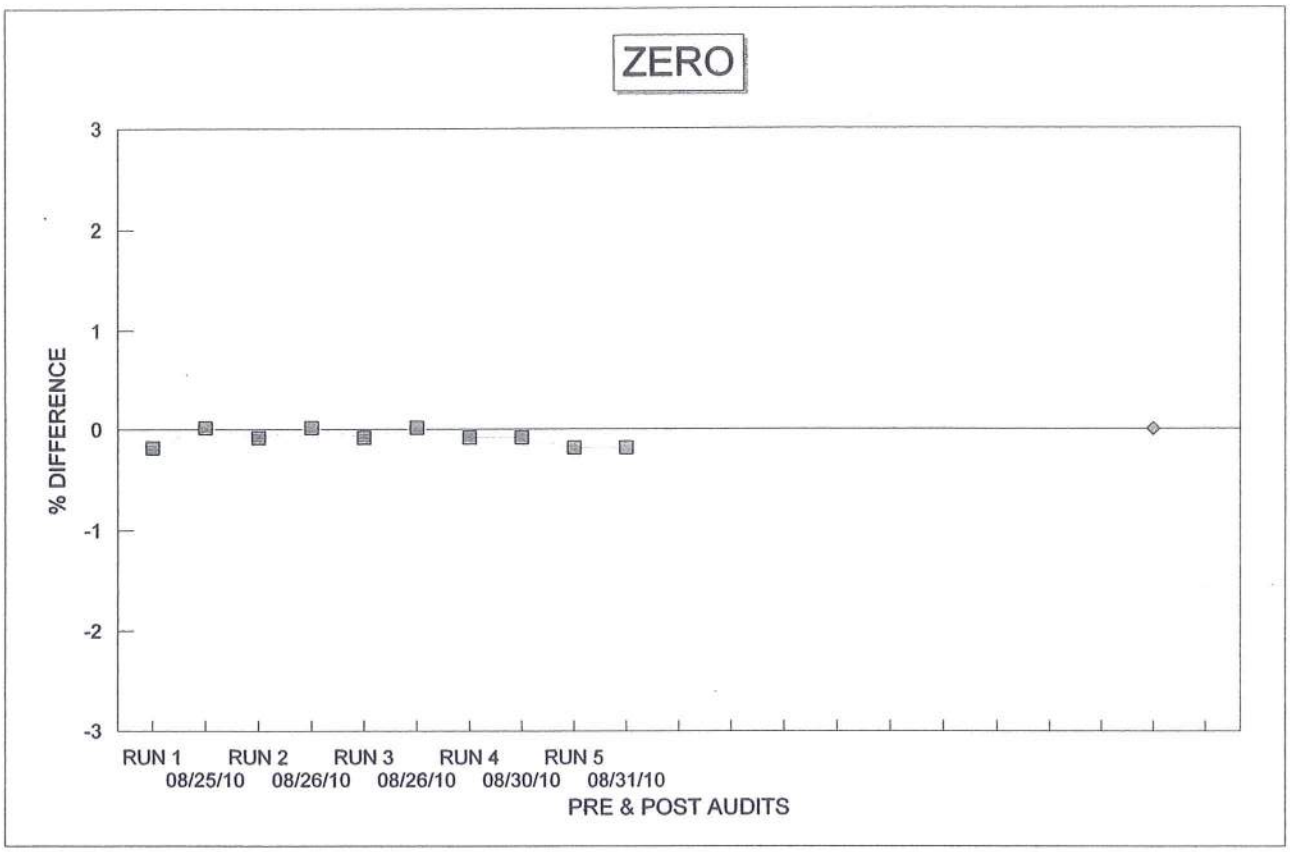


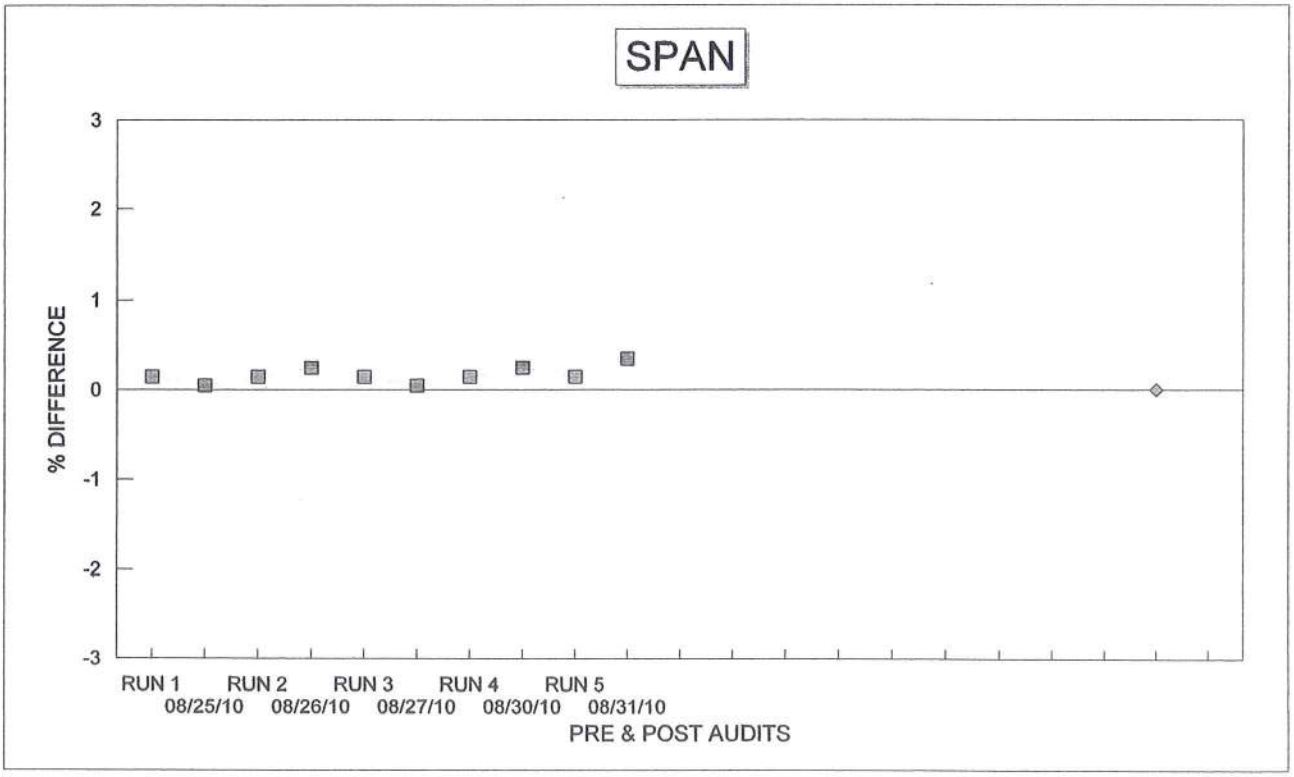
EPA Span Value = ± 2.0% of 25% O_2 = ± .5%

Cal Volts = Cal Volt Conc - Std Conc = ± Conc Diff = ± Δ %

HIGH VOLTS .831 = 20.78 - 20.9 = -.120 = -.480

LOW VOLTS .252 = 6.30 - 6.25 = .050 = .206


ZERO
3
2
1
0
-1
-2
-3
% DIFFERENCE
RUN 1 08/25/10
RUN 2 08/26/10
RUN 3 08/26/10
RUN 4 08/30/10
RUN 5 08/31/10
PRE & POST AUDITS


SPAN
3
2
1
0
-1
-2
-3
% DIFFERENCE
RUN 1 08/25/10
RUN 2 08/26/10
RUN 3 08/27/10
RUN 4 08/30/10
RUN 5 08/31/10
PRE & POST AUDITS

CO ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Date: 8-24-2010

Analyzer: Make: HORIBA Model: PIR 2000 SN: 408005

Calibration by: C Westmyer

Cal Gas Flow: 1.5 SCFH Measured by: Rotameter

BP: 30.18 Instrument ID: PRINCO

Temp: 68 Instrument ID: TR

Cylinders:

1. # 168TAC 3-A Concentration: 00.00 % **CO** Cyl. Press.: 420 PSI
   Certified by: AIR LIQUIDE Date: 04-19-04
2. # 487905 Concentration: 4.90 % **CO** Cyl. Press.: 1390 PSI
   Certified by: AIR LIQUIDE Date: 11-1-07
3. # CA06641 Concentration: 8.63 % **CO** Cyl. Press.: 1430 PSI
   Certified by: AIR LIQUIDE Date: 1-5-2007
4. # CC-12731 Concentration: 1.98 % **CO** Cyl. Press.: 1120 PSI
   Certified by: AIR LIQUIDE Date: 03-13-03

Analyzer: **Calibrated Range:** 0-10.0 % **Output:** 0-1.0 V.
Flow: 1.5 SCFH **Measured by:** Rotameter

Calibration Results

Point #	CYL. #	% CO	EXPECTED METER	EXPECTED DVM	ACTUAL METER	ACTUAL DVM	ADJ. METER	ADJ. DVM
1	1	0.00	00.0	.000	00.0	.000	00.0	.000
2	2	4.90	49.0	.490	49.1	.491	49.0	.490
3	3	8.63	86.3	.863	86.1	.861		
4	4	1.98	19.8	.198	19.6	.196		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 5.012

CO Linear Regression Results:

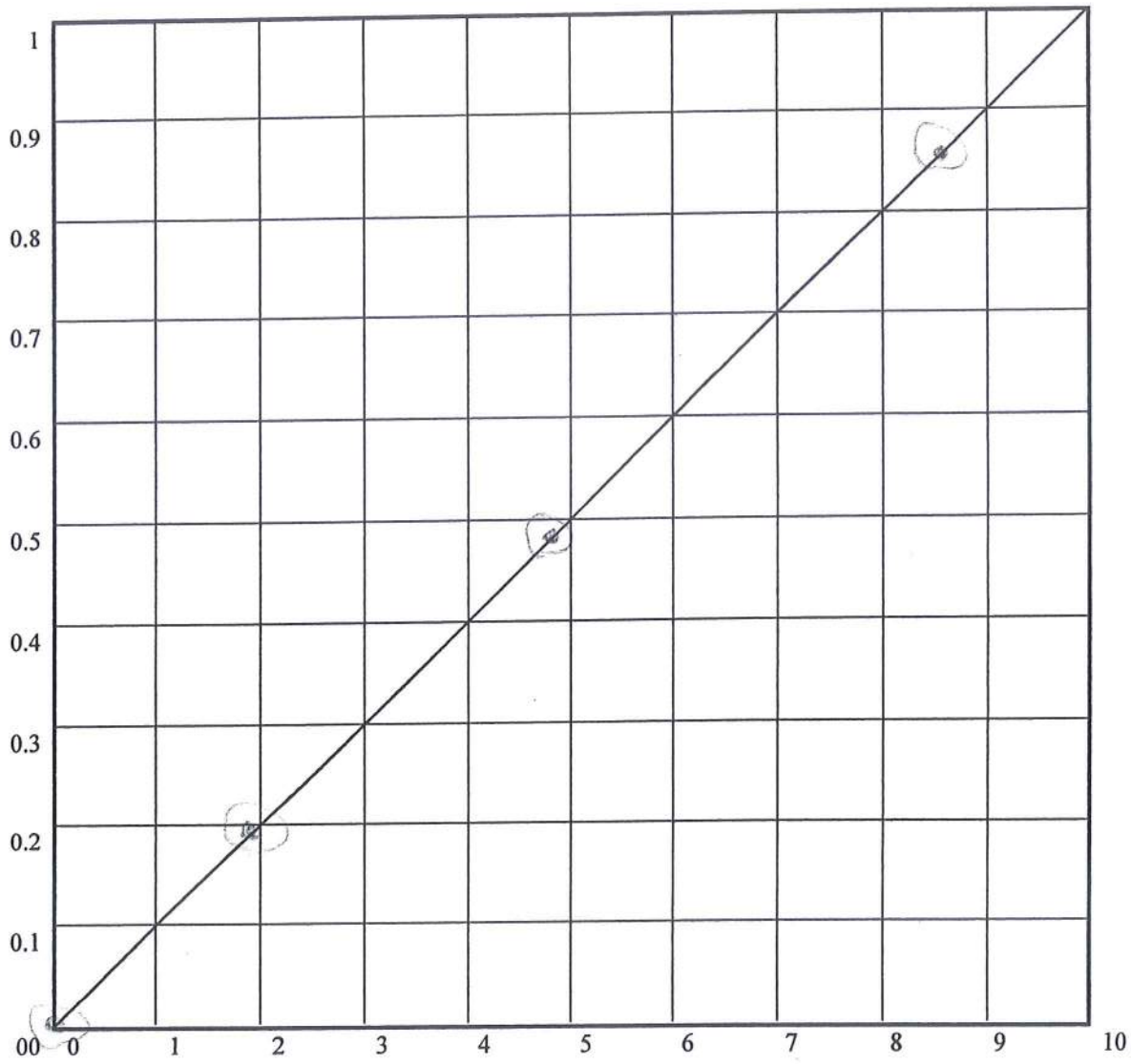
Y = MX +B

Slope (M) = -.0047762

Y Intercept (B) = .0998649

Correlation Coefficient (r) = .9999962

r^2 = .9999923



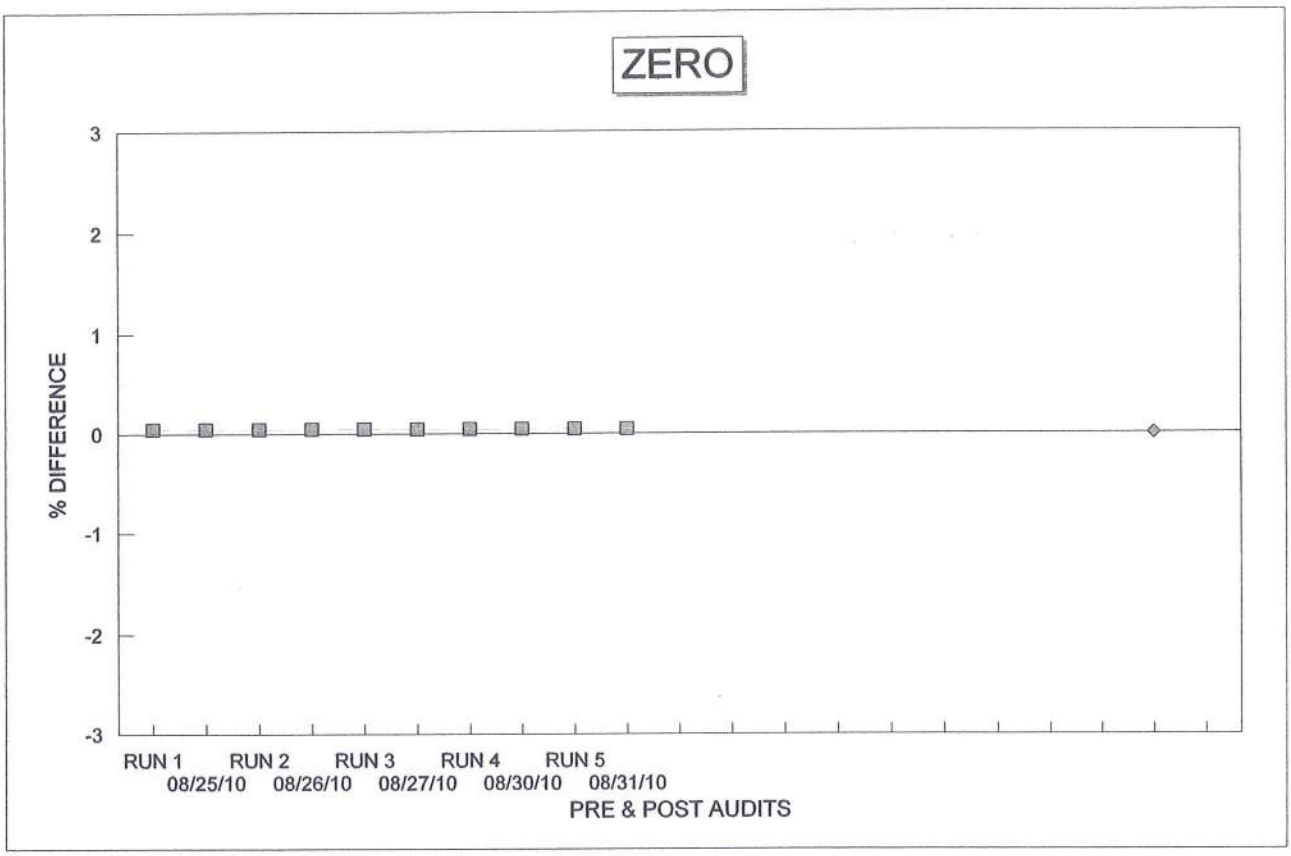
EPA Span Value = ± 2.0% of 10% CO = ± .2%

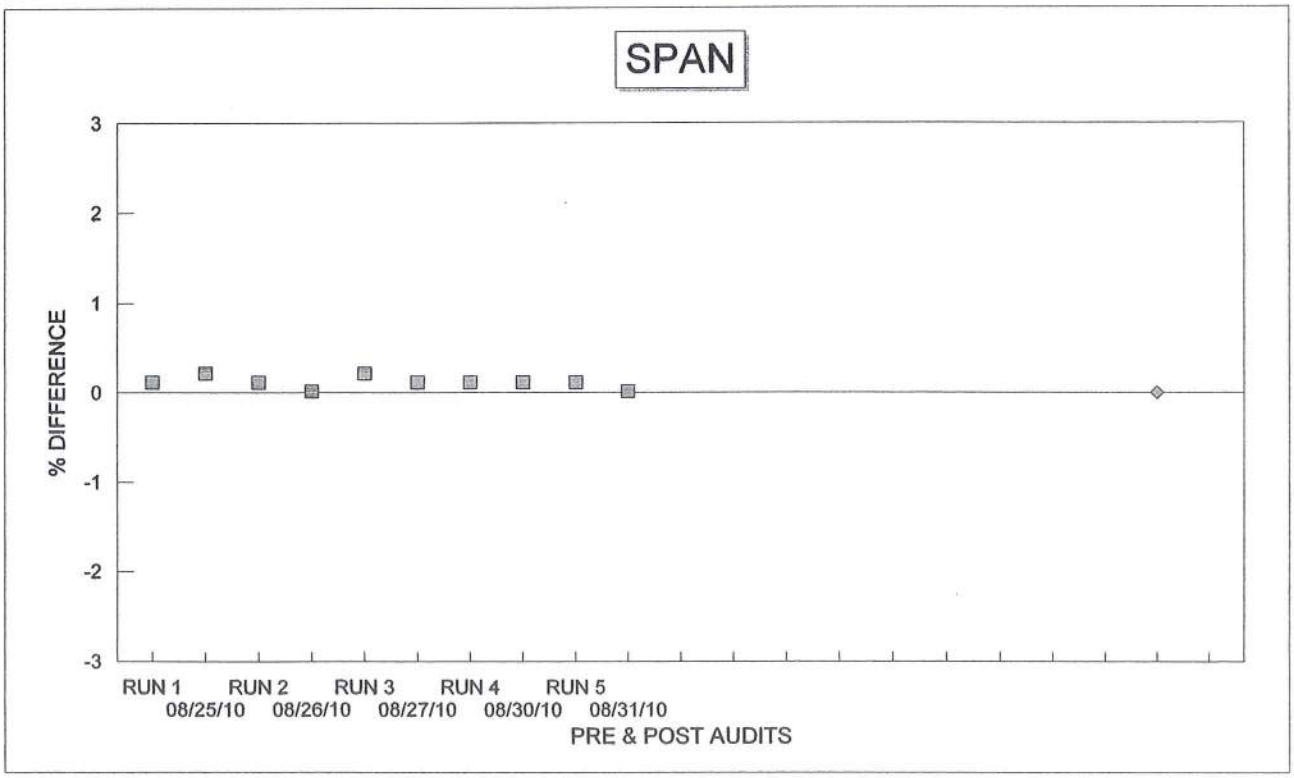
Cal Volts = Cal Volt Conc - Std Conc = ± Conc Diff = ± Δ %

HIGH VOLTS	.861	= 8.61 - 8.63	= -.020	=	-.200
LOW VOLTS	.196	= 1.960 - 1.98	= -.020	=	-.200

CO

Top Loader





SO_2 ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Date: 8-24-2010

Analyzer: Make: HORIBA Model: PIR 2000 SN: 403019

Calibration by: C. Woolbright

Cal Gas Flow: 1.5 SCFH Measured by: Rotameter

BP: 30.18 Instrument ID: PRINCO

Temp: 64 Instrument ID: TR

Cylinders:

1. # 168TAC 3A Concentration: 30.00 % SO_2 Cyl. Press.: 420 PSI
   Certified by: AIR LIQUIDE Date: 04-19-04
2. # CC82089 Concentration: 1250 % SO_2 Cyl. Press.: 1720 PSI
   Certified by: AIR LIQUIDE Date: 1-3-2007
3. # ALM0 49127 Concentration: 1770 % SO_2 Cyl. Press.: 700 PSI
   Certified by: SCOTT SPECIALTY GASES Date: 05-15-97
4. # ALM0 52285 Concentration: 506 % SO_2 Cyl. Press.: 710 PSI
   Certified by: SCOTT SPECIALTY GASES Date: 05-15-97

Analyzer: **Calibrated Range:** 0-2500 PPM **Output:** 0-1.0 V.
Flow: 1.5 SCFH **Measured by:** Rotameter

Calibration Results

Point #	CYL. #	PPM SO2	EXPECTED		ACTUAL		ADJ.	
			METER	DVM	METER	DVM	METER	DVM
1	1	0.00	00.0	.000	2.30	.023	0.00	.000
2	2	1250	50.0	.500	51.0	.516	50.0	.500
3	3	1770	70.8	.708	71.0	.710		
4	4	506	20.2	.202	20.2	.202		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 1248.04

SO_2 Linear Regression Results:

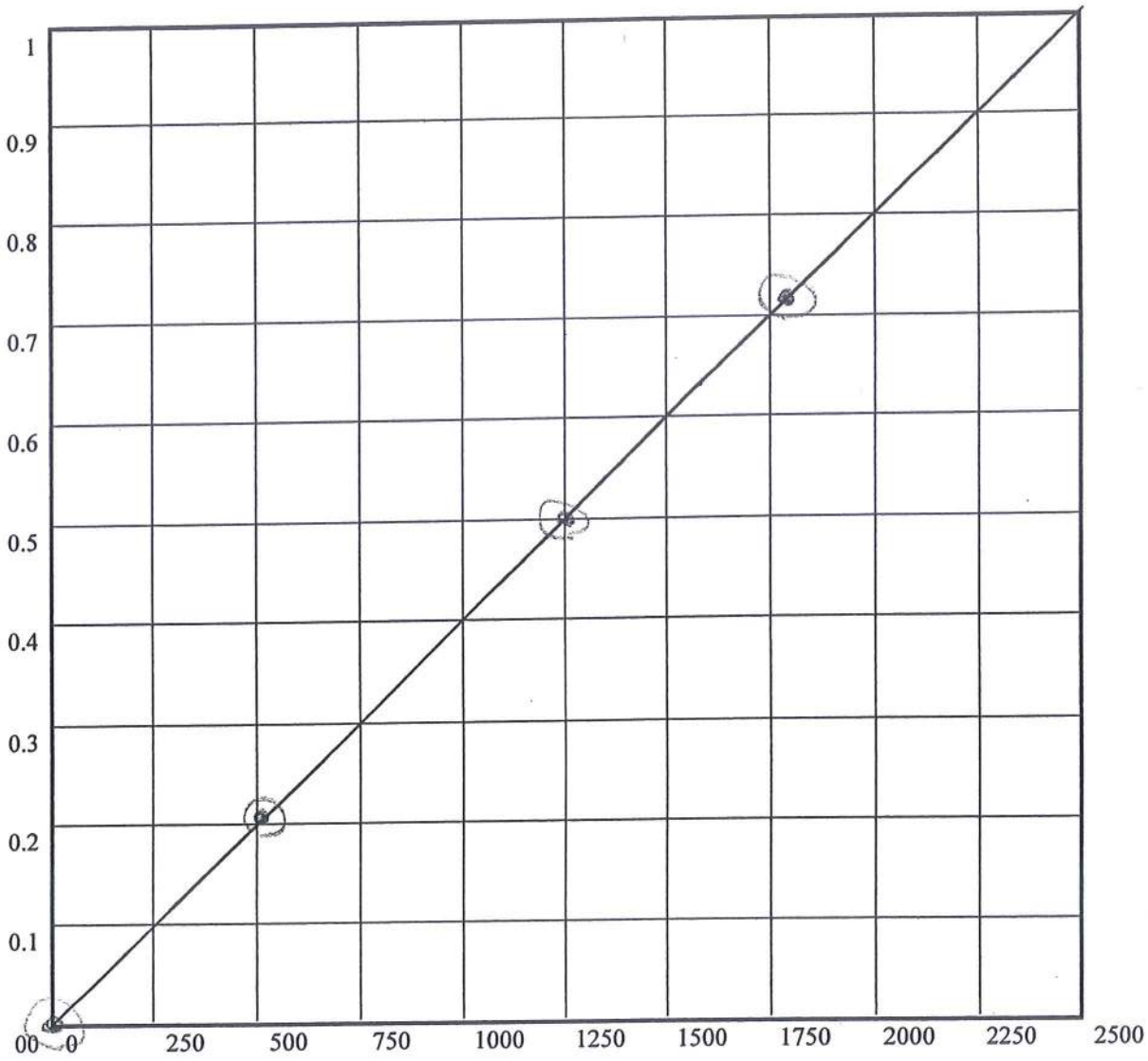
Y = MX +B

Slope (M) = -.0005216

Y Intercept (B) = .0004010

Correlation Coefficient (r) = .9999975

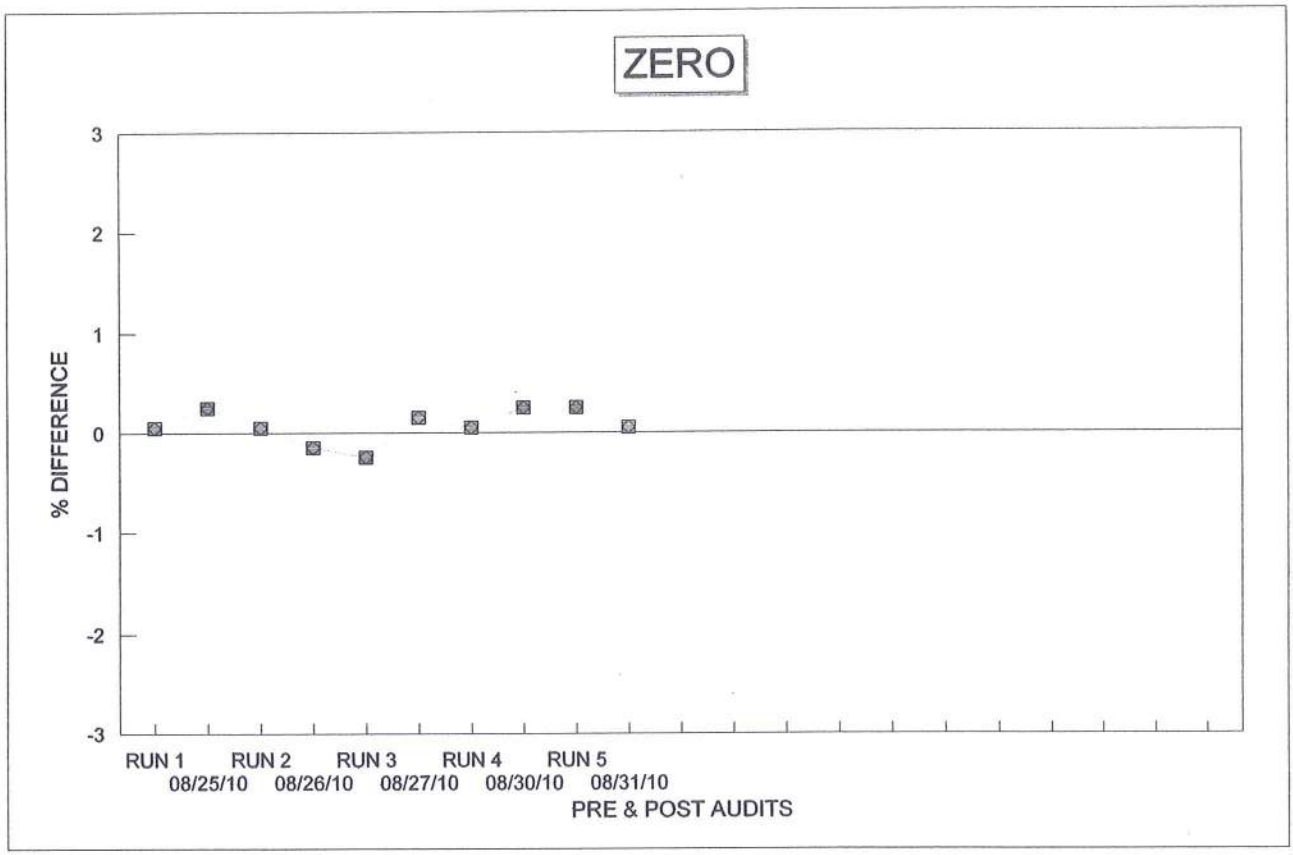
r^2 = .9999949



EPA Span Value = ± 2.0% of 2500 PPM SO_2 = ± 50 PPM

Cal Volts = Cal Volt Conc - Std Conc = ± Conc Diff = ± Δ %

HIGH VOLTS	.710	= 1775.0	- 1770.0	= 5.000	=	.200
LOW VOLTS	.202	= 505.0	- 5060	= -1.000	=	-.040


ZERO
3
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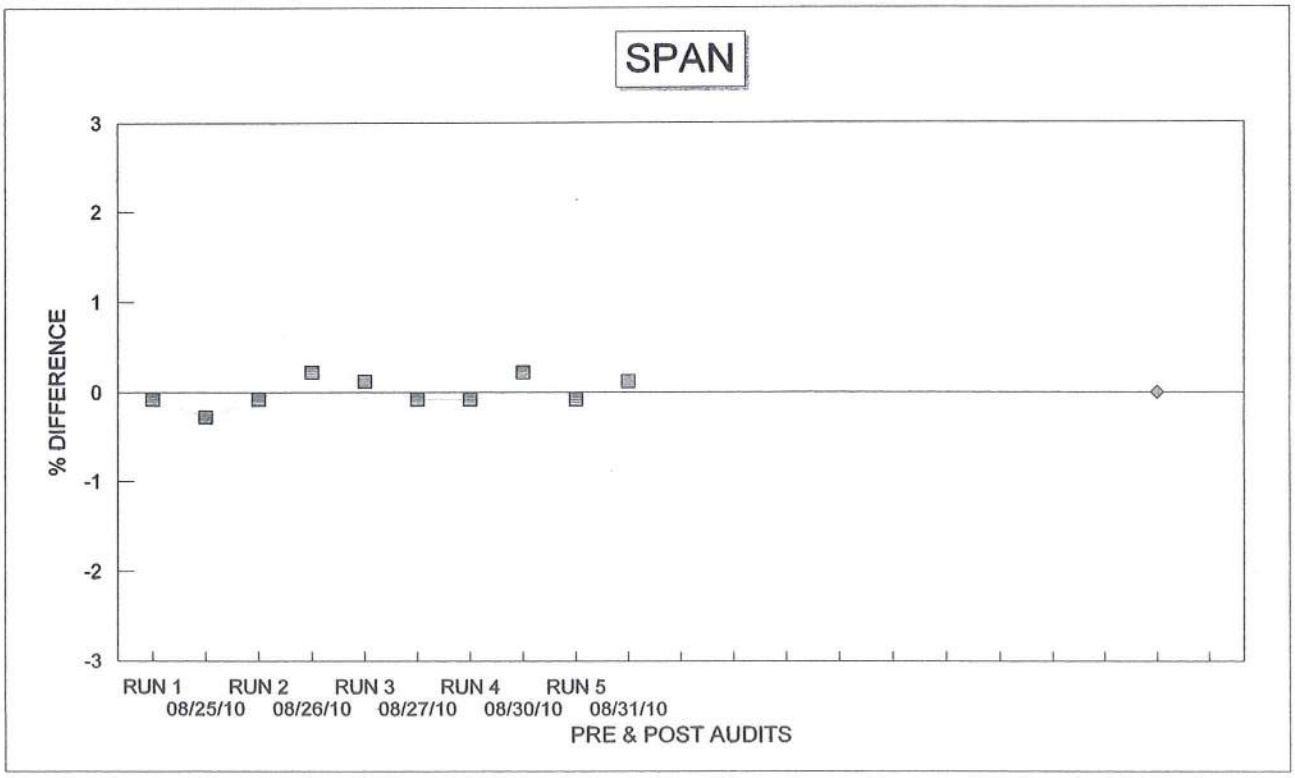
-1
-2
-3
% DIFFERENCE
RUN 1 08/25/10
RUN 2 08/26/10
RUN 3 08/27/10
RUN 4 08/30/10
RUN 5 08/31/10
PRE & POST AUDITS


SPAN
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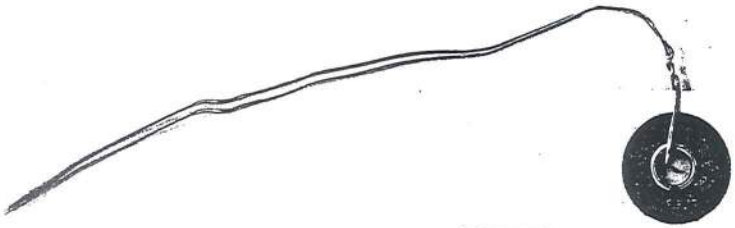
% DIFFERENCE
RUN 1 08/25/10
RUN 2 08/26/10
RUN 3 08/27/10
RUN 4 08/30/10
RUN 5 08/31/10
PRE & POST AUDITS

ORSAT ANALYSIS DATA SHEET DATE : 5-11-10

Gas	1	2	3	AVE	CONC	TANK ID
CO_2	Ø	Ø	Ø	Ø	Ø	ILSTAC 3A
O_2	Ø	Ø	Ø	Ø	Ø	
CO	Ø	Ø	Ø	Ø	Ø	
CO_2					12.2	487905
O_2					12.6	NEW 11-01-07
CO					4.90	Exp. 10-31-2012
CO_2					21.1	CA 06041
O_2					20.9	
CO					8.63	EXP. 4-5-2012
CO_2	6.2	6.2	6.2	6.2	6.22	CC-12730
O_2	6.2	6.3	6.3	6.27	6.25	
CO	2.0	2.0	2.0	2.0	1.98	
CO_2						
O_2						
CO						



LOW SPAN

AIR LIQUIDE

GASES FOR RESEARCH AND DEVELOPMENT

CYL # CC-12731 CGA 590

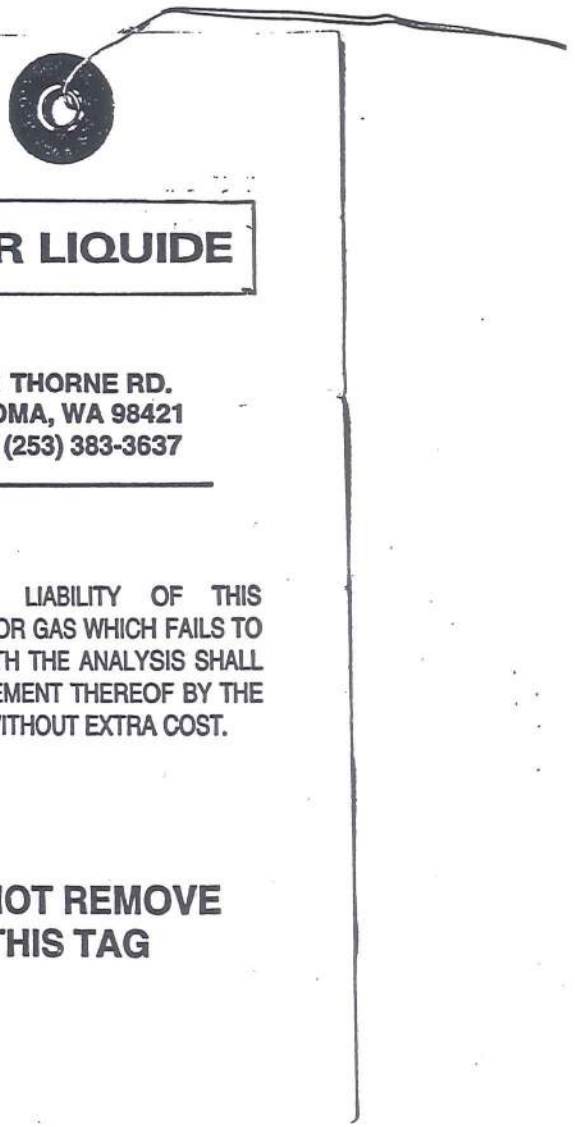
PRES 1665 VOL 130 c.f

TEST # 07203 DATE 03-13-03

Analytical Method GC/paramagnetic

	Requested	Analyzed
Hydrogen		
Nitrogen	Bal.	Bal.
Argon		
Air		
Carbon Monoxide	2%	1.98%
Methane		
Oxygen	6.25%	6.25%
Helium		
Carbon Dioxide	6.25%	6.22%

SIGNED



AIR LIQUIDE

1451 THORNE RD.
TACOMA, WA 98421
TEL: (253) 383-3637

THE ONLY LIABILITY OF THIS COMPANY FOR GAS WHICH FAILS TO COMPLY WITH THE ANALYSIS SHALL BE REPLACEMENT THEREOF BY THE COMPANY WITHOUT EXTRA COST.

DO NOT REMOVE THIS TAG

AIR LIQUIDE™

CERTIFICATE OF ANALYSIS

Customer : Pacifice Rim Oxygen Service
P.O. Number : 200159
Document # : 23639406-1A
Mix/Lot # : SFS103795
Item Number : SFS103795
Valid Until : 4 January, 2012

Specification : CUSTOM CERTIFIED
Phase : GAS
Cyl. Size : 30AL
Valve : CGA 590
Pressure : 1667
Volume : 120 SCF

Cylinder Number: **CAO6641**

Component	Requested Concentrations MOLE	Actual Concentration MOLE	% Analytical Uncertainty	Equipment Used Scale	Analyt. Inst.	Calibration Standard
NITROGEN	Balance	Balance		2		
CARBON MONOXIDE	8.6 %	8.63 %		2	4620	PQ
OXYGEN	21 %	20.9 %		2	4620	TB
CARBON DIOXIDE	21 %	21.1 %		2	4620	PD

7001-30AL

This mixture was certified by analysis using one or more calibration standards prepared with scales certified against weights traceable to N.I.S.T.

Comments:-

Dewpoint calculated to 40° F, unless otherwise stated. Improper storage or use may affect the accuracy of this standard.
Reported impurities are approximate and should not be used for calibration purposes.

Prepared by _____ Date: 5-Jan-2007

8832 Dice Road -- Santa Fe Springs, CA 90670
Phone (562) 945-1383 **Fax** (562) 696-7903
ISO: 9001-2000

A-L WELDING PRODUCTS

A Division of Pacific Rim Oxygen Services, Inc.
15700 Nelson Road South • Tukwila, Washington 98188
Telephone (425) 228-2218 • Fax (425) 228-2397

Certificate of Analysis

Customer: AL Welding Products
Product: 5% CO. 12.5% CO2, 12.5% O2, balance Nitrogen
Grade: Certified Standard
Cylinder Number: 487905
Product Code: 2505COOXCDNTHC
Lot Number: K3171302

11-01-07

CGA 590
Pressure: 1650 psig
Contents: 175 ft^3

Mixture Analysis

Component	Specification	Concentration	Analytical Method
Oxygen	12.5%	12.6%	MTIGC-TCD
CO2	12.5%	12.2%	Varian
CO	5.0%	4.9%	MTIGC-TCD
Nitrogen	Balance	Balance	MTI GC-TCD

I certify the above referenced cylinder was analyzed and found to contain the listed concentrations.

Thomas M Chesser, Chemist

11-01-07
Date

Scott Specialty Gases

500 WEAVER PARK RD,LONGMONT,CO 80501 Phone: 303-442-4700 Fax: 303-772-7673

CERTIFICATE OF ANALYSIS: Interference-Free™ Multi-Component EPA Protocol Gas

Customer
ENERGY & ENV MEASUREMENT

C/O ED WADINGTON
3730 N. PELLEGRINO DR.
TUCSON,AZ 85749

Assay Laboratory

SCOTT SPECIALTY GASES
500 WEAVER PARK RD
LONGMONT,CO 80501

Project No.: 08-34135-001
P.O. No.: VERBAL

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure #G1; September, 1993.

Cylinder Number: ALM052285 Certification Date: 4/21/97 Exp. Date: 4/21/2000
Cylinder Pressure***: 1996 PSIG

COMPONENT	CERTIFIED CONCENTRATION	ANALYTICAL ACCURACY**
SULFUR DIOXIDE *	506 PPM	+/- 1% NIST Traceable
NITROGEN	BALANCE	

*** Do not use when cylinder pressure is below 150 psig.
** Analytical accuracy is inclusive of usual known error sources which at least include precision of the measurement processes.
Product certified as +/- 1% analytical accuracy is directly traceable to NIST standards.
* This Protocol has been certified using corrected NIST SO2 standard values, per EPA guidance dated 7/24/96 and will not correlate with uncorrected Protocols.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 1661	9/27/98	ALM059505	488.5 PPM	SO2/N2

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	LAST DATE CALIBRATED	ANALYTICAL PRINCIPLE
FTIR System/8220/AAB9400251	03/20/97	Scott Enhanced FTIR

ANALYZER READINGS

(Z = Zero Gas R = Reference Gas T = Test Gas r = Correlation Coefficient)

SULFUR DIOXIDE *

First Triad Analysis			Second Triad Analysis			Calibration Curve	
Date: 04/14/97	Response Unit: PPM		Date: 04/21/97	Response Unit: PPM		Concentration = A + Bx + Cx2 + Dx3 + Ex4	
Z1 = 0.3847	R1 = 487.72	T1 = 505.77	Z1 = 0.3241	R1 = 488.29	T1 = 505.43	r = 0.999990	
R2 = 488.79	Z2 = 1.6201	T2 = 505.89	R2 = 488.83	Z2 = 1.6098	T2 = 505.75	Constants:	A = 0.000000
Z3 = 1.6428	T3 = 505.78	R3 = 488.89	Z3 = 0.5340	T3 = 505.74	R3 = 488.69	B = 1.000000	C = 0.000000
Avg. Concentration:	505.8	PPM	Avg. Concentration:	505.8	PPM	D = 0.000000	E = 0.000000

Special Notes:

ANALYST: Devon VonFeldt
Devon VonFeldt

SO2 concentration analysis
05/10/10

Vm(std)	1.500			
mcf	1.004		dscf=	1.500
Hg	30.00			
DH	0.12			
temp	66	529	ppm =	507
ml BA ++	177			
Normality	0.0101			

Run1	507
Run 2	515
Run3	507
avg.	510

Tank I.D. # ALMO52285

AIR LIQUIDE™

CERTIFICATE OF ANALYSIS

Customer : Pacific Rim Oxygen Service Inc
P.O. Number : 200160
Document # : 23540983-1A
Mix/Lot # : SFS103340
Item Number : SFS103340
Valid Until : 2 January, 2010

Specification : CUSTOM CERTIFIED
Phase : GAS
Cyl. Size : 30AL
Valve : CGA 660
Pressure : 2000
Volume : 144 SCF

Cylinder Number: **CC82089**

Component	Requested Concentrations MOLE	Actual Concentration MOLE	% Analytical Uncertainty	Equipment Used Scale	Analyt. Inst.	Calibration Standard
NITROGEN	Balance	Balance		4		
SULFUR DIOXIDE	1250 PPM	1250 PPM	+/- 2%	4	4503	GL
6154-30AL						

This mixture was certified by analysis using one or more calibration standards prepared with scales ertified against weights traceable to N.I.S.T.

Comments:

Dewpoint calculated to 40° F, unless otherwise stated. Improper storage or use may affect the accuracy of this standard.
eported impurities are approximate and should not be used for calibration purposes.

Prepared by _____ Date: 3-Jan-2007

8832 Dice Road -- Santa Fe Springs, CA 90670
Phone (562) 945-1383 **Fax** (562) 696-7903
ISO: 9001-2000

Scott Specialty Gases

500 WEAVER PARK RD,LONGMONT,CO 80501 Phone: 303-442-4700 Fax: 303-772-7873

CERTIFICATE OF ANALYSIS: EPA PROTOCOL GAS

Customer
ENERGY & ENV MEASUREMENT

C/O ED WADINGTON
3730 N. PELLEGRINO DR.
TUCSON,AZ 85749

Assay Laboratory

SCOTT SPECIALTY GASES
500 WEAVER PARK RD
LONGMONT,CO 80501

Project No.: 08-34135-003
P.O. No.: VERBAL

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure #G1; September, 1993.

Cylinder Number: ALM049127 **Certification Date:** 4/21/97 **Exp. Date:** 4/21/2000
Cylinder Pressure*:** 1860 PSIG

COMPONENT	CERTIFIED CONCENTRATION		ANALYTICAL ACCURACY**
SULFUR DIOXIDE *	1,770	PPM	+/- 1% NIST TRACEABLE
NITROGEN		BALANCE	

*** Do not use when cylinder pressure is below 150 psig.

** Analytical accuracy is inclusive of usual known error sources which at least include precision of the measurement processes. Product certified as +/- 1% analytical accuracy is directly traceable to NIST standards.

* This Protocol has been certified using corrected NIST SO2 standard values, per EPA guidance dated 7/24/96 and will not correlate with uncorrected Protocols.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM-R-1696	7/03/98	ALM057797	3131. PPM	SULFUR DIOXIDE

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	LAST DATE CALIBRATED	ANALYTICAL PRINCIPLE
FTIR System/8220/AAB9400251	03/20/97	Scott Enhanced FTIR

ANALYZER READINGS

(Z = Zero Gas R = Reference Gas T = Test Gas r = Correlation Coefficient)

First Triad Analysis

SULFUR DIOXIDE *

Date: 04/14/97	Response Unit: PPM	
Z1 = 0.7210	R1 = 3127.7	T1 = 1767.1
R2 = 3131.7	Z2 = 4.6770	T2 = 1768.1
Z3 = 4.6770	T3 = 1768.1	R3 = 3133.7
Avg. Concentration:	1768.	PPM

Second Triad Analysis

Date: 04/21/97	Response Unit: PPM	
Z1 = 0.4020	R1 = 3125.8	T1 = 1770.2
R2 = 3132.3	Z2 = 6.6540	T2 = 1769.3
Z3 = 4.9410	T3 = 1770.9	R3 = 3134.9
Avg. Concentration:	1770.	PPM

Calibration Curve

Concentration = A + Bx + Cx2 + Dx3 + Ex4	
r = 0.999990	1696
Constants:	A = 0.00000
B = 1.00000	C = 0.00000
D = 0.00000	E = 0.00000

Special Notes:

ANALYST: Devon VonFeldt
DEVON VONFELDT

SO2 concentration analysis
05/11/10

Vm(std)	1.500			
mcf	1.004		dscf=	1.500
Hg	30.00			
DH	0.12			
temp	66	529	ppm =	1778
ml BA ++	621			
Normality	0.0101			

Run1	1775
Run 2	1758
Run3	1778
avg.	1770

Tank I.D. # ALMO49127

Certificate of Analysis

ANALYTICAL CONTROL LABORATORY ANALYSIS
METHYLENE CHLORIDE - OPTIMA

Catalog No. D151
Lot No. 035941

July 23, 2003

This is to certify that this lot was tested and found to comply with the specifications for this product. The following are the actual analytical results obtained:

TESTS	ACTUAL ANALYSIS
Assay	99.9%
Color	5 APHA
Description	Clear, Colorless Liquid
Free Halogens	Pass Test
Identification	Pass Test
Fluorescence Background (as Quinine Sulfate)	Not more than 1 ppb
Certified for EPA Test #1625	Pass Test
Pesticide Residue Analysis (as Heptachlor Epoxide)	Not more than 10ng/l
Density (g/ml) at 25°C	1.317 .
Optical Absorbance At 254 nm	0.002
At 240 nm	0.10
At 233 nm	0.54
Refractive Index at 25°C	1.4209
Residue after Evaporation	0.4 ppm
Titratable Acid	0.00004 Meq/g.
Preservative (Amylene)	64 ppm
Water (H_2O)	0.008%

Fisher Scientific

Chemical Division
1 Reagent Lane
Fair Lawn, N.J. 07410
201-796-7100

Approved By: Edgar E. Hess

Edgar E Hess
Q.C. Laboratory Manager

Certificate of Analysis

ANALYTICAL CONTROL LABORATORY ANALYSIS
METHYLENE CHLORIDE - OPTIMA

Catalog No. D151
Lot No. 035941

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Fisher Scientific

Chemical Division
1 Reagent Lane
Fair Lawn, N.J. 07410
201-796-7100

Approved By: Edgar E. Hess

Edgar E Hess
Q.C. Laboratory Manager

KEITHLEY

Keithley Instruments, Inc.
28775 Aurora Road
Cleveland, Ohio 44139
(440) 248-0400
Telefax: (440) 248-6168

Certificate of Calibration

Model 2700 **Serial No** 0872585 **Date** 13 Mar 2002

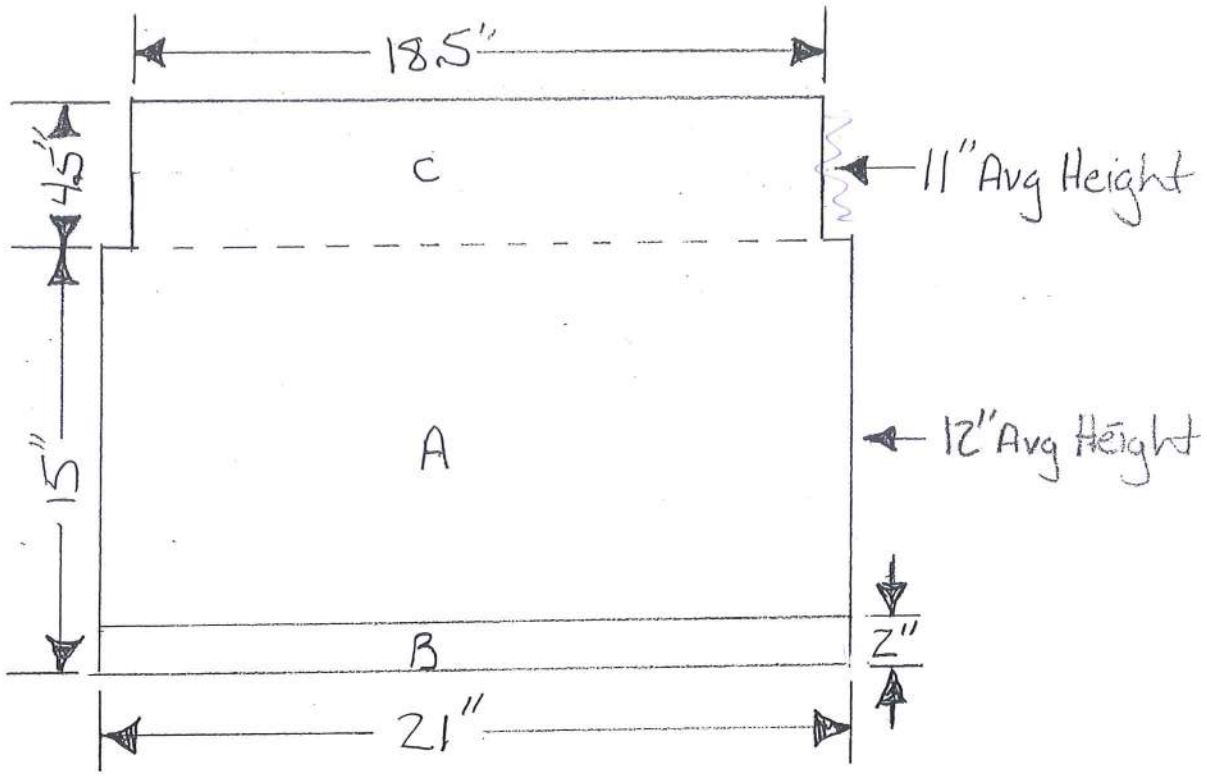
This notification serves to certify that the unit described above has been inspected and tested in accordance with specifications published by Keithley Instruments, Inc.

The accuracy and calibration of this instrument are traceable through reference standards that are compared, at planned intervals, to national standards maintained by the National Institute of Standards and Technology (NIST), by comparison to natural physical constants or self-calibrating ratio type measurements.

The measurement standards which support this calibration are calibrated on a schedule to maintain required accuracy level.

James A. Crane
Metrology Services

Firebox and Fuel Load Calculations for the Jotul Top Loader



A = 12" x 15" x 21"	=	3780.000
− B = 1.75" x 2" x 21"	=	− 73.500
C = 11 x 4.5" x 18.5"	=	915.750
		4622.250 in^3
		2.675 ft^3

Fuel Load Weight

16.9 ← 18.724 → 20.5

July 26, 2010

Mr. Chip Wadington
Lokee Testing Laboratory
13235 Prairie Circle East
Sumner, Washington 98390

Dear Mr. Wadington,

The following is a guideline for adjusting the air control of the Jøtul F50 TL in order to achieve burn rates in the appropriate categories. The blower speed for each test category is also indicated.

The primary air is operated by a single control located below the ash lip at front center of the stove.

The secondary air is controlled through an opening located at the center rear bottom of the stove. Secondary air is a non-adjustable fixed opening size.

	Air Control	Blower Setting
Burn Rate	Primary	Blower Speed / Time on
Low (Min. dry kg/hr)	9/32" open	Low / On at 30 minutes
Med. Low (< 1.25 dry kg/hr)	3/8" open	Low / On at 30 minutes
Med. High (1.25-1.90 dry kg/hr)	5/8" open	Low / On at 30 minutes
High (Max dry kg/hr)	Max. open	High / Entire test

Air and blower setting information contained in the operation manual will be presented in a way as to be representative of the information contained above.

Sincerely,

Roger W. Purinton
Product Development Manager
Jotul North America
55 Hutcherson Drive
Gorham, Maine 04038

MANUAL

5.0 Operation

Please read the following section before building the first fire in your new Jøtul F 50 TL.

5.1 Use Solid Wood Fuel Only

This stove is designed to burn **natural wood only**. Wood that has been air-dried for a period of 6 to 14 months will provide the cleanest, most efficient heat.

Do not burn:

- Coal
- Garbage
- Cardboard
- Solvents
- Drift wood
- Treated or painted wood
- Chemical Chimney cleaners
- Colored paper
- Any synthetic fuel or logs
- Laminated wood

The burning of any of these materials can result in the release of toxic fumes. Never use gasoline, gasoline-type lantern fuel, kerosene, charcoal lighter fluid, or similar liquids to start or "freshen-up" the fire. Always keep such liquids away from the heater at all times.

Important: Never build or allow the fire to rest directly on the glass panel. Try to keep the logs spaced at least one inch from the glass to allow for proper air flow over the glass and within the firebox.

5.2 How your Jøtul F 50 TL works

Modern, non-catalytic wood stoves burn fuel efficiently by the precise control and delivery of primary and secondary air to the fire.

Primary Air is drawn into a front inlet in the stove bottom and directed through a regulator shutter under the front door before entering the lower fire chamber. Additional primary air is directed to the top of the front door to act as an air wash which prevents extreme soot build-up on the glass panel. The amount of primary air available to the fire determines the intensity of heat output and rate of fuel combustion; the greater the amount of air, the greater the heat output, the faster the wood burns.

Additional air is separately directed into the top of the fire chamber to support combustion of exhaust gasses before passing out of the stove. This unregulated ***Secondary Air*** enters through an inlet in the rear of the stove bottom and is heated as it passes through the rear of the stove into a two-tiered manifold at the top of the firechamber. Additional secondary air is directed through a stainless steel tube built into the baffle plate hinge. Volatile gases, released unburned from the fuel bed, rise to the baffle where they are turbulently mixed with the hot, fresh oxygen. Secondary combustion then occurs before the gases pass into the heat exchange chamber.
See **fig. 16.**

WARNING

ALWAYS WEAR STOVE GLOVES WHILE TENDING THE FIRE.

NEVER ALLOW THE FIRE TO REST DIRECTLY ON THE GLASS. KEEP THE LOGS SPACED AT LEAST ONE INCH FROM THE GLASS TO ALLOW FOR PROPER AIR FLOW WITHIN THE STOVE. AVOID STRIKING THE GLASS WITH LOGS.

OPERATE THIS STOVE ONLY WITH THE FRONT DOOR AND ASH DOOR FULLY CLOSED. OPERATION WITH THE DOOR PARTIALLY OPEN MAY RESULT IN OVER-FIRING. IF THE DOOR IS LEFT PARTIALY OPEN, GAS AND FLAME MAY BE DRAWN OUT OF THE STOVE CREATING SAFETY RISKS FROM BOTH FIRE AND SMOKE.

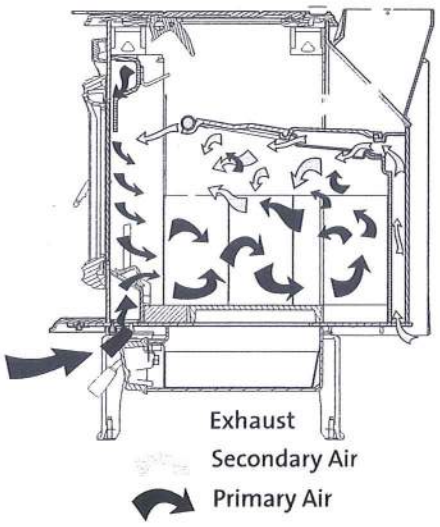


Figure 16. Combustion air paths

5.3 Air Control / Blower Settings

Use the following guide for best performance.

Burn Rate	Air Control Setting	Blower Speed
Min. Low	Min. Open	Low / On at 30 min.
Med. Low	3/8" Open	Low / On at 30 min.
Med. High	3/4" Open	Low / On at 30 min.
High	Max. Open	High / On

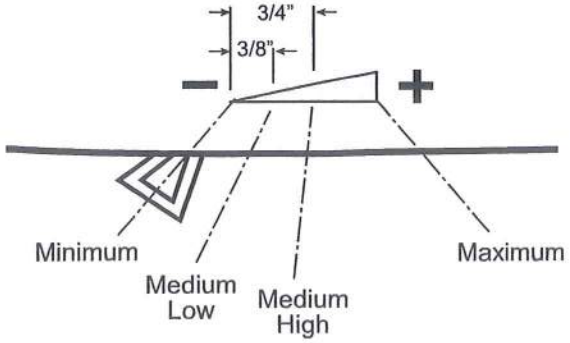


Figure 17. Air Control Settings

5.4 Controlling the Fire

Combustion intensity is controlled by the position of an air shutter located under the front door. You adjust its position using the handle located under the ash lip. Slide the handle to the left to decrease air to the fire. Sliding it to the right increases air delivery and consequently, fire intensity. See **fig. 17**. The shutter regulates and directs primary air to the front of the burn chamber. Push it to the right to allow maximum air to support combustion. It should be fully open when first starting or rekindling a fire, or when greater heat output is desired.

5.5 Top Loading

You will want to take advantage of the convenience of adding logs to a burning fire through the top of your stove. The hinged heat exchanger baffle must be in the open position in order to add wood to the fire through the top of the stove. When the side handle is in a horizontal position, the baffle is also in a horizontal position - Closed. Swing the handle down into a vertical position to open the baffle. See section 5.7 for more details.

5.6 Break-In Procedure

Although your Jøtul F 50 TL is constructed of welded, 1/4" steel plate, it also incorporates cast iron components. This material requires the stove to be"broken-in" gradually so that heat expansion does not occur too quickly and cause damage. The following steps describe the proper break-in procedure for your stove. Use a magnetic stove-top thermometer to monitor stove temperature, placed directly on the cook plate.

Set the Primary Air Shutter fully open, all the way to the right.

1. Light a small fire of newspaper and kindling at the front of the stove. Gradually add small pieces of wood, but only allow the stove to reach a maximum surface temperature of 200°F (93° C). Continue burning at this low rate for approximately 1 hour.
2. Allow the stove to cool to room temperature.
3. Light a second fire, allowing the stove to reach a maximum temperature of 300°F (149°C) for 1 hour.
4. Cool the stove to room temperature.
5. Light a third fire and gradually allow the stove to reach a surface temperature of 400°F (204°C)
6. Cool the stove to room temperature. This completes the "break-in" procedure.

Note: If the temperature exceeds the limit during any break-in fire, move the Air Shutter all the way to the left to shut off the air supply completely. It is normal that the stovetop temperature will continue to climb until the fuel burns down somewhat. Once the fire is out and the stove has cooled to room temperature, continue the break-in procedure. Never attempt to reduce the temperature by removing burning logs from the fire.

Break-in Odors: It is normal for a newly painted stove to emit odor and smoke during the first few fires. This is caused by curing of the high temperature paint and will diminish with each fire. Open a window or door to provide additional ventilation to alleviate this condition.

5.7 Starting and Maintaining a Fire

Burn only solid wood directly on the bottom grate of the stove. Do not elevate the fire in any way.

1. With the **Primary Air Shutter** in the full open position (to the right), start with several sheets of crumpled newspaper placed directly on the grate. On top of the newspaper, place several pieces of small dry kindling * (1" - 2" in diameter or less) with two to three larger logs (approx. 3" to 4" in diameter) on top.

2. Light the fire and close the door. Allow the chimney to warm and establish a strong draft. Slowly build the fire by adding larger and larger logs. Be sure to follow the break-in procedure (Sect. 5.5) before creating a hot fire that might damage the stove.

3. Once the stove has reached a surface temperature range of between 400° and 600°, (204°C -316°C), adjust the primary air control lever as appropriate to generate the desired heat output and burn time.

   With time and experience, you will soon become acquainted with the operating characteristics of your particular installation.

We recommend use of a magnetic stovetop thermometer to monitor the surface temperature of the stove. The optimum surface temperature range for the most efficient burn is between 400° and 600° (204°C -316°C).

You can also monitor stove performance through the window. Peak combustion efficiency occurs when exhaust gas is burned at the baffle in the top of the firebox. This is apparent as rolling yellow-orange flames appearing at the secondary air ports in the underside of the baffle plate and forward tube. At this stage, little or no smoke will be visible exiting the chimney.

WARNING:

NEVER OVER-FIRE THE STOVE. IF ANY PART OF THE STOVE OR CHIMNEY GLOWS, YOU ARE OVER-FIRING. A HOUSE FIRE OR SERIOUS DAMAGE TO THE STOVE OR CHIMNEY COULD RESULT. IF THIS CONDITION OCCURS, IMMEDIATELY CLOSE THE AIR CONTROL.

5.8 Adding Fuel

Follow this procedure when reloading the stove while it is still hot and a bed of hot embers still exists:

- Always wear gloves when tending to the stove.
- Adjust the Primary Air Shutter Lever to the fully open position and open the baffle plate. Wait a few seconds to re-establish strong draft before opening the load door. This will allow fresh air to flush the firebox and prevent smoke escaping when either the front or top door is opened.
- Open the Baffle and Top Door,
  Or,
  Open the Front Door.
- Use a stove tool or poker to evenly distribute the hot embers around the firebox.
- Load the fuel, usually with smaller logs first.
- Close the Front Door, being sure to latch the door tightly.
  Or,
  Close the Baffle and then the Top Load Door. The baffle will also automatically close when the top plate is set back down.
- Wait 5 – 10 minutes before setting the air controls for the desired heat output and burn time.
  (If you have at least a 2" thick ember bed when reloading, it may be possible to close the door and immediately adjust the air control setting).
- Set the Air Shutter on the door for the desired heat output.

5.9 Open Door Fire-viewing

Warning: This stove should be operated with the door either fully open with optional Spark Screen in place or with the door fully closed. If the door is left partly open, there is risk of overfiring. Also, gas and flame may be drawn out of the fireplace stove opening, creating risks from both fire and smoke.

Be aware that when operating with the door open, there exists the possibility of generating carbon monoxide by some fuels (e.g. charcoal), and the hazards of carbon monoxide. Be sure adequate fresh air and ventilation is available to the stove.

5.10 Creosote Formation and the Need for Removal

When wood is burned slowly, it produces tar and other vapors that combine with moisture to form creosote. Creosote vapors condense in the relatively cool chimney flue, and creosote residue accumulates on the flue lining. When ignited, this creosote fuels an extremely hot fire.

The chimney connector and chimney flue should be inspected at least twice monthly during the heating season to determine if creosote buildup has occurred. If creosote has accumulated, it should be removed to reduce the chance of a chimney fire.

In the event that creosote ignites in the flue, the resulting fire is often accompanied by a roaring noise and crackling sound as flakes of burning creosote break loose. If you suspect you are having a chimney fire, immediately close the air controls and make sure the door is closed securely. Call the fire department and have everyone leave the house.

Do not attempt to extinguish the fire. Opening the door will only supply additional oxygen and intensify the fire. When the fire in the flue has subsided, resist the temptation to open the door to check on the fire. The fire may have suffocated, but could re-ignite with a supply of fresh air. After a chimney fire, do not use the stove until the chimney connector and flue have been cleaned and inspected to ensure no damage has been sustained.

See Section 6.6 of this manual regarding chimney cleaning.

5.11 Ash Removal

Ashes will drop through the bottom grate into the internal ash pan during normal operation. Empty the ash pan periodically, depending on how frequently the stove is used. Avoid letting the ash accumulation to spill over the pan and into the pan housing.

Always wear safety gloves when handling the ashes.

Ashes should only be placed in a metal container equipped with a tight sealing lid. The container should be placed on a noncombustible floor or on the ground, well away from all combustible materials, pending final disposal. If the ashes are disposed of by burial in soil or otherwise locally dispersed, they should be kept in the closed container until all cinders have thoroughly cooled.

Appendix A

EXAMPLE CALIBRATION/DATA FLOW

All individual test run raw data sheets are organized in a manner that would allow a data reviewer to follow the data as it is being calculated in a step by step fashion. In many cases, the equations used to calculate a specific required data are given on the raw data sheets themselves.

For example, the particulate emission rate in g/dscf is calculated on Data Sheet #7. However, the data used to derive this data begins on Data Sheet #2 (Meterbox Data Sheet) where the meter volume (cubic feet), average meter temperature (°F), average ΔH (in. H_2O), and average Barometric pressure (in. Hg) are recorded and averaged. Each of the averages for these parameters are used in equation 1 on P. 7 where the volume (MCF) is converted to dscf.

The moisture catch total (g. H_2O) on the Particulate Catch/Moisture Data sheet (p. 3) is transferred to P. 7 and the percent stack moisture is calculated in equations 2 and 3.

The gross and net gravimetric (g) particulate catches are determined and calculated on PP. 3-6. Pages 4-1, 4-2 and 4-3 show the initial (tare) constant weights for filters (p. 4-1) and beakers (p. 4-2) and the final constant weights (p. 4-3) for those filters and beakers used for each run. Final and tare weight data is transferred to P. 3 and the gross gravimetric (g) catch for each filter and beaker is calculated. On P. 5 the gravimetric catch for each blank is calculated. The gross gravimetric catch for each filter and beaker is transferred to P. 6 and the net gravimetric catch (g) is calculated, as well as front half and back half catch totals. The net gravimetric catch (g) is transferred to P. 7 and the grain loading/dscf is calculated in equation 4.

Some data sheet specific information is listed below on a page by page basis.

P. 8 The % ambient moisture is determined by interpolating from psychrometric charts which are contained in the State of Oregon Department of Environmental Quality's "Standard Method for Measuring the Emissions and Efficiencies of Woodstoves".

The % relative humidity is determined from the wet bulb/dry bulb temperature readings using the tables found in Section 3.1.2.4 of the State of Montana Air Quality Bureau's Quality Assurance Manual.

P. 10 The uncorrected moisture meter readings are corrected for pin insulation and may or may not be corrected for ambient (wood) temperatures. All corrections are based upon the correction equations or tables supplied by the moisture meter manufacturer. (These are standard, known corrections.)

P. 11 The moisture meter readings are corrected as discussed above.

P. 12 The gas concentrations shown for each gas monitored (CO_2, O_2, CO and SO_2) are determined by converting the analyzer's voltage output recorded on P. 12 to the concentration shown using the analyzer's current calibration curve. The SO_2 concentration is determined using the manufacturer's calibration curve and the current calibration curve.

The cal. W/B (calculated wet bulb) temperature is obtained by first determining the % moisture in the extracted flue gas stream using the temperature data from thermocouples 1 (Wet Bulb) and 2 (Dry Bulb). Then based upon the stack temperature (thermocouple 3) and the % moisture in the extracted gas stream, a calculated wet bulb temperature is determined. All data is derived from the psychrometric tables found in the State of Oregon's "Standard Method for Measuring the Emissions and Efficiencies of Woodstoves".

The following pages contain the equations used to generate the data on Tables 3-5 on the computer printouts:

Dry Gas Volume (standard):

$$V_{m(std)} = \frac{V_m * 17.65 * mcf * \left(P_{bar} + \frac{\Delta H}{13.6} \right)}{T_m}$$

Volume of Water:

$$V_{w(std)} = (0.04707)(ml\ H_2O)$$

Moisture Content:

$$B_{ws} = \left(\frac{V_w}{V_w + V_{m(std)}} \right) * 100$$

Dry Burn Rate:

$$Br = \left(\frac{Wwt - (Wwt * \%\ H_2O)}{2.2046} \right) * \frac{60}{\theta}$$

Carbon Balance (N_t):

$$Nt = \frac{K_3 Nc}{(YCO_2 + YCO + YHC)}$$

Stack Flow Rate (Q_{sd}):

$$Q_{sd} = K_4 N_t Br$$

Particulate Concentration (C_s):

$$C_s = \frac{M_n}{V_{m(std)}}$$

Particulate Emission Rate (E):

$$E = C_s Q_{sd}$$

Proportional Rate Variation (Pr):

$$Pr = \left(\frac{\theta S_i * V_{mi(std)}}{10 \sum_{i=1}^{n} [S_i * V_{mi(std)}]} \right) * 100$$

Where:

Br =	dry wood burn rate, kg/hr.
B_{ws} =	Water vapor in the gas stream, proportion by volume.
c_s =	Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, g/dscm (g/dscf).
E =	Particulate Emission Rate, g/hr.
ΔH =	Average pressure differential across the orifice meter (see Figure 5-2), mm H_20 (in. H_20).
K_3 =	1.0 lb/lb (English) 1000 g/kg (metric)
K_4 =	0.02406 dsm^3/g-mole(metric) 384.8 dscf/lb-mole (English)

m_n = Total amount of particulate matter collected, mg.

mcf = Dry gas meter correction factor.

N_c = Gram atoms of carbon/gram of dry fuel (lb/lb), equal to 0.0425.

N_t = Total dry moles of exhaust gas/Kg of dry wood burned.

P_r = Percent of proportional sampling rate.

P_{bar} = Barometric pressure at the sampling site, mm Hg (in. Hg).

Q_{sd} = Total gas flow rate, dscf/hr.

S_i = Concentration measured at the SO_2 analyzer for the "i^{th}" 5 minute interval, ppm.

S_1 = Concentration measured at the SO_2 analyzer for the first 5 minute interval, ppm

T_m = Absolute average DGM temperature (see Figure 5-2), °K (°R).

T_{std} = Standard absolute temperature, 293°K (528°R).

V_m = Volume of gas sample as measured by dry gas meter, dcm (dcf).

$V_{m(std)}$ = Volume of gas sample measured by the dry gas meter, corrected to standard conditions, dscm (dscf).

$V_{w(std)}$ = Volume of water vapor in the gas sample, corrected to standard conditions, scm (scf).

W_{wt} = Wet wood weight.

Y = Dry gas meter calibration factor.

Y_{CO} = Measured mole fraction of CO (dry).

Y_{CO2} = Measured mole fraction of CO_2 (dry).

Y_{HC} = Assumed mole fraction of HC (dry);
=0.0088 for catalytic woodheaters
=0.0132 for noncatalytic woodheaters
=0.0080 for pellet fired woodheaters

θ = Total sampling time, min.

13.6 = Specific gravity of mercury.

60 = Sec/min.

100 = Conversion to percent.

M5H PARTICULATE SAMPLING TRAIN

1. Probe

   3/8" seamless SS-20" long. Outlet end of probe is attached to a SS outlet fitting with a Sweglock SS union. The probe is unheated except for the portion that is in the stack and the heated filter box. The probe is sealed to the stack with a washer.

2. Filter Holder

   A 3" or 4" standard M5 filter holder. A SS filter support with gasket.

3. Filters

   3" or 4" fiber glass (#25 glass) manufactured by Schleicher and Schuell.

4. Front Half Filter Heater

   A box containing a fan for air circulation and a cone heater. The temperature in the box is monitored with a type K thermocouple and adjusted with a voltage regulator to maintain a temperature below 248 °F.

5. Desiccant

   Indicating silica gel, 6-20 mesh. The silica gel is changed as needed.

6. Filter (Back Half) Holder

   Same as front half 3" or 4" filter.

7. Impinger Gas

   Type K thermocouple threaded into the exit "arm" of the impinger. Ice is added to the cooler whenever necessary to maintain an exit gas temperature less than 68 °F.

8. Meterbox

   RAC Stack Sampler modified by EEMC

   Ranges: 0-1.0" inclined water manometer

   0-10.0" vertical water manometer

   Accuracy: Dry gas Meter 0-999.999 cu ft ±1.0%

   Temperatures are monitored using two type K thermocouples.

SAMPLING PROCEDURES AND INSTALLATION DESCRIPTION

This section is broken into two major parts. The first contains a brief description of the sampling and procedures used by LoKee Testing Laboratory when performing a test using EPA Methods 28, 28A and 5H. The second section contains a complete listing of all equipment in each of the major sampling trains and a diagram of each major train.

LoKee Testing Laboratory uses EPA M5H for the particulate sampling procedure and collects the required data so that efficiency of a unit can be calculated using the Oregon Method.

TEST FACILITY AND WOOD HEATER EQUIPMENT LIST

1. Flue Pipe

   The diameter of the 24 gauge black steel flue pipe used for each stove varies with the size of the stove's flue collar, e.g., 6" flue pipe is used with a 6" flue collar. The joint at the flue collar is sealed with mortar. The pipe is attached to the stove at the flue collar with three sheet metal screws. All sampling ports are sized for the sampling probes and sealed using washers.

2. Insulated Flue Pipe

   The diameter of the insulated flue pipe matches the diameter of the flue collar on the stove. The 6", 7" and 8" pipe meet the requirements of UL 103 HT. The SO_2 injection loop port is sealed with high temperature silicone sealant.

3. Liquid Seal

   The liquid (oil) seal used by LoKee varies in size with the flue pipe. The seals are made of 12 gauge steel. The liquid sealant is mineral oil. The cooler consists of 3/8" copper tubing which is coiled in the bottom of the lower half of the seal. Ambient air is pumped through this line when necessary to cool the seal.

4. Supports

   The lower half of the seal and the 24 gauge steel black flue pipe is supported by the stove. The upper half of the seal and the insulated flue pipe are hung from wooden supports.

5. Platform Scale

   Platform (30" X 30" deck)

   Manufacturer: Weightronics

   Model: platform: DS-014/SN 4479 readout: W1-110/SN 016409

   Type: Electronic

   Range: 0-1000 lb.

Capacity:	1000 lb.
Resolution:	±0.1 lb.
Accuracy:	±0.1%

6. Fuel Balance Scale

LoKee uses the platform scale listed above to weigh the fuel charges.

7. Fuel Storage Area

LoKee stores the fuel in a humidity and temperature regulated room.

8. Moisture Meter

LoKee has two moisture meters which it uses to determine wood moisture levels.

The primary meter is:

Manufacturer:	Delmhorst Instrument Co.	
Model:	RC-1C/SN 16152 with 26-E probe and #496 insulated pins.	
Type:	Electrical Resistance	
Resolution:	±0.1% moisture	
Ranges:	6-11%, 11-25%, 25-80%	
Accuracy:	Moisture	Content Accuracy
	6-12%	±0.5%
	12-20%	±1.0%
	20%-saturation point	±2.0%

Type of Calibration: The RC-1C is equipped with two potentiometers (Zero and Span) which are checked and adjusted on a daily basis. The unit is also checked with a calibration block.

Electrode and Pin Type: 26-E probe and #496 insulated pins

The backup moisture meter:

Manufacturer:	Delmhorst Instrument Co.	
Model:	G-30SN/2477 with 26-E probe and #496 insulated pins	
Type:	Electrical Resistance	
Resolution:	±0.1% moisture	
Accuracy:	Moisture	Content Accuracy
	6-12%	±0.5%
	12-20%	±1.0%
	20%-saturation point	±2.0%

Type of Calibration: Calibration is accomplished with an internal calibration point and a potentiometer. The calibration can also be checked against a calibration block.

Description of Operation: The pins are pounded into the wood to be sampled. The meter reading is recorded on Data Sheet #10 (Wood Moisture) or Data Sheet #11 (Density Determination). This is the uncorrected reading which is then corrected for pin insulation and, as needed, temperature using the correction tables for each parameter supplied by the manufacturer.

9. Temperature Monitors

The temperatures are monitored with Type K thermocouples. Each thermocouple's calibration is checked prior to use.

The thermocouple readout is an Omega Model 410B-K/SN 05/4475, with a range of -58 °F to 1999 °F (type K) and an accuracy of ±0.9 °C, which can be read at ±0.1 °F. EEMC reads and rounds to 1.0 °F. The single channel readout is interfaced with a manually operated selector switch that allows 24 channels to be monitored with the same readout. The thermocouples are attached to the test unit with sheet metal screws. The thermocouples monitoring internal stove temperature are sealed at the point of entry with sealant.

10. Draft Gauge

Manufacturer:	Dwyer
Model:	
Type:	Inclined Water Manometer
Range:	0-0.25" water
Resolution:	0.001" water
Accuracy:	±0.001" water (readability)

11. Anemometer

Manufacturer:	Dwyer
Model:	480 Vaneometer/SN S 222 D
Range:	0-400 FPM
Accuracy:	±5% of full scale from 0-1 FPM

12. Humidity Gauge

Manufacturer:	Bacharach
Model:	SAC
Type:	Sling Psychrometer
Range:	Wet Bulb: 30-110 °F
Dry Bulb:	30-110 °F
Resolution:	±1 °F
Accuracy:	±1 °F

13. Barometer

Manufacturer:	Princo Instruments, Inc.
Model:	NOVA 469

Type:	Mercury Barometer
Range:	20-32" Hg
Resolution:	0.01" Hg
Accuracy:	±0.01" when calibrated and installed as per the manufacturer's written operating instructions.

Equation 6.3.1a of the "Standard Methods for Measuring the Emissions and Efficiencies of Residential Wood Stoves" and equation #1 are programmed into a Hewlett Packard 15C calculator which first calculates stack gas flow rate and then the ΔH. The stack gas flow rate and ΔH are both recorded on Data sheet #2. The ΔH is used to set the flow rate through the dry gas meter at 5 minute intervals during the test.

In order to successfully maintain the correct sampling ratio, the following data is recorded on Data Sheet #2 (Meter Box Data Sheet): temperature (°F) at the SO_2 injection rotameter (Tr), pressure (inches H_2O) at the SO_2 injection rotameter (Pr), SO_2 injection rate (cc/min), barometric pressure (BP) (inches Hg), stack gas SO_2 concentration (ppm SO_2), sampling ratio (Sr), and the average dry gas meter temperature (°F). This data is entered into the HP15C, which is used to first calculate a stack gas flow rate (dscf) and then a ΔH for every sampling interval. The flow rate through the dry gas meter is adjusted and maintained by maintaining the appropriate ΔH.

CEM MONITORS

1. Calibration Gases

   LoKee uses vendor certified (±2.0%) calibration gases for each CEM. The concentrations purchased coincide with ranges specified in M5H. Upon receipt of the cylinder, the concentrations are verified with Method 3 (ORSAT) analysis.

2. Flow Regulators

   LoKee uses a variety of standard gas flow regulators to meter the flow of calibration gases from the cylinders.

3. Point of Injection

   Calibration gases are injected directly into the end of the probe. The line carrying the calibration gases from the cylinders is connected to the probe with a short piece of rubber tubing.

4. Sample Gas Conditioning System

   The combustion gas is conditioned with a train that is a duplicate of a M5H train. It contains the following components:

   SS probe

   Glass 4" M5H filter and holder in a heated box

4 1000 ml glass impingers

Glass 4" M5H filter and holder

Indicating silica gel

Type K thermocouple to monitor exit gas temperature

Thomas pump

5. Filters

The filters used are the same as EPA M5H filters.

6. Manifold and Exhaust

The gas stream is delivered to each analyzer through a manifold and flowmeter with the excess gases being routed to an exhaust.

7. CO Analyzer

Horiba PIR 2000/SN 408005

Nondispersive infrared (NDIR)

The gas stream flow is controlled by a SS flowmeter downstream of the analyzer. The calibrated range used is 0-10.0% by volume. The resolution is 0.01% CO. The manufacturer's specification given for linearity is ±1.0%.

8. CO_2 Analyzer

Horiba PIR 2000/SN 407069

The CO_2 analyzer is also a NDIR and is operated in exactly the same manner as the CO analyzer. The range of the CO_2 analyzer is 0-25.0% CO_2.

COMBUSTION GAS ANALYZER TRAIN OPERATING INSTRUCTIONS

A. Pretest Preparation, Checks and Audit Procedures

1. Clean the probe with acetone and a brush. Seal the end of the probe for a leak check.
2. Remove the filter holder from the sample box and change the filter.
3. Empty water from all the impingers in the train. Clean all impingers and fill the first 2 with 100 ml of water.
4. Remove the second filter holder from the train and change the filter.
5. Visually check the indicating silica gel in the fourth impinger. If it is visibly impacted by water, replace the silica gel with dry silica gel.
6. Turn on the pump and perform a leak check on the entire train. This is done by placing the exhaust line in water. A successful leak check is accomplished when no bubbles are detected.
7. Slowly release the plug from the probe to prevent any back flushing.
8. Turn off the pump.

9. Turn on the heat in the sample box. Adjust Variac voltage controller so that temperature in the sample box does not exceed 248 °F.
10. Open the bypass valve on the pump.
11. Connect the probe to the zero/span gas delivery line.
12. Turn on the zero gas and adjust the flow rate to 1.5 SCFH.
13. Wait until the zero gas has completely flushed the train and a stable reading is obtained.
14. Record the zero gas readings of the DVM on Data Sheets #15.
15. Turn off the zero gas at the cylinder.
16. Disconnect the zero/span gas delivery line from the zero gas cylinder.
17. Connect the zero/span gas delivery line to the span gas source for each analyzer.
18. Turn on the span gas and adjust the flow rate to 1.5 SCFH. Wait until a stable reading is obtained on each analyzer. Repeat until all three analyzers are spanned properly.
19. Record the span gas readings of the DVM. Record the analyzer's output and all other pertinent information Data Sheets #15.
20. Turn off the span gas at the cylinder.
21. Disconnect the probe from the zero/span gas delivery line.
22. Insert the probe in the stack.
23. Close the bypass valve on the pumps.
24. Approximately 15-20 minutes before the actual start of the test, turn on the pump and adjust the flow through each analyzer until the flow rate is 1.5 SCFH.

B. Operation During Testing

1. Monitor the flow rate to the analyzers periodically to maintain a flow rate of 1.5 SCFH. Make any necessary adjustments.
2. Record data as follows:
   a. At the start of each 5 minute data cycle, record the scale weight, wet bulb/dry bulb, stack gas temperature and static pressure on Data Sheet #12 (Gas Data).
   b. Record the combustion gas (CO_2, O_2 and CO) analyzer data and the SO_2 analyzer data on Data Sheet #12.
   c. Record the remainder of the temperature data.

C. Post Test Checks and Audit Procedures

1. Remove the probe from the stack. (Be careful when handling the probe as it can be quite hot.)
2. Seal the end of the probe.
3. Perform a leak check on the entire train.
4. Slowly release the plug from the end of the probe to prevent any back flushing.
5. Turn off the pump.

6. Open the bypass valve on the pump.
7. Connect the probe to the zero/span gas delivery line.
8. Turn on the zero gas and adjust the flow rate through each analyzer to 1.5 SCFH.
9. Wait until the zero gas has completely flushed the train and a stable reading is obtained from each analyzer.
10. Record the zero gas reading. Record each analyzer's output and all other pertinent information on Data Sheets #15.
11. Turn off the zero gas at the cylinder.
12. Disconnect the zero/span gas delivery line from the zero gas cylinder.
13. Connect the zero/span gas delivery line to the span gas source for each analyzer.
14. Turn on the span gas and adjust until the flow rate through each analyzer to 1.5 SCFH. Wait until the span gas has completely flushed the train and a stable reading is obtained on each analyzer.
15. Record the span gas reading. Record each analyzer's output and all other pertinent information on Data Sheets #15.
16. Turn off the span gas at the cylinder.
17. Disconnect the probe from the zero/span gas delivery line.

D. Determination of the Combustion Gas Train's Response Time

1. The response time of the combustion gas analyzer train is to be determined using the following procedures. It is best to determine the combustion gas analyzer train response time during the "charcoal phase" of a test burn so that CO levels are relatively stable.
   a. Leak check the combustion gas (CEM) analyzer train.
   b. Zero the CO analyzer using ambient air.
   c. Calibrate the CO analyzer.
   d. Insert the probe for the combustion gas analyzer train in the stack.
   e. Sample flue gas until a stable reading is obtained.
   f. Remove the probe from the stack, note the exact CO concentration as measured on the DVM and start a stop watch at the exact time of removal.
   g. Observe the stop watch and DVM. Record the length of time to initial response, i.e., when the CO levels begin to decline.
   h. Continue observing the stop watch and DVM. Record the time when the analyzer's output equals zero (0.000 v).
   i. Repeat steps d-h 2 or 3 times to verify results.

E. Calibration and Audit Procedures for the Combustion Gas Analyzers

1. Calibrate by presenting zero and span gases to each analyzer at the probe and through the entire sampling train. (See Sections 6.7.2 and 6.9 [M5H].) Record the responses on the appropriate calibration forms.
2. Immediately prior to and after each test run, present the zero and span gases to the analyzers through the entire sampling train as is discussed in section C. Record each analyzer's response on Data Sheets #15.
3. Calculate the ± concentration difference and the actual percent difference as follows using the zero and span gas values obtained in #2 above. All calculations are to be based upon the actual gas concentrations involved.

$$\pm \text{ Concentration Difference} = \text{Actual Conc (\%)} - \text{Std Conc (\%)}$$

$$\text{Zero \% Difference} = \frac{\text{Act Conc (\% or ppm)} - \text{Std Conc (\% or ppm)}}{\text{Full Scale Value (\% or ppm)}} * 100$$

$$\text{Span Act \% Difference} = \frac{\text{Act Response (\% or ppm)} - \text{Exp Response (\% or ppm)}}{\text{Full Scale Value (\% or ppm)}} * 100$$

Then refer to Section 4.2 and 4.3 (M5H) to determine whether the audits are acceptable or not.

TRACER GAS (SO_2) EQUIPMENT

1. SO_2 Injection Probe

   A circular SS loop about 4" in diameter is positioned in the center of the stack. The loop extends outside the stack and is connected to the line leading from the SO_2 injection rotameter with Sweglock fittings. The loop is inserted in the stack at 9.5 ±0.5 ft above the top of the scale.

2. Rotameter

   A rotameter that has been calibrated with a bubble tube. The rotameter is all glass, stainless steel and Teflon. The rotameter has a flow control mechanism which is set to the calibrated flow.

3. Temperature

   The temperature at the injection rotameter is measured with a type K thermocouple.

4. Injection Gas

   Pure SO_2, 99.999% pure, released from the cylinder through a SS regulator and shut off valve.

5. Calibration Gases

LoKee uses vendor certified calibration gases with traceability established in accordance with EPA Protocol #1 as specified in Section 3.3.1 and verified using EPA Method 6.

6. Sample Probe

3/8" SS tubing inserted at 13.5 ±0.5 feet above the platform scale. No obstructions are in the stack between the injection and sample probes.

7. Combustor

Lindberg tube furnace, Model 55035/SN 800125, range 0-2000 °F. The temperature in the tube furnace is monitored with a type K thermocouple and controlled with a Variac voltage regulator. Power adjustments are made as necessary to maintain temperature at 1425 °F ±25 °F.

8. Sample Condenser

The sample condenser consists of 3 modified M5 impingers immersed in a freezer.

A filter assembly

The exit gas temperature is monitored with a type K thermocouple.

9. Filter

A standard EPA M5H 3" or 4" filter.

10. SO_2 Analyzer

Horiba, PIR 2000/SN 403019

Nondispersive infrared (NDIR)

The analyzer is operated as per the manufacturer's instructions at a flow rate of 1.5 SCFH. The calibration range is 0-2500 ppm SO_2 at a resolution of ±25.0 ppm. The manufacturer's specification for linearity is ±1.0%. The voltage response is displayed on a DVM which is converted to ppm using the manufacturer's calibration curves.

11. Flow Control

Flow through the tracer gas sampling train is controlled by a SS flowmeter.

TRACER GAS TRAIN OPERATING INSTRUCTIONS

A. Pretest Preparation and Checks and Audit Procedures

1. Clean the probe with a brush. After cleaning, seal the end of the probe.

   Note: Do Not Use Acetone Or Other Organic Solvents To Clean The Probe Immediately Prior To Running A Test Or Conducting A Leak Check.

2. Turn on the tube furnace in order to insure that the unit is at the correct operating temperature (1425 °F) at the start of the test.
3. Remove all water and clean the impingers.
4. Change the filter.

5. Turn on the pump.
6. Perform a leak check on the entire tracer gas train. This is done by placing the SO_2 exhaust line in water. A successful leak check is accomplished when no bubbles are detected.
7. Slowly remove the plug from the end of the probe to prevent any back flushing.
8. Turn off the pump.
9. Bypass the pump.
10. Connect the probe to the zero/span delivery gas line.
11. Connect the zero/span gas delivery line to the zero gas cylinder and turn on the zero gas and adjust the flow until the flow rate through the SO_2 analyzer is 1.5 SCFH.
12. Wait until the zero gas has completely flushed the train.
13. Record the zero gas reading. Record the SO_2 analyzer's DVM output on Data Sheets #15.
14. Turn off zero gas at the cylinder.
15. Disconnect the zero/span gas delivery line from the zero gas cylinder.
16. Connect the zero/span gas delivery line to the span gas cylinder.
17. Turn on the span gas and adjust the flow until the flow rate through the SO_2 analyzer is 1.5 SCFH. Wait until the span gas has completely flushed the train and a stable reading is obtained on the analyzer.
18. Record the span gas reading. Record the analyzer's output and all other pertinent information on Data Sheets #15.
19. Turn off the span gas at the cylinder.
20. Disconnect the zero/span gas delivery line from the probe.
21. Insert the probe in the stack.
22. Close the bypass on the pump.
23. Approximately 15 to 20 minutes before the actual start of the test, turn on the SO_2 injection train and the pump for the tracer gas train.

B. Operation

1. Turn on the tube furnace to insure furnace is at approximately 1425 °F when the test begins.
2. Approximately 15-20 minutes before the actual start of the test, turn on the cylinder of pure SO_2.
3. Using the rotameter's current calibration, adjust the SO_2 flow rate to the calibrated level.
4. Turn on the pump in the tracer gas train. Adjust the flow rate through the SO_2 analyzer so that it remains at 1.5 SCFH.

5. Monitor the SO_2 concentrations in the stack and stack gas flow rates in order to establish a sampling ratio for the test and a correct ΔH at the start of the test.

6. At the start of the test and every 5 minutes thereafter, record the SO_2 analyzer output in volts and the stack gas SO_2 concentration in order to calculate the stack gas flow rate and determine the correct ΔH for the meter box.

   Also monitor and record the temperature at the Rotameter (Tr), pressure at the Rotameter (Pr), barometric pressure (BP) SO_2 injection rate (cc/min) and static pressure on Data Sheets #2 and #12.

C. Post Test Checks and Audit (Zero/Span) Procedures

1. Remove the probe from the stack. (Be careful when removing the probe from the stack as it can be quite hot.)
2. Plug the end of the probe.
3. Perform a leak check.
4. Slowly remove the plug from the end of the probe to prevent any back flushing.
5. Turn off the pump.
6. Bypass the pump.
7. Connect the probe to the zero/span gas delivery line.
8. Connect the zero/span gas delivery line to the zero gas cylinder. Turn on and adjust until the flow rate through the SO_2 analyzer is 1.5 SCFH.
9. Wait until the zero gas has completely flushed the train.
10. Record the zero gas reading. Record the SO_2 analyzer's DVM output on Data Sheet #15.
11. Turn off zero gas at the cylinder.
12. Disconnect the zero/span gas delivery line from the zero gas cylinder.
13. Connect the zero/span gas delivery line to the span gas cylinder.
14. Turn on the span gas and adjust the flow until the flow rate through the SO_2 analyzer is 1.5 SCFH. Wait until the span gas has completely flushed the train and a stable reading is obtained.
15. Record the span gas reading. Record the analyzer's output and all other pertinent information on Data Sheet #15.
16. Turn off the span gas at the cylinder.
17. Disconnect the zero/span gas delivery line from the probe.

D. Determination of Tracer Gas Train's Response Time

1. Zero and calibrate the SO_2 analyzer.
2. Prepare and leak check the tracer gas train as per A above.
3. Insert the probe in the stack which contains flue gas and SO_2 concentrations in the ranges normally encountered during wood stove testing.

4. Sample flue gas with SO_2 concentrations until a stable reading is obtained. It is best to determine the tracer gas train's response time during the "charcoal phase" of a test burn so that the SO_2 concentrations are as stable as possible.
5. Remove the probe from the stack, noting the exact SO_2 concentration as measured by the DVM and starting a stop watch at the exact time of removal.
6. Observe the stop watch and DVM. Record the length of time to the initial response, i.e., when the SO_2 levels begin to decline.
7. Continue observing the stop watch and DVM. Record the time when the SO_2 analyzer's output equals zero (0.000 v.).
8. Repeat steps 3-7 two or three times to verify results.

E. Calibration and Audit Procedures for the Tracer Gas (SO_2) Analyzer

1. Calibrate by presenting zero and span gases to the analyzer at the probe and through the entire sampling train. Record the responses on the appropriate calibration form.
2. Immediately prior to and after each test run, present the zero and span gases to the analyzer through the entire sampling train as is discussed in Sections A and C. Record the analyzer's response on Data Sheet #15.
3. Calculate the ± concentration differences and actual percent difference as follows using values obtained in #2 above as the expected response. All calculations are to be based upon the actual gas concentration involved.

$$\pm \text{ Concentration Difference} = \text{Actual Conc (\%)} - \text{Std Conc (\%)}$$

$$\text{Zero \% Difference} = \frac{\text{Act Conc (\% or ppm)} - \text{Std Conc (\% or ppm)}}{\text{Full Scale Value (\% or ppm)}} * 100$$

$$\text{Span Act \% Difference} = \frac{\text{Act Response (\% or ppm)} - \text{Exp Response (\% or ppm)}}{\text{Full Scale Value (\% or ppm)}} * 100$$

Then refer to Section 4.2 and 4.3 (M5H) to determine whether the audits are acceptable or not.

TEMPERATURE SENSING OPERATING INSTRUCTIONS

A. Operate the thermocouple readout selector switch and record the temperature for each thermocouple. All the temperature in the test facility should be approximately the same. Repair as necessary.

B. Check the operation and output of the thermocouple readout using the Omega NBS Traceable Thermocouple Simulator. The simulator is hooked up to thermocouple readout #23. Check the readout over its full range at 200 °F intervals. Record the data on Data Sheet #16.

C. One hour before the actual test start record stove temperatures (thermocouple readout #'s 4, 5, 6, 7 and 8), firebox (readout #9), post catalytic combustor or secondary burn chamber (readout #10), and room temperature (readout #11). Record the temperatures every 5 minutes until the start of the test on Data Sheet #13 (Preburn).

D. During the test record the temperatures every 5 minutes for each of the thermocouples on Data Sheets #12 and 14.

FUEL PREPARATION

A. No more than 4 hours prior to use, obtain 3 moisture readings from each piece of wood. Record all moisture readings on Data Sheet #10.

B. Obtain kindling by finely splitting pieces that otherwise cannot be used as test fuel. Weigh the kindling and record the weight on Data Sheet #8.

C. Obtain the pretest fuel by using 2 x 4's. The length of the pretest fuel can be no less than 1/3 the length of the test fuel. Weigh the pretest fuel prior to its being loaded in the stove. Record weights on Data Sheets #8 and #9.

D. Obtain the test fuel by cutting dimensional lumber (either 2 x 4's or 4 x 4's) so that the length is 5/6's the length of the longest usable dimension of the firebox. Use the mix of 2 x 4's and 4 x 4's specified in Section 4.3 M28. The test fuel shall be essentially free of knots, sap seams or rotten areas.

E. The spacers shall measure 1 x 5 x 1" (nominally). The spacers shall be free of knots, sap seams or rotten areas. Nail the spacers to the 2 x 4's and 4 x 4's as described in the regulations.

F. Take a photograph of the assembled fuel charge at a 90° angle from the photograph that will be taken when the fuel charge is loaded in the stove.

WOOD DENSITY DETERMINATION

A. When cutting the test fuel, cut a representative piece of 2 x 4 or 4 x 4 that is approximately 3 to 5-inches in length.

B. Take a moisture reading from the top, bottom and side of the piece. Record readings on Data Sheet #11. Determine the % moisture on a wet and dry basis.

C. Weight the piece on a balance.

D. Take measurements of width, depth and length at the four corners with a micrometer. Determine the volume of the piece. (Length x width x depth = Volume in cubic centimeters)

E. Dry the piece in an oven at 95-100 °C for a minimum of 24 hours.

F. Reweigh the piece on the balance.

G. Calculate % moisture on a dried basis.

$$\%\ \text{moisture (dry basis)} = 1 - \frac{\text{dried weight}}{\text{wet weight}} * 100$$

H. Calculate the density.

$$\text{Density (g / cc)} = \frac{\text{dried weight (g)}}{\text{volume (cc)}}$$

BTU'S/LB DETERMINATION

A. When cutting the test fuel (only the test fuel, not the kindling, pretest fuel or spacers), collect a sawdust sample. Place in a clearly marked plastic bag.

B. Forward sample to a commercial laboratory for BTU contents analysis.

STOVE PREPARATION

A. Clean the stove.

B. Weigh the stove, record the weight on Data Sheet #8.

C. Add approximately 0.3 lb. of wadded newspaper to the stove. Record weight of newspaper on Data Sheet #8. Add 4-8 lb. of kindling to the stove, and record the weight of the kindling on Data Sheet #8.

D. Light the paper and kindling, leaving the stove's air draft control(s) wide open and the door cracked until well ignited.

E. Close door.

F. When between 50% - 75% of the weight of the kindling has been burned add the first pretest fuel charge.

G. Continue to add pretest fuel until the stove has thoroughly warmed up. As necessary, rake the coal bed prior to adding additional pretest fuel charges.

H. Remove all material from the firebox after two or more hours of burning on high. Obtain the dry empty stove weight and record on Data Sheet #8.

I. Set the stove's air draft control(s) at the desired setting a minimum of 1 hour before the test run is to begin.

J. As necessary set the heat exchange blower(s) at the specified setting a minimum of one hour before the test is to begin.

K. Record the stove surface temperatures, firebox and post catalytic or secondary burn temperatures and scale weigh for a minimum of one hour before the test run begins. As necessary add fuel, rake the coal bed, level the coal bed and/or remove coals during the first 45 minutes of the hour immediately preceding the start of the test. Record all information concerning raking, fuel additions, etc. on Data Sheet #13.

L. If necessary, sometime during the last 15 minutes before the start of the test, open the door and brake up all large pieces and then rake and level the pretest fuel in the stove. At this time, level the coal bed as necessary to accommodate loading the fuel charge into the stove. Close the door. Total time door can be open during the last 15 minutes is 1 minute. No further manipulation of the stove is allowed during the 15 minutes immediately preceding the start of the test.

M. When the weight of the coal bed equals 20-25% of the weight of the test fuel charge, load the test fuel. Take a photograph of the fuel load in the stove immediately after loading the fuel. Leave the door open as per the manufacturer's instruction, but no longer than 5 minutes.

N. Document all stove operating data from ignition through loading and test start up on Data Sheet #9.


Jotul
Top Load
Run 1
8-25-2010


Jotul
Top Load
Run 1
8-25-2010


Jotul
Top Load
Run 2
8-26-2010


Jotul
Top Load
Run 2
8-26-2010


Jotul
Top Load
Run 3
8-27-2010


Jotul
Top Load
Run 3
8-27-2010

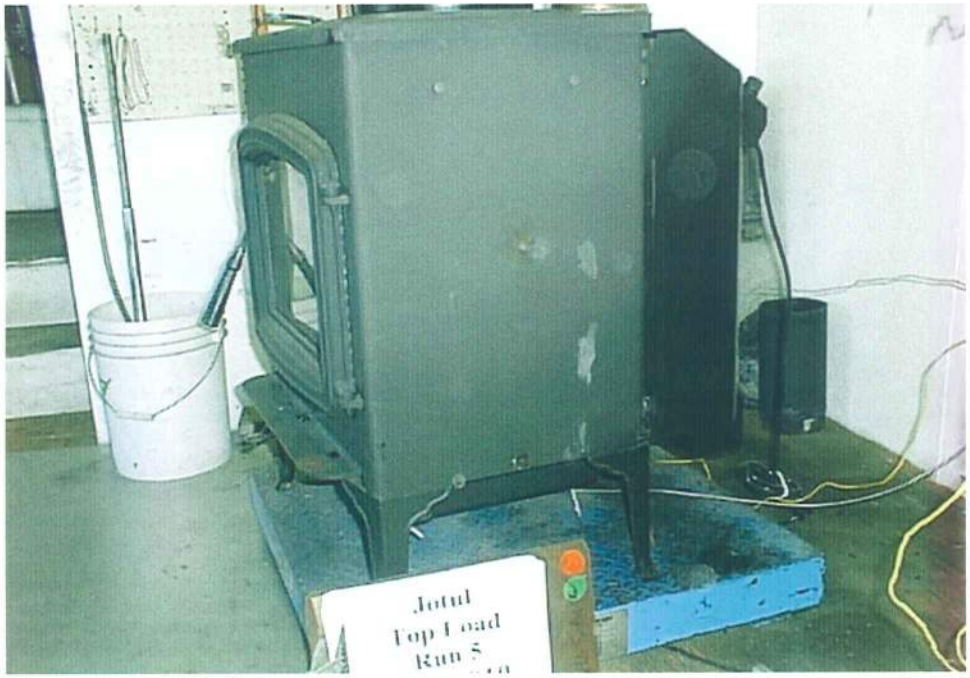

Jotul
Top Load
Run 4
8-30-2010


Jotul
Top Load
Run 4
8-30-2010


Jotul
Top Load
Run 5
8-31-2010


Jotul
Top Load
Run 5
8-31-2010


Jotul
Top Load


Jotul
Top Load
Run 5