LOKEE TESTING Laboratory

United States
Environmental Protection Agency
Wood Heater Certification Test Report

Jotul North America.

C550 CB

Volume 1 of 1

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

United States
Environmental Protection Agency
Wood Heater Certification Test Report

Jotul North America
55 Hutcherson Drive
Gorham, ME 04038
C550

Volume 1 of 1

Report By:

Chip Wadington

CONFIDENTIAL

RELEASED ONLY BY
AUTHORIZED PERSONNEL

9/22/2008

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TEST SERIES INFORMATION

Unit name and model number: C550

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: 5/7/2008 Aged:8/11+12/2007 Dates Tested: 8/25-28/2008

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: 500 feet above sea level

LoKee's Field Team

Team Members: Chip Wadington

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.

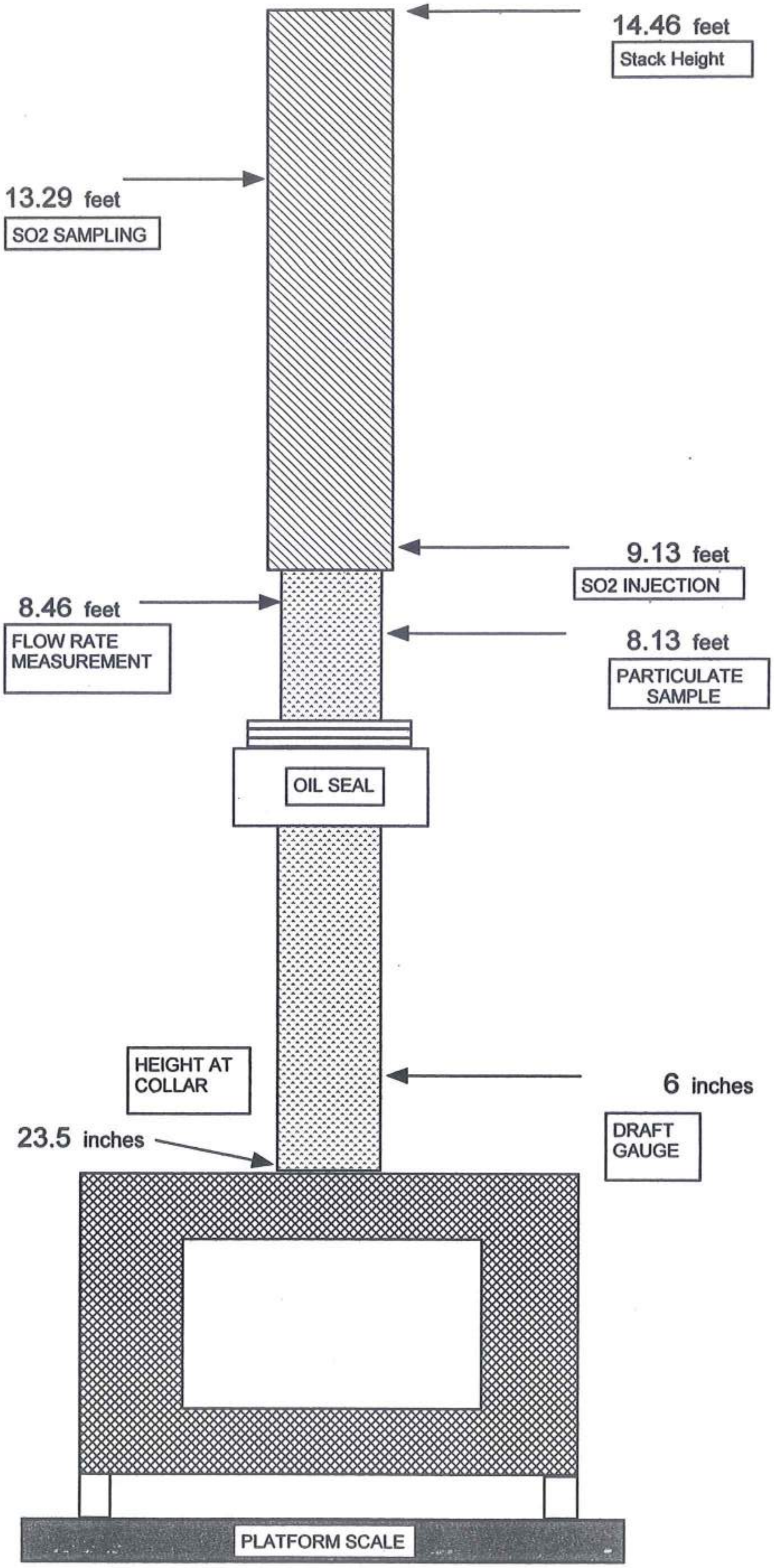
WARNING

SEALED EPA TEST UNIT

DO NOT TAMPER WITH SEALS
TO DO SO WILL VOID CERTIFICATION

JOTUL NORTH AMERICA
C550

Model: Jotul C550 **Date:** 08/28/08



AGING DATA SHEET

UNIT : C550 DATE: 8-11-2008

Hr #	DATE	TIME	TEMP Stack ~~Fbox~~ 1	TEMP Top ~~Stc~~ 2
1	8-11-08	1215	510	835
2	"	1315	234	476
3	"	1415	315	558
4	"	1515	324	656
5	"	1615	215	402
6	"	1715	184	314
7	"	1815	159	250
8	"	1915	147	220
9	8-12-08	1135	457	853
10	"	1235	242	472
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				
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COMMENTS:

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

August 10, 2008

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:C550

If you have any questions please feel free to call.

Sincerely,

Chip Wadington

Chip Wadington
Owner

LOKEE TESTING Laboratory

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

July 10, 2008

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 July 10, 2008 at 12:25 am PST, Irvin Keefer 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 C550

If you have any questions please feel free to call.

Sincerely,

Chip Wadington

Chip Wadington
Owner

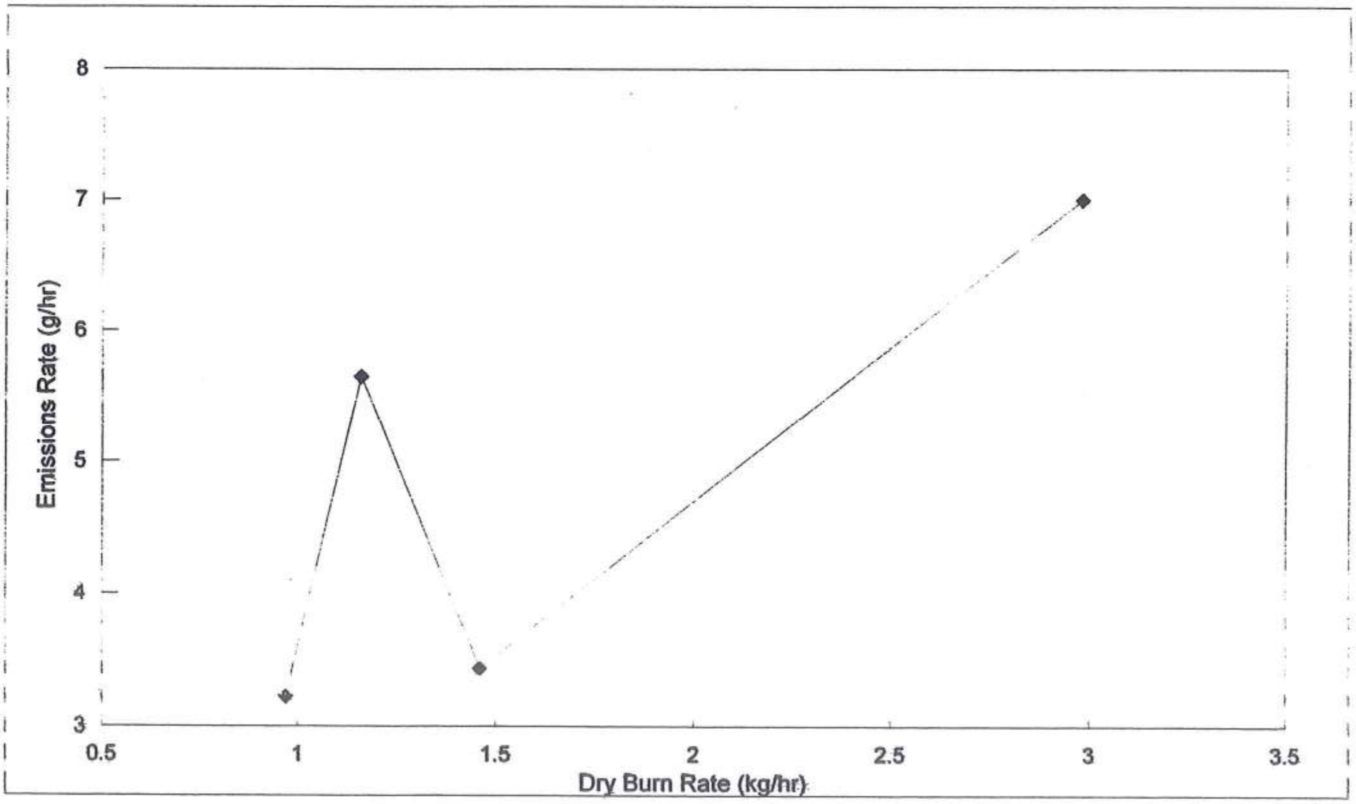
Data Summary

Wood Heater Emission Test Summary

Laboratory/Wood Heater Information

Stove Manufacturer:	Jotul
Model Identification:	C550
Stove Type> 1=cat, 2=noncat, 3=pellet:	2
Laboratory Name:	LoKee Testing
Laboratory Contact:	CHIP WADINGTON
Telephone no.:	360-897-9685
Test Dates:	8/25-28/2008
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) 4.47
1	0.970	3.22	11696	
4	1.160	5.65	13988	
2	1.460	3.43	17605	
3	2.980	7.00	35933	
			NA	
			NA	
			NA	
			NA	



DATA SUMMARY

Unit: Jotul-C550

	RUN #	1	4	2	3				
Particulate Emissions:									
Concentration:	grains/dscf:	.1229	.1904	.0856	.1179				
Emissions Rate	grams/hr:	3.22	5.65	3.43	7.00				
Emissions Factor	grams/kg:	3.32	4.88	2.35	2.35				
Front Half Catch	% of total	24.0	51.5	35.7	36.8				
Total Mass Captured	total catch:	.7372	.9372	.3726	.2083				
Heat Output (EPA Default):	BTU/hr	11720.6	13987.5	17580.9	35933.4				
Fuel Burn Rates:									
Average kg/hr (dry)	Kg/hr	.97	1.16	1.46	2.98				
Fuel Moisture Content:									
Kindling (wet basis)	%	11.348	12.867	12.229	11.269				
Pretest Fuel (wet basis)	%	17.378	16.225	16.435	16.225				
Test Fuel (wet basis)	%	16.458	16.957	16.541	17.533				
Air to Fuel Ratio		-	-	-	-				
Average Stack Gas									
Avg CO_2	%	5.8	6.52	6.32	9.83				
Avg O_2	%	-	-	-	-				
Avg CO	%	1.53	1.28	.86	.55				
Avg Moisture	%								
Avg Stack Gas Emissions:									
CO	g/Kg	213.44	169.13	121.63	56.83				
	g/hr	207.25	196.02	177.34	169.3				

Unit: Jotul-C550

	RUN #	1	4	2	3				
Avg Stack Gas Flow Rate									
EPA CMB	dscfm	6.73	7.63	10.3	15.28				
Tracer Gas	dscfm	6.458	7.413	8.507	10.914				
Draft (static)	in H_2O	-.036	-.044	-.045	-.056				
Proportionality Average	%	100	100	100	100	100	100	100	100
Average Temperatures									
Stack Gas	°F	232	251	278	472				
Firebox	°F	-	-	-	-				
Secondary	°F	-	-	-	-				
Catalytic Combustor	°F	-	-	-	-				
Top	°F	416	459	516	571				
Left Side	°F	254	276	293	396				
Back	°F	246	279	299	297				
Right Side	°F	298	308	348	434				
Bottom	°F	229	278	297	280				
Temperature Change	°F	-124.4	-32.3	-24.1	-64.3				
Test Chamber Enviroment									
Average Barometer	in. Hg	29.99	30.15	30.15	30.05				
Average Temperature	°F	77	78	73	82				
Ambient Moisture	% H_2O	1.55	1.75	1.3	1.5				
Relative Humidity	%RH	46.5	55.0	43.0	40.5				
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	3.0	3.5	3.4	3.1				
Pre Test Fuel (inc kindling)	lbs	46.5	42.9	44.0	45.7				
Test Fuel	lbs	14.1	14.1	13.8	14.6				
Burn Time	min	330	275	215	110				

MINIMUM DBR

TABLE 1 ----- RAW DATA

CLIENT : Jotul TEST No. : 1

MODEL: C550 DATE: 25-Aug-08

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	735.000	0.150	84	1.12	3.80	550
5	736.500	0.290	84	0.51	7.70	400
10	738.522	0.180	84	0.43	2.20	500
15	740.141	0.150	84	0.45	2.90	550
20	741.612	0.150	84	0.57	3.70	550
25	743.084	0.150	84	0.65	4.20	550
30	744.555	0.150	84	1.04	6.70	550
35	746.027	0.140	84	1.18	8.20	575
40	747.435	0.150	84	0.94	7.80	550
45	748.906	0.150	84	0.99	8.00	550
50	750.378	0.180	84	0.48	10.60	500
55	751.996	0.200	84	0.40	9.30	475
60	753.700	0.200	84	0.36	10.80	475
65	755.403	0.230	84	0.27	10.70	450
70	757.201	0.230	84	0.27	10.10	450
75	758.999	0.230	84	0.29	10.60	450
80	760.797	0.200	85	0.26	9.90	475
85	762.507	0.200	85	0.19	9.70	475
90	764.217	0.220	86	0.17	9.90	450
95	766.028	0.220	86	0.24	10.60	450
100	767.839	0.200	86	0.34	11.30	475
105	769.550	0.200	86	0.43	11.80	475
110	771.271	0.200	86	0.41	12.00	475
115	772.987	0.160	86	0.58	10.60	525
120	774.540	0.140	86	0.73	12.30	575
125	775.958	0.150	86	0.83	8.20	550
130	777.440	0.150	86	1.13	7.80	550
135	778.923	0.150	86	1.35	7.00	550
140	780.405	0.150	86	1.85	6.00	550
145	781.888	0.150	86	2.41	5.30	550
150	783.370	0.150	86	2.60	4.90	550
155	784.853	0.160	86	2.64	4.90	525
160	786.406	0.160	86	2.77	4.60	525
165	787.959	0.160	86	2.59	4.70	525
170	789.511	0.160	86	2.55	4.40	525
175	791.064	0.160	86	2.58	4.30	525

180	792.617	0.160	86	2.56	4.20	525
185	794.171	0.160	86	2.68	4.10	525
190	795.725	0.160	86	2.31	4.20	525
195	797.279	0.160	86	2.33	4.20	525
200	798.833	0.160	86	2.35	4.10	525
205	800.387	0.160	86	2.27	3.90	525
210	801.941	0.160	86	2.28	3.70	525
215	803.495	0.160	86	2.20	3.60	525
220	805.049	0.150	86	2.08	3.30	550
225	806.533	0.160	86	2.15	3.40	525
230	808.087	0.150	86	2.11	3.40	550
235	809.570	0.150	86	2.07	3.40	550
240	811.054	0.150	86	2.11	3.40	550
245	812.537	0.150	86	2.09	3.30	550
250	814.020	0.140	86	2.09	3.30	575
255	815.439	0.140	86	2.02	3.30	575
260	816.858	0.140	86	1.90	3.20	575
265	818.277	0.140	86	1.98	3.20	575
270	819.696	0.140	86	2.08	3.20	575
275	821.115	0.140	86	2.14	3.20	575
280	822.534	0.140	86	2.15	3.20	575
285	823.953	0.140	86	2.39	3.70	575
290	825.372	0.140	86	2.20	3.80	575
295	826.791	0.140	86	2.09	3.80	575
300	828.210	0.130	86	1.97	3.70	600
305	829.570	0.130	86	1.88	3.60	600
310	830.930	0.130	86	1.82	3.60	600
315	832.290	0.130	86	1.89	3.60	600
320	833.650	0.130	86	1.90	3.60	600
325	835.010	0.130	86	2.01	3.60	600
330	836.370	0.130	86	1.92	3.60	600

TABLE 2---RAW DATA

CLIENT : Jotul TEST No. 1

MODEL: C550 DATE: 25-Aug-08

****

METER CAL. FACTOR (Y) -------	0.94	Wt. WOOD BURNED(LB) -------	14.1	Lbs
BAROMETRIC PRESS.(Pb) -------	29.99 in Hg	WET,FUEL MOISTURE % -------	16.458	%
LEAK RATE POST (Lp) -------	0.003 cfm	Wt. PART. COLLECTED -------	0.7372	g
WATER VOL. (V1c) -------	130.8 Ml	METER VOLUME Vm -------	101.37	mcf
TEST TIME (MIN) -------	330 min	HC MOLE FRACTION -------	0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT : Jotul TEST No. 1

MODEL: C550 DATE: 25-Aug-08

****

AVG DELTA H	-------	0.16 in H_2O	AVG PRCNT CO	-------	1.53	%
AVG METER TEMP. Tm	-------	85 deg F	AVG PRCNT CO_2	-------	5.80	%
AVG PPM SO_2	-------	535 PPM	AVG BAL CO_2/CO	-------	3.79	%

TABLE 4 ----- CALCULATIONS

CLIENT :	Jotul	TEST No.	1
MODEL:	C550	DATE:	25-Aug-08

****

STD SAMPLE VOL. Vm(std) d) ------	92.50 dscf		STACK GAS FLOW Qsd -------	404.066	dscf/Hr
					&
				6.73	dscf/min
VOL. WATER VAPOR Vw(s td) -----	5.178 scf		PARTICULATE CONCTRT. C s ------	0.0080	g/dscf
PRCNT MSTR Bws -------	5.30 %		PARTC.EMISS. RATE E -------	3.22	g/Hr
BURN RATE BR -------	0.97 Kg/Hr		MOLES OF GAS PER Lb WOOD Nt ----	0.49	Lb-mole/Lb
CO EMISSION RATE -------	207.25	g/Hr	PART.EMISS. RATE ------	3.32	g/Kgdry fuel
		&			
	213.44	g/Kgdry fuel			

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Jotul | TEST No. : 1

MODEL: C550 | DATE: 25-Aug-08

	TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR		PROPRTN RATE VAR. AVERAGE	
	5	754.9	102		100	
	10	740.3	100			
	15	740.7	100			
	20	740.3	100			
	25	740.8	100			
	30	740.3	100			
	35	740.8	100			
	40	740.7	100			
	45	740.3	100			
	50	740.8	100			
	55	740.3	100			
	60	740.7	100			
	65	740.2	100			
	70	740.5	100			
	75	740.5	100			
	80	739.8	100			
	85	741.9	100			
	90	741.2	100			
	95	743.1	100			
	100	743.1	100			
	105	741.0	100			
	110	745.3	100			
	115	743.2	100			
	120	743.3	100			
	125	743.3	100			
	130	743.1	100			
	135	743.6	100			
	140	743.1	100			
	145	743.6	100			
	150	743.1	100			
	155	743.6	100			
	160	743.3	100			
	165	743.3	100			
	170	742.8	100			
	175	743.3	100			
	180	743.3	100			

185	743.8	100
190	743.8	100
195	743.8	100
200	743.8	100
205	743.8	100
210	743.8	100
215	743.8	100
220	743.8	100
225	744.1	100
230	743.8	100
235	743.6	100
240	744.1	100
245	743.6	100
250	743.6	100
255	743.8	100
260	743.8	100
265	743.8	100
270	743.8	100
275	743.8	100
280	743.8	100
285	743.8	100
290	743.8	100
295	743.8	100
300	743.8	100
305	743.8	100
310	743.8	100
315	743.8	100
320	743.8	100
325	743.8	100
330	743.8	100

COMPUTER INPUT DATA SHEET #1

Client: Jotul North America

Address: 55 Hutcherson

Gorham, ME 04038

3,22

Phone: 800-797-5912 Fax: 207-591-6623

Run No.: 1 Date of Test: 8-25-2008 Burn Rate: .97

Model No.: C550 ☒ min ☐ min-1.25 ☐ fan

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

Dry Gas Meter Y Factor: .940 (0.000) (Data Sheet #2) Post Leak Rate: .003 cfm (.000) (Data Sheet #2) Time: 330 min. (000) (Data Sheet #2)

Dry Gas Meter Volume: 101.370 cf (00.000) (Data Sheet #2)

Stack Flow: 6.458 dscfm (00.000) (Data Sheet #2) Δ H: .162 in. H_2O (.000) (Data Sheet #2)

Maximum Vac.: 3.0 (0.0) (Data Sheet #2) Barometric Pressure: 29.99 in. Hg (00.00) (Data Sheet #2)

H_2O Captured: 130.8 g (00.0) (Data Sheet #3)

Front Half Catch % Of Total: 24.0 % (00.0) (Data Sheet #6) Total Particulate Catch: .7372 g (0.0000) (Data Sheet #6)

Flue Gas Moisture: 6.2387 % (00.000) (Data Sheet #7)

Particulate Emission: .1229 gr/dscf (0.0000) (Data Sheet #7)

Relative Humidity: 46.5 % RH (00.0) (Data Sheet #8) Ambient Moisture: 1.55 % H_2O (0.00) (Data Sheet #8)

Preburn Fuel Wt.: 37.3 lbs. (00.0) (Data Sheet #8) Coal Bed Wt.: 3.0 lbs. (00.0) (Data sheet #8) Test Fuel Wt.: 14.1 lbs. (00.0) (Data sheet #8)

Heat Output (EPA Default): 11720.6 BTU/hr (00,000.0) (Data Sheet #8)

Kindling Fuel % Moisture (wet): 11.348 % (00.000) (Data Sheet #10) Pretest Fuel % Moisture (wet): 17.378 % (00.000) (Data Sheet #10)

Test Fuel % Moisture (dry): 19.700 % (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove]) Test Fuel % Moisture (wet): 16.458 %

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

Stack Static Pressure: -.036 in. H_2O (+/- .000) (Data Sheet #12)

Average Ambient Temperature: 77 °F (00) (Data Sheet #14) Stove Temperature Change: -124.4 °F (+/- 000.0) (Data Sheet #14)

Test start = TIME 1155

End = 1725

meter temp = 545

(320)

METER BOX DATA SHEET PAGE # 2

UNIT : Jotul C550 RUN : 1 DATE : 8-25-2008

Meter Box: 5H Y Factor: .940

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

15 " Hg @ .003 cfm ______ " Hg @ ______ cfm

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

ROTO: PRESS:	.19		SAMPLING RATIO: 20.5 : 1				BP: 30.00		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1155	735.000	——	6.253	.15	84	550	84	2.0
5	1200	736.500	——	8.597	.29	84	400	84	3.0
10	05	738.522	738.522	6.878	.18	84	500	84	2.0
15	10	740.141	740.141	6.253	.15	84	550	84	2.0
20	15	741.612	741.612	6.253	.15	84	550	84	2.0
25	20	743.084	743.084	6.253	.15	84	550	84	2.0
30	25	744.555	744.555	6.253	.15	84	550	84	2.0
35	30	746.027	746.027	5.981	.14	84	575	84	2.0
40	35	747.435	747.435	6.253	.15	84	550	84	2.0
45	40	748.906	748.906	6.253	.15	84	550	84	2.0
50	45	750.378	750.378	6.878	.18	84	500	84	2.0
55	50	751.996	751.996	7.240	.20	84	475	84	2.0
ROTO PRESS:		.19	TOTALS:	79.345	2.04	1008	BP.: 30.00		
60	1255	753.700	753.700	7.240	.20	84	475	84	2.0
65	1300	755.403	755.403	7.642	.23	84	450	84	2.0
70	05	757.201	757.201	7.642	.23	84	450	84	2.0
75	10	758.999	758.999	7.642	.23	84	450	84	2.0
80	15	760.797	760.797	7.227	.20	85	475	85	2.0
85	20	762.507	762.507	7.227	.20	85	475	85	2.0
90	25	764.217	764.217	7.614	.22	86	450	86	2.0
95	30	766.028	766.028	7.614	.22	86	450	86	2.0
100	35	767.839	767.839	7.213	.20	86	475	86	2.0
105	40	769.555	769.555	7.213	.20	86	475	86	2.0
110	45	771.271	771.271	7.213	.20	86	475	86	2.0
115	50	772.987	772.987	6.526	.16	86	525	86	2.0
			TOTALS:	88.013	2.49	1022	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	167.358	4.53	2030	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

UNIT: Jotol C550 RUN: 1 DATE: 8-25-2008

Meter Box: SH Y Factor: .940

Leak checks: 15 " Hg @ .001 cfm ______ " Hg @ ____ cfm

15 " Hg @ .003 cfm ______ " Hg @ ____ cfm

Inject SO² @ 100 cc/min. Nozzle : Probe @ 3/8 " od Initial Volume: 1.500

ROTO: PRESS:	.19		SAMPLING RATIO:	20.5		: 1	BP: 30.00		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1355	774.540	774.540	5.959	.14	86	575	86	2.0
125	1400	775.958	775.958	6.230	.15	86	550	86	2.0
130	05	777.440	777.440	6.230	.15	86	550	86	2.0
135	10	778.923	778.923	6.230	.15	86	550	86	2.0
140	15	780.405	780.405	6.230	.15	86	550	86	2.0
145	20	781.888	781.888	6.230	.15	86	550	86	2.0
150	25	783.370	783.370	6.230	.15	86	550	86	2.0
155	30	784.853	784.853	6.526	.16	86	525	86	2.0
160	35	786.406	786.406	6.526	.16	86	525	86	2.0
165	40	787.959	787.959	6.526	.16	86	525	86	2.0
170	45	789.511	789.511	6.526	.16	86	525	86	2.0
175	50	791.064	791.064	6.526	.16	86	525	86	2.0
ROTO PRESS:	.19		TOTALS:	75.969	1.84	1032	BP.:	29.98	
180	1455	792.617	792.617	6.522	.16	86	525	86	2.0
185	1500	794.171	794.171	6.522	.16	86	525	86	2.0
190	05	795.725	795.725	6.522	.16	86	525	86	2.0
195	10	797.279	797.279	6.522	.16	86	525	86	2.0
200	15	798.833	798.833	6.522	.16	86	525	86	2.0
205	20	800.387	800.387	6.522	.16	86	525	86	2.0
210	25	801.941	801.941	6.522	.16	86	525	86	2.0
215	30	803.495	803.495	6.522	.16	86	525	86	2.0
220	35	805.049	805.049	6.226	.15	86	550	86	2.0
225	40	806.533	806.533	6.522	.16	86	525	86	2.0
230	45	808.087	808.087	6.226	.15	86	550	86	2.0
235	50	809.570	809.570	6.226	.15	86	550	86	2.0
			TOTALS:	77.376	1.89	1032	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	153.345	3.73	2064	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

UNIT : Jotul C550 RUN : 1 DATE : 8-25-08

Meter Box: SH Y Factor: .940

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

15 " Hg @ .003 cfm ______ " Hg @ ______ cfm

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

ROTO: PRESS:	.19		SAMPLING RATIO: 80.5		: 1		BP: 29.98		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
240	1555	811.054	811.054	6.226	.15	86	550	86	2.0
245	1600	812.537	812.537	6.226	.15	86	550	86	2.0
250	05	814.020	814.020	5.955	.14	86	575	86	2.0
255	10	815.439	815.439	5.955	.14	86	575	86	2.0
260	15	816.858	816.858	5.955	.14	86	575	86	2.0
265	20	818.277	818.277	5.955	.14	86	575	86	2.0
270	25	819.696	819.696	5.955	.14	86	575	86	2.0
275	30	821.115	821.115	5.955	.14	86	575	86	2.0
280	35	822.534	822.534	5.955	.14	86	575	86	2.0
285	40	823.953	823.953	5.955	.14	86	575	86	2.0
290	45	825.372	825.372	5.955	.14	86	575	86	2.0
295	50	826.791	826.791	5.955	.14	86	575	86	2.0
ROTO PRESS:	.19		TOTALS:	72.002	1.70	1032	BP.: 29.98		
300	1655	828.210	828.210	5.707	.13	86	600	86	2.0
305	1700	829.570	829.570	5.707	.13	86	600	86	2.0
310	05	830.930	830.930	5.707	.13	86	600	86	2.0
315	10	832.290	832.290	5.707	.13	86	600	86	2.0
320	15	833.650	833.650	5.707	.13	86	600	86	2.0
325	20	835.010	835.010	5.707	.13	86	600	86	2.0
330	25	836.370	836.370	5.707	.13	86	600	86	2.0
335				39.949	.910	602			
340									
345				111.951	2.61	1634			
350						5728			
355				432.654	10.87				
			TOTALS:			85	MAX VACC =		3.0
TOTAL Cu Ft.		101.370	TOTALS:	6.458	.162	545	AVG. BP:	29.99	

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : C550 RUN : 1 DATE : 8-25-08

SCALE	WEIGHT
295.0 g	295.0
590.0 g	590.0
885.0 g	885.0

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

IMPINGER	# 1	# 2	# 3	# 4
FINAL WT	704.0	588.2	486.7	872.7
INITIAL WT	602.4	581.3	483.5	853.6
NET WT GRAMS	101.6	6.9	3.2	19.1

TOTAL CATCH : 130.8 GRAMS H_2O

FRONT HALF

FILTER #	138F	
FINAL WT g	.7050	
INITIAL WT g	.6164	
NET WT g	.0886	

BEAKER #	71
DESC.	ACETONE
FINAL WT g	104.2405
INITIAL WT g	104.1515
NET WT g	.0890
VOL. DESC. ml	110

BACK HALF

FILTER #	138B	
FINAL WT g	.4609	
INITIAL WT g	.3624	
NET WT g	.0985	

BEAKER #	72	73	74	75	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	104.0940	104.4158	107.5844	96.5328	
INITIAL WT g	103.8272	104.3550	107.5075	96.4665	
NET WT g	.2660	.0608	.0769	.0663	.1432
VOL. DESC ml	150	75	150	160	310

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 1-17-2008 Time : 1300 By : Cfs W.

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

Back Size: 8.2 cm Lot No. :

FILTER #	DATE: 1-22-08 FIRST WEIGHT	BY: Cf TIME	DATE: 1-23-08 SECOND WEIGHT	BY: Cf TIME	DATE: THIRD WEIGHT	BY: TIME
131F	.6219	1207	.6221	1410	✓	
132F	.6179	1208	.6180	1411	✓	
133F	.6197	1209	.6195	1412	✓	
134F	.6166	1210	.6166	1413	✓	
135F	.6199	1211	.6195	1414	✓	
136F	.6193	1212	.6193	1415	✓	
137F	.6182	1213	.6181	1416	✓	
138F	.6162	1214	.6164	1417	✓ ← R-1	
139F	.6159	1215	.6158	1418	✓	
140F	.6126	1216	.6126	1419	✓	

131B	.3596	1217	.3598	1420	✓	
132B	.3610	1218	.3611	1421	✓	
133B	.3624	1219	.3625	1422	✓	
134B	.3608	1220	.3607	1423	✓	
135B	.3598	1221	.3599	1424	✓	
136B	.3630	1222	.3631	1425	✓	
137B	.3650	1223	.3651	1427	✓	
138B	.3626	1224	.3624	1428	✓ ← R-1	
139B	.3634	1225	.3633	1429	✓	
140B	.3658	1226	.3657	1430	✓	

Checked by: Cfs W. Date: 2-15-08 Time: 1220

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
1-22-08	1200	Cf		68	47
1-23-08	1400	Cf		74	47

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date: 9-20-2007 Time: 1130 By: Cp W.

	DATE: 10-5-2007	BY: Cp	DATE: 10-6-07	BY: Cp	DATE:	BY:
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
51	104.8722	0945	104.8727	1431	✓	
52	107.4960	0946	107.4965	1432	✓	
53	105.7327	0947	105.7332	1433	✓	
54	107.3038	0948	107.3040	1435	✓	
55	93.4865	0949	93.4870	1436	✓	
56	106.8593	0951	106.8598	1437	✓	
57	97.4075	0953	97.4080	1438	✓	
58	96.8888	0954	96.8891	1439	✓	
59	105.3495	0955	105.3499	1440	✓	
60	98.1978	0957	98.1980	1441	✓	
61	99.3465	0958	99.3470	1443	✓	
62	97.8623	0959	97.8628	1444	✓	
63	93.2126	1000	93.2130	1445	✓	
64	104.7861	1001	104.7865	1446	✓	
65	98.4406	1002	98.4410	1447	✓	
66	96.5070	1003	96.5075	1450	✓	
67	106.2220	1004	106.2224	1451	✓	
68	94.1556	1005	94.1560	1452	✓	
69	108.9915	1006	108.9920	1453	✓	
70	107.4782	1007	107.4785	1454	✓	
71	104.1510	1008	104.1515	1455	✓	
72	103.8269	1009	103.8272	1456	✓ R-1	
73	104.3545	1010	104.3550	1457	✓	
74	107.5072	1011	107.5075	1458	✓	
75	96.4664	1013	96.4665	1459	✓	

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH	
10-5-07	0930	Cp		75	48	Checked by: C. Walmsley
10-6-07	1400	Cp		78	46	Date: 10-6-07
						Time: 1705

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : C55D RUN : 1 DATE : 8-25-08 Page : 1 of

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
71	8-26	0910	Cp	104.2401	8-27	0911	Cp	104.2405	8-28	0937	Cp				
72	8-26	0910	Cp	104.0935	8-27	0912	Cp	104.0940	8-28	0938	Cp				
73	8-26	0910	Cp	104.4250	8-27	0913	Cp	104.4207	8-28	0939	Cp	104.4162	8-29	1306	Cp
				104.4158	8-30	1035	Cp								
74	8-26	0910	Cp	107.5841	8-27	0914	Cp	107.5844	8-28	0940	Cp				
75	8-26	0910	Cp	96.5324	8-27	0915	Cp	96.5328	8-28	0941	Cp				

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
138F	8-25	1930	Cp	.7733	8-26	0905	Cp	.7273	8-27	0908	Cp	.7164	8-28	0935	Cp
				.7086	8-29	1305	Cp	.7045	8-30	1036	Cp	.7050	8-31	1020	Cp
138B	8-25	1430	Cp	.4639	8-26	0906	Cp	.4614	8-27	0909	Cp	.4609	8-28	0936	Cp

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	8-26-08	0900	Cp	78	43
2	8-27-08	0900	Cp	78	46
3	8-28-08	0930	Cp	78	46
4	8-29-08	1300	Cp	78	46
5	8-30-08	1030	Cp	78	46

Weighing Session	Date	Time	By	DB	%RH
6	8-31-08	1015	Cp	76	49
7					
8					
9					
10					

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 8-27-2008 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
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

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

;,08

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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 4-26-2007 Through 10-14-2007	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
99.9997	10.0001	1.0001	.0999	CP	4-26	0815	73	47
100.0002	10.0001	1.0000	.0999	CP	4-27	1400	78	46
99.9999	10.0000	1.0000	.1000	CP	4-29	1100	74	44
100.0003	10.0001	.9999	.1000	CP	5-1	1000	71	45
100.0003	10.0001	.9999	.1000	CP	5-7	1530	76	45
100.0001	9.9999	1.0000	.1000	CP	5-9	1400	78	46
100.0001	10.0000	1.0000	.0998	CP	5-13	1630	76	45
100.0002	10.0001	1.0000	.1000	CP	5-18	1350	77	46
100.0003	10.0001	1.0000	.0998	CP	5-21	1300	72	46
99.9999	10.0001	1.0000	.1000	CP	5-22	1600	78	46
99.9999	10.0001	1.0000	.0996	CP	6-5	1530	74	44
100.0000	10.0001	.9998	.0999	CP	6-7	1030	70	48
100.0000	10.0001	1.0000	.1000	CP	6-8	1000	68	47
99.9998	10.0004	1.0000	.1000	CP	6-9	1300	78	40
99.9997	10.0000	1.0000	.1000	CP	6-10	1530	78	49
100.0003	10.0002	1.0000	.0998	CP	6-11	0900	72	46
99.9998	10.0000	.9999	.0998	CP	6-12	2100	78	40
99.9998	9.9998	1.0000	.0998	CP	6-13	1600	74	47
99.9999	9.9999	1.0000	.0999	CP	6-14	1630	77	49
99.9999	10.0000	1.0000	.1000	CP	6-15	1430	75	48
100.0001	10.0007	1.0001	.1000	CP	6-19	1040	78	46
100.0000	10.0001	.9999	.0997	CP	6-20	1050	75	48
99.9996	9.9998	.9999	.0998	CP	8-29	1830	74	48
100.0002	10.0002	1.0001	.0999	CP	8-31	1000	78	46
99.9999	10.0002	1.0001	.1000	CP	9-1	1130	77	46
99.9999	10.0001	.9999	.0999	CP	9-4	1100	78	43
99.9997	9.9999	.9998	.0998	CP	9-5	1000	78	46
100.0000	10.0000	.9999	.0999	CP	9-6	1500	78	46
99.9997	10.0000	1.0000	.1000	CP	9-7	1745	78	43
100.0001	10.0000	1.0000	.0997	CP	9-8	1500	78	46
100.0002	10.0000	.9999	.1000	CP	10-5	0930	75	48
100.0003	10.0003	1.0000	.0999	CP	10-6	1400	78	46
100.0001	10.0000	1.0000	.0999	CP	10-8	1000	75	44
100.0002	10.0001	1.0000	.0999	CP	10-9	1130	78	46
100.0001	10.0002	.9999	.0997	CP	10-10	1500	74	44
99.9999	10.0000	1.0001	.0999	CP	10-11	1120	75	48
100.0000	9.9999	.9999	.0998	CP	10-12	1130	72	45
100.0003	9.9999	1.0000	.1000	CP	10-13	1030	78	46
99.9999	10.0000	1.0000	.1000	CP	10-14	1410	78	46

BLANK PROCESSING DATA SHEET # 5

UNIT : C550 RUN : 1 DATE : 8-25-08

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 Sparkletts 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: C550 RUN: 1 DATE: 8-25-08

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: .0886 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0886 g

BEAKERS: .0890 (Total Catch) g - 110 (ml Acetone) (.000007 g) (Blank Value / ml Acetone) = .0882 g
.0008

TOTAL FRONT HALF CATCH : .1768 g

BACK HALF CATCH

FILTERS: .0985 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0985 g

BEAKERS:

Acetone: .2660 (Total Catch) g - 150 (ml Acetone) (.000007 g) (Blank Value / ml Acetone) = .2649 g
.0011

Extract: .0608 (Total Catch) g - 75 (ml Dichloromethane) (.000019 g) (Blank Value / Dichloromethane) = .0594 g
(.0014)

Water: .1432 (Total Catch) g - 310 (ml Water) (.000018 g) (Blank Value / Water) = .1376 g
.0056

TOTAL BACK HALF CATCH : .5604 g

TOTAL CATCH : .7372 g

% FRONT HALF : 24.0 %

CALCULATIONS DATA SHEET # 7

UNIT: Jotul C550 RUN: 1 DATE: 8-25-2008

1) $$Vm\,(std) = \frac{(101.370\ Vm)(17.64)(.940\ mcf)\left(29.99\ "\ Hg + \frac{.162"\ H_2O}{13.6}\right)}{(545\ TmA)} = \frac{92.5312}{000.0000}\ dscf$$

2) $$Vw\,(std) = (.04707)(130.8\ ml\ H_2O) = \frac{6.1568}{00.0000}\ scf$$

3) $$Asw = \frac{(6.1568\ scf)}{(6.1568\ scf + 92.5312\ dscf)} = \frac{.0624}{.0000}\ Bws \times 100 = \frac{6.2387}{00.0000}\ \%\ H_2O$$

4) $$Cs = \frac{(.7372\ g.)}{(92.5312\ dscf)}(15.43) = \frac{.1229}{0.0000}\ gr\ /\ dscf$$

5) $$Estimated\ g\ /\ hr = \frac{(.7372\ g.)}{(92.5312\ dscf)}\left(\frac{6.458}{00.0000}\ dscfm\right)(60) = \frac{3.0871}{00.0000}\ g\ /\ hr$$

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 C550 RUN : 1 DATE : 8-25-2008

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

Wet Bulb / Dry Bulb

Pre : WB : 66 DB : 80 = 47 % RH 1.6 % H_2O

Post : WB : 64 DB : 78 = 46 % RH 1.5 % H_2O

Average : 46.5 % RH 1.55 % H_2O

Empty Stove Weight (lbs) : N/A w/ stack & oil seal : Wet : N/A Dry : 0.0

Kindling Weight (lbs) : Paper : .1 Wood : 2.2

Preburn Fuel Weight : 17.1 + 16.4 + 1.6 Total : 35.1

Kindling & Preburn Fuel Weight (wood only) (lbs) : Total : 37.3

Coal Bed Wt Range (lbs) : 3.5 - 2.9 Scale : 3.5 - 2.9

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

Lower : .20 × fuel weight : Always round UP to nearest tenth Actual Coal Bed Weight : 3.0

Maximum Coal Bed Removal (lbs) : (($\underset{\text{Upper}}{3.5}$ + $\underset{\text{Lower}}{2.9}$) ÷ 2) .25 = $\underset{\text{round down to nearest tenth}}{.8}$

Test Fuel (.75" × 1.5" × 5" spacers) = 18 pcs

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" × 4"	16	3	6.1	43.3
4" × 4"	16	2	8.0	56.7

Test Fuel Weight : 14.1 lbs

Estimated Dry Burn Rate :

$$\frac{14.1 - (14.1 \times .16430)}{2.2046} \times \frac{60}{\underset{\text{TIME}}{330}} = .972 \text{ kg / hr}$$

Estimated BTU's/hr : $19{,}140 \times \frac{63}{100} \times \frac{.972}{\text{DBR}} = 11720.6$ BTU's/hr

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

WOOD STOVE OPERATING DATA PAGE #9

Unit : Jotol C550 Run : 1 Date : 8-25-2008

FIRE STARTED: 0710

WARM UP AND PREBURN:

PRIMARY AIR : Set wide open for all warm-up / preburn fuel charges. Then set to 5/32" 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 25 sec.

TEST:

DOOR wide open during loading Ø min. 50 sec.

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

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

FAN:

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

ON / OFF first 30 minutes of test ON / OFF balance of test run

Fan speed set at LOW

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 10 or 16 inches.

1st warm up / pre-burn fuel charge (17.1 lbs.) added at 0728

2nd warm up / pre-burn fuel charge (16.4 lbs.) added at 0830

3rd warm up / pre-burn fuel charge (1.6 lbs.) added at 1130

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 C550 Run : 1 Date : 8-25-2008

Room Temperature : 71 °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	Average
1	2"x4"x8'	K	12.7	13.0	12.7	12.800
2						
3						
4	2"x4"x8'	P	18.9	21.2	18.8	19.6
5	2"x4"x8'	P	24.2	22.3	22.5	23.0
6	2"x4"x8'	P	20.9	20.2	20.3	20.5
7	2"x4"x8'	P				63.1
8	2"x4"x8'	P				
9						
10						
11						
12	2x4x16"	T	22.0	21.7	21.9	21.9
13	"	T	19.0	19.2	18.7	19.0
14	"	T	18.7	18.3	18.7	18.7
15	4x4x16"	T	18.6	19.7	19.1	19.1
16	"	T	20.0	20.1	20.1	20.1
17						98.3
18						
19						
20	Spacers	T	21.9	20.7	21.0	21.2

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	12.800 %	21.033 %	19.660 %
Wet Moisture % :	11.348 %	17.378 %	16.430 %

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 with meter corrected for temperature.

GAS DATA SHEET #12

WEIGHT: 3.0

DATE: 8-25-2008

UNIT: Jotul C550

RUN: 1

PAGE: 1 OF

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V..	CO	STATIC	SO_2PPM
0 / 1155	17.1	14.1	—	.151	3.7	.638	16.0	.111	1.12	.030	550
5 / 1200	16.3	13.3	8	.311	7.7	.504	12.6	.049	.51	.045	400
10 / 05	16.2	13.2	.1	.092	2.2	.727	18.2	.041	.43	.040	500
15 / 10	16.0	13.0	.2	.120	2.9	.693	17.4	.043	.45	.036	550
20 / 15	15.7	12.7	.3	.152	3.7	.660	16.5	.055	.57	.030	550
25 / 20	15.4	12.4	.3	.169	4.2	.637	16.0	.064	.65	.030	550
Fan 30 / 25	15.0	12.0	.4	.271	6.7	.522	13.1	.103	1.04	.040	550
35 / 30	14.3	11.3	.7	.329	8.2	.453	11.3	.117	1.18	.045	575
40 / 35	13.6	10.6	.7	.316	7.8	.478	12.0	.093	.94	.046	550
45 / 40	13.1	10.1	.5	.322	8.0	.468	11.7	.098	.99	.047	550
50 / 45	12.5	9.5	.6	.427	10.6	.389	9.7	.046	.48	.050	500
55 / 50	11.8	8.8	.7	.457	11.4	.356	8.9	.038	.40	.051	475
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.490	*****
60 / 55	11.3	8.3	.5	.397	9.9	.418	10.5	.034	.36	.051	475
65 / 1300	10.8	7.8	.5	.404	10.0	.417	10.4	.025	.27	.052	450
70 / 05	10.3	7.3	.5	.425	10.6	.393	9.81	.025	.27	.051	450
75 / 10	9.9	6.9	.4	.408	10.1	.412	10.3	.027	.29	.052	450
80 / 15	9.5	6.5	.4	.434	10.8	.388	9.7	.025	.26	.051	475
85 / 20	8.9	5.9	.6	.443	11.0	.384	9.6	.017	.19	.050	475
90 / 25	8.5	5.5	.4	.436	10.8	.392	9.8	.015	.17	.051	450
95 / 30	8.1	5.1	.4	.405	10.1	.416	10.4	.022	.24	.050	450
100 / 35	7.8	4.8	.3	.380	9.4	.464	11.6	.032	.34	.050	475
105 / 40	7.4	4.4	.4	.359	8.9	.456	11.4	.041	.43	.049	475
110 / 45	7.1	4.1	.3	.352	8.7	.464	11.6	.039	.41	.048	475
115 / 50	6.8	3.8	.3	.407	10.1	.404	10.1	.056	.58	.049	525
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.604	*****
120 / 55	6.4	3.4	.2	.338	8.4	.464	11.6	.072	.73	.049	575
125 / 1400	6.2	3.2	.2	.330	8.2	.468	11.7	.082	.83	.048	550
130 / 05	6.0	3.0	.2	.316	7.8	.472	11.8	.112	1.13	.046	550
135 / 10	5.8	2.8	.2	.282	7.0	.496	12.4	.134	1.35	.044	550
140 / 15	5.7	2.7	.1	.242	6.0	.516	12.9	.184	1.85	.041	550
145 / 20	5.6	2.6	.1	.214	5.3	.520	13.0	.240	2.41	.040	550
150 / 25	5.5	2.5	.1	.200	4.9	.532	13.3	.260	2.60	.038	550
155 / 30	5.4	2.4	.1	.197	4.9	.532	13.2	.263	2.64	.036	525
160 / 35	5.3	2.3	.1	.188	4.6	.488	12.2	.275	2.77	.036	525
165 / 40	5.2	2.2	.1	.190	4.7	.540	13.5	.259	2.59	.034	525
170 / 45	5.1	2.1	.1	.180	4.4	.552	13.8	.255	2.55	.033	525
175 / 50	5.1	2.1	.0	.176	4.3	.556	13.9	.258	2.58	.032	525
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.477	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	1.571	*****

GAS DATA SHEET #12

WEIGHT: 3.0 DATE: 8-25-2008

UNIT: C550 RUN: PAGE: OF

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
180 55	5.0	2.0	.1	.172	4.2	.561	14.0	.256	2.56	.033	525
185 1500	4.9	1.9	.1	.166	4.1	.560	14.0	.268	2.68	.032	525
190 05	4.8	1.8	.1	.171	4.2	.567	14.2	.230	2.31	.031	525
195 10	4.8	1.8	.0	.170	4.2	.570	14.3	.232	2.33	.030	525
200 15	4.7	1.7	.1	.167	4.1	.569	14.3	.234	2.35	.030	525
205 20	4.6	1.6	.1	.159	3.9	.585	14.6	.226	2.27	.030	525
210 25	4.5	1.5	.1	.151	3.7	.588	14.7	.227	2.28	.029	525
215 30	4.5	1.5	.0	.145	3.6	.595	14.9	.219	2.20	.029	525
220 35	4.4	1.4	.1	.135	3.3	.612	15.3	.207	2.08	.029	550
225 40	4.4	1.4	.0	.138	3.4	.605	15.1	.214	2.15	.028	525
230 45	4.4	1.4	Ø	.138	3.4	.614	15.3	.210	2.11	.028	550
235 50	4.3	1.3	.1	.138	3.4	.613	15.3	.206	2.07	.027	550
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.356	*****
240 55	4.2	1.2	.1	.138	3.4	.607	15.2	.210	2.11	-.026	550
245 1600	4.2	1.2	.0	.134	3.3	.616	15.4	.208	2.09	-.026	550
250 05	4.1	1.1	.1	.134	3.3	.616	15.4	.208	2.09	-.026	575
255 10	4.0	1.0	.1	.132	3.3	.615	15.4	.201	2.02	-.026	575
260 15	4.0	1.0	Ø	.128	3.2	.627	15.7	.189	1.90	-.026	575
265 20	3.9	.9	.1	.129	3.2	.620	15.5	.197	1.98	-.025	575
270 25	3.8	.8	.1	.130	3.2	.617	15.4	.207	2.08	-.025	575
275 30	3.8	.8	.Ø	.130	3.2	.618	15.5	.213	2.14	-.025	575
280 35	3.7	.7	.1	.131	3.2	.617	15.5	.214	2.15	-.025	575
285 40	3.6	.6	.1	.149	3.7	.588	14.7	.238	2.39	-.025	575
290 45	3.5	.5	.1	.152	3.8	.587	14.7	.219	2.20	-.024	575
295 50	3.5	.5	Ø	.152	3.8	.592	14.8	.208	2.09	-.024	575
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.303	*****
300 55	3.4	.4	.1	.147	3.7	.606	15.2	.196	1.97	-.023	600
305 1700	3.3	.3	.1	.144	3.6	.612	15.3	.187	1.88	-.023	600
310 05	3.3	.3	Ø	.143	3.6	.611	15.3	.181	1.82	-.023	600
315 10	3.2	.2	.1	.142	3.6	.612	15.3	.188	1.89	-.023	600
320 15	3.1	.1	.1	.141	3.6	.607	15.2	.189	1.90	-.023	600
325 20	3.1	.1	Ø	.144	3.6	.603	15.1	.200	2.01	-.023	600
330 25	3.0	Ø	.1	.142	3.6	.607	15.2	.191	1.92	-.023	600
335										-.161	
340											
345											
350											
355										-.820	
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-2.391	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.036	*****

PREBURN DATA SHEET #13

UNIT: Jotul C550 RUN: 1 DATE: 8-25-2008 PAGE: 1 of 2

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
0 9:40	4.3	—	421	722	439	432	486	569			83	-.053	PREBURN START: # ~ 8 UP
5 45	4.2	.1	344	679	436	434	484	553			77	-.050	COAL BED SCALE RANGE:
10 50	4.1	.1	310	637	430	432	479	536			77	-.049	3.5 → 2.9
15 55	4.0	.1	293	596	419	423	472	516			75	-.048	PRIMARY AIR: 5/32"
20 1000	3.9	.1	279	561	409	413	464	494			74	-.046	SECONDARY AIR: N/A
25 05	3.8	.1	270	535	396	403	455	478			73	-.045	FAN: Low
30 10	3.7	.1	263	514	386	393	448	465			72	-.044	PUMPS ON AT:
35 15	3.6	.1	258	497	376	385	442	456			73	-.043	CHECK WB/DB: N/A
40 20	3.5	.1	253	485	368	379	438	446			72	-.040	
45 25	3.4	.1	250	473	360	374	432	437			72	-.041	
50 30	3.3	.1	246	463	352	369	424	431			71	-.041	407
55 35	3.2	.1	243	455	345	365	420	420			71	-.040	
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	
60 40	3.1	.1	241	447	340	361	415	412			71	-.040	395
65 45	3.0	.1	238	440	332	356	408	399			71	-.040	
70 50	2.8	.2	236	434	328	353	404	394			71	-.039	383
75 55	2.7	.1	239	427	326	449	398	385			71	-.038	
80 1100	2.7	.0	228	417	322	347	394	380			73	-.036	372
85 05	2.6	.1	221	405	317	338	388	374			74	-.036	364
90 10	2.6	.0	217	394	313	326	380	362			75	-.035	355
95 15	2.5	.1	209	382	307	315	371	354			74	-.033	345
100 20	2.5	.0	193	366	300	303	360	340			75	-.031	333
105 25	2.4	.1	189	356	296	296	352	331			75	-.031	326 (+1.61 lbs)
110 30	4.0	0	193	341	290	286	342	317			75	-.030	
115 35	3.7	.3	192	334	284	277	334	306			74	-.029	

PREBURN DATA SHEET #13

UNIT: C550 RUN: 1 DATE: 8-25-08 PAGE: 2 of 2

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
120 / 1140	3.5	.2	231	376	279	268	326	297			75	-.030	PREBURN START: #
125 / 45	3.2	.3	289	505	273	265	323	290			75	-.045	UP .8
130 / 50	3.1	.1	290	570	271	261	323	284			75	-.044	COAL BED SCALE RANGE:
/ 55	3.0	.1	273	529	273	262	323	283			76	-.043	3.5 → 2.9
/ 1200													PRIMARY AIR: 5/32"
/ 05													SECONDARY AIR: N/A
/ 10													FAN: LOW
/ 15													PUMPS ON AT:
/ 20													CHECK WB/DB:
/ 25													
/ 30													
/													
/													
*****	****	***	****	*****	*****	****	*****	*****	*****	*****	*****	****	
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Jotul C550 Temperatue Data Sheet 14 Run 1

8/25/08

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	273	529	273	262	323	283	######	######	76	1348	243	52	238	34	37
5	401	501	270	261	326	310	######	######	78	1349	242	42	237	34	37
10	256	462	269	266	320	314	######	######	77	1350	242	41	239	35	37
15	224	418	267	265	313	311	######	######	76	1350	242	42	239	35	37
20	212	388	261	257	305	307	######	######	76	1349	242	42	239	35	37
25	210	372	256	252	296	302	######	######	77	1348	243	43	239	38	37
30	232	381	250	246	289	296	######	######	75	1345	243	43	239	37	38
35	254	394	247	249	283	269	######	######	75	1343	243	44	239	37	38
40	289	464	245	247	279	255	######	######	75	1341	243	44	240	37	38
45	275	473	243	247	277	244	######	######	75	1341	244	44	240	38	38
50	315	552	242	245	279	237	######	######	75	1340	244	44	240	38	38
55	336	601	241	245	285	230	######	######	75	1340	244	44	241	38	38
60	334	603	243	247	292	225	######	######	77	1340	245	44	242	38	38
65	334	601	247	247	297	221	######	######	77	1341	245	44	243	38	38
70	338	617	252	246	300	220	######	######	76	1343	245	44	243	38	39
75	335	628	257	248	302	218	######	######	77	1343	245	44	244	38	39
80	329	624	262	252	305	216	######	######	78	1344	244	45	245	38	39
85	331	640	268	259	310	216	######	######	78	1344	244	45	245	38	39
90	333	657	270	267	316	216	######	######	78	1345	243	45	246	38	39
95	329	650	275	275	322	216	######	######	78	1345	243	46	246	38	39
100	322	632	279	282	327	217	######	######	78	1346	243	46	247	37	39
105	313	612	282	288	332	218	######	######	78	1348	243	46	247	37	39
110	307	597	284	292	335	219	######	######	79	1349	243	47	247	37	39
115	308	595	286	295	337	219	######	######	79	1350	242	47	247	37	39
120	306	602	291	298	339	220	######	######	79	1353	242	48	247	37	39
125	298	604	293	300	341	225	######	######	79	1356	243	48	247	37	39
130	291	584	295	297	343	236	######	######	79	1358	244	48	247	37	39
135	274	557	295	292	345	244	######	######	79	1361	246	49	247	37	39
140	256	524	296	288	346	253	######	######	79	1364	244	48	247	37	38
145	244	496	295	284	347	261	######	######	79	1367	242	49	247	37	38
150	235	470	294	280	346	265	######	######	79	1369	241	49	247	37	37
155	227	450	292	276	344	267	######	######	79	1370	239	49	247	38	37
160	221	431	290	273	341	268	######	######	80	1371	239	49	247	38	37
165	217	414	287	269	338	268	######	######	79	1372	238	49	247	38	37
170	212	401	284	265	335	267	######	######	79	1372	237	50	247	37	37

175	208	390	280	262	331	265	######	######	79	1373	236	50	246	37	36
180	205	377	277	259	327	262	######	######	79	1373	235	50	247	37	36
185	202	368	274	255	323	259	######	######	80	1373	235	50	246	36	36
190	198	359	271	252	319	255	######	######	79	1374	234	51	246	36	35
195	195	351	269	249	316	251	######	######	79	1374	234	51	246	36	35
200	193	343	266	246	312	247	######	######	79	1374	234	51	245	35	35
205	190	338	263	243	309	244	######	######	79	1374	234	52	245	35	35
210	188	330	259	240	305	241	######	######	79	1374	233	52	245	35	35
215	185	324	256	238	302	237	######	######	79	1374	233	52	244	35	35
220	183	317	251	235	298	232	######	######	77	1374	232	52	244	35	35
225	181	311	248	231	293	225	######	######	76	1372	231	52	243	34	34
230	179	304	246	228	288	220	######	######	76	1371	231	52	243	34	34
235	176	299	242	225	284	215	######	######	76	1370	230	51	243	34	34
240	174	294	240	222	280	209	######	######	76	1369	230	51	242	34	34
245	173	289	237	220	276	204	######	######	75	1369	230	51	242	34	34
250	171	285	233	218	272	199	######	######	75	1368	229	51	242	34	34
255	169	280	230	217	268	196	######	######	75	1367	229	51	241	33	34
260	167	275	228	215	265	192	######	######	74	1367	228	51	241	33	34
265	165	270	225	214	261	188	######	######	73	1367	228	52	240	33	34
270	163	265	222	213	257	185	######	######	73	1366	229	52	240	33	34
275	161	260	220	212	254	182	######	######	74	1366	231	52	240	33	34
280	159	254	217	212	252	178	######	######	73	1366	232	52	239	33	34
285	159	251	215	213	249	175	######	######	73	1365	233	52	239	33	34
290	158	249	213	212	248	173	######	######	74	1364	234	52	238	33	33
295	158	248	212	210	247	172	######	######	73	1362	235	53	238	33	33
300	157	247	211	207	246	172	######	######	73	1361	237	53	237	33	33
305	157	245	209	205	245	171	######	######	73	1360	238	53	237	33	33
310	156	245	209	202	244	170	######	######	73	1360	238	53	237	33	33
315	155	243	207	200	243	169	######	######	73	1361	239	53	237	33	33
320	155	242	207	199	241	168	######	######	73	1361	240	53	237	32	33
325	155	241	206	198	240	167	######	######	73	1361	240	57	237	32	33
330	155	240	206	197	239	167	######	######	74	1361	241	58	236	32	33

TEMPERATURE DATA SHEET #14A

TEST TIME 330

STACK AVG	232	TOP AVG	416	LT SIDE AVG	254
BACK AVG	246	RT SIDE AVG	298	BOTTOM AVG	229
FIREBOX AVG	########	SEC/CAT AVG	########	AMBIENT AVG	77

END	209.7	
START	334.1	
	-124.4	DELTA T

CIRCLE: LOSS / GAIN

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 8-21-2008 Analyte : CO_2 (15-1)

Unit : Jotul C550 Run # : 1

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 % CO_2 Cyl. Press. : 700 PSI

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

Span Cyl. # : 487905 Conc. : 12.20 % CO_2 Cyl. Press. : 1100 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 : Cfp Washington Time : 1000 Temp : 80 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-.007	-.007	-.027
SPAN	48.8	.488	12.20	48.8	.488	12.185	-.015	-.062

POST RUN Audit : by : Cfp Washington Time : 1740 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	-.032	-.032	-.127
SPAN	48.8	.488	12.20	48.7	.487	12.160	-.040	-.161

± 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 - - 2008 Analyte : O_2 (15-2)

Unit : Jotul C550 Run # : 1

Zero Cyl. # : 168TAC 3A Conc. : 0.00 % O_2 Cyl. Press. : 700 PSI

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

Span Cyl. # : 487905 Conc. : 12.60 % O_2 Cyl. Press. : 1700 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 : Cp Washington Time : 1000 Temp : 80 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-.030	-.030	-.121
SPAN	12.60	.504	12.6	12.6	.504	12.608	.008	.033

POST RUN Audit : by : Cp Washington Time : 1740 Temp : 72 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.002	.020	.020	.079
SPAN	12.60	.504	12.6	12.6	.505	12.633	.033	.133

± 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 : 8-21-2008 Analyte : CO (15-3)

Unit : Jotul C550 Run # : 1

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 % CO Cyl. Press. : 700 PSI

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

Span Cyl. # : C487905 Conc. : 4.90 % CO Cyl. Press. : 1700 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 : Cp Washington Time : 1000 Temp : 80 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.023	.023	.225
SPAN	49.0	.490	4.90	49.0	.490	4.897	-.003	-.028

POST RUN Audit : by : Cp Washington Time : 1740 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	.023	.023	.225
SPAN	49.0	.490	4.90	49.1	.491	4.907	.007	.071

± 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 - 21 - 2008 Analyte: SO_2 (15-4)

Unit: Jotul C550 Run #: 1

Zero Cyl. #: 168TAC 3-A Conc.: 0.00 ppm SO_2 Cyl. Press.: 700 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: Cp Washington Time: 1000 Temp: 80 °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	.424	.424	.017
SPAN	50.0	.500	1250	50.0	.500	1256.4	6.400	.256

POST RUN Audit: by: Cp Washington Time: 1740 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	-.001	-2.088	-2.088	-.084
SPAN	50.0	.500	1250	50.2	.502	1261.4	11.400	.456

± 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 C550 RUN: ______ DATE: 8- -2008

Thermocouple Check:

T/C # 1	—	°F	T/C # 13	72.0	°F
T/C # 2	—	°F	T/C # 14	70.4	°F
T/C # 3	71.5	°F	T/C # 15	71.6	°F
T/C # 4	69.4	°F	T/C # 16	76.4	°F
T/C # 5	69.0	°F	T/C # 17	71.8	°F
T/C # 6	68.4	°F	T/C # 18	72.2	°F
T/C # 7	68.8	°F	T/C # 19	71.6	°F
T/C # 8	68.3	°F	T/C # 20	—	°F
T/C # 9	—	°F	T/C # 21	—	°F
T/C # 10	—	°F	T/C # 22	—	°F
T/C # 11	69.8	°F	T/C # 23	—	°F
T/C # 12	72.8	°F	T/C # 24	—	°F

Thermocouple Readout:

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

ZERO 0.0 °F Adj. to 0.0 °F ZERO .4 °F Difference .020 %

SPAN 2001.6 °F Adj. to 2000.0 °F SPAN 1998.9 °F Difference .055 %

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 200.2 °F	400	= 399.8 °F
600	= 599.7 °F	800	= 799.7 °F	1000	= 999.7 °F
1200	= 1199.6 °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: 13.5 − 3.5 = 10.0

Post: 12.6 − 2.6 = 10.0

Stack Cleaned Prior to Test Run: YES X NO ______

TABLE 1 ----- RAW DATA

CLIENT : Jotul TEST No. : 4

MODEL: C550 DATE: 26-Aug-08

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	941.500	0.150	80	1.05	3.50	450
5	943.000	0.480	80	0.40	3.20	250
10	945.732	0.170	80	0.45	2.80	425
15	947.341	0.150	81	0.47	3.20	450
20	948.867	0.170	81	0.61	8.00	425
25	950.483	0.170	81	0.55	6.40	425
30	952.098	0.150	81	0.78	7.30	450
35	953.624	0.150	81	0.74	6.20	450
40	955.150	0.130	81	1.39	13.10	475
45	956.596	0.130	81	1.16	11.00	475
50	958.041	0.130	81	1.16	11.90	475
55	959.487	0.130	81	0.80	10.90	475
60	960.933	0.150	81	0.75	8.70	450
65	962.458	0.130	84	0.67	8.90	475
70	963.920	0.150	85	0.53	9.40	450
75	965.469	0.130	86	0.70	9.30	475
80	966.941	0.140	86	0.60	9.40	450
85	968.495	0.140	86	0.49	9.50	450
90	970.050	0.160	86	0.50	9.60	425
95	971.695	0.140	86	0.49	9.20	450
100	973.249	0.140	86	0.41	9.60	450
105	974.804	0.140	86	0.65	9.20	450
110	976.358	0.130	86	0.76	8.40	475
115	977.830	0.120	86	0.85	7.70	500
120	979.229	0.120	87	0.97	7.50	500
125	980.637	0.120	87	1.13	7.10	500
130	982.045	0.120	87	1.22	7.00	500
135	983.453	0.120	87	1.06	7.30	500
140	984.861	0.120	87	1.36	7.00	500
145	986.269	0.120	87	1.33	6.90	500
150	987.676	0.120	87	1.43	6.40	500
155	989.084	0.120	87	1.25	6.40	500
160	990.492	0.120	87	1.31	6.10	500
165	991.900	0.120	87	1.71	5.60	500
170	993.308	0.120	87	2.01	5.30	500
175	994.715	0.120	87	2.02	5.30	500

180	996.123	0.130	87	2.18	5.20	475
185	997.605	0.130	87	2.09	4.90	475
190	999.087	0.130	87	2.08	4.70	475
195	1000.569	0.130	87	2.04	4.60	475
200	1002.051	0.130	87	2.01	4.50	475
205	1003.533	0.130	87	2.11	4.20	475
210	1005.015	0.130	87	2.14	4.20	475
215	1006.496	0.130	87	2.02	4.10	475
220	1007.978	0.130	87	2.07	4.00	475
225	1009.460	0.130	87	2.12	3.90	475
230	1010.942	0.130	87	1.97	3.80	475
235	1012.424	0.130	87	1.50	5.30	475
240	1013.906	0.130	87	1.60	4.90	475
245	1015.387	0.130	87	1.76	4.80	475
250	1016.869	0.130	87	1.72	4.70	475
255	1018.351	0.130	87	1.76	4.50	475
260	1019.833	0.130	87	1.74	4.50	475
265	1021.315	0.130	87	1.66	4.40	475
270	1022.797	0.130	87	1.86	4.20	475
275	1024.278	0.130	87	1.37	5.20	475
280						

TABLE 2---RAW DATA

CLIENT :	Jotul	TEST No.	4
MODEL:	C550	DATE:	26-Aug-08

****

METER CAL. FACTOR (Y) -------	0.94		Wt. WOOD BURNED(LB) -------	14.1	Lbs
BAROMETRIC PRESS.(Pb) -------	30.15	in Hg	WET,FUEL MOISTURE % -------	16.957	%
LEAK RATE POST (Lp) -------	0.015	cfm	Wt. PART. COLLECTED -------	0.9372	g
WATER VOL. (V1c) -------	126.8	Ml	METER VOLUME Vm -------	82.778	mcf
TEST TIME (MIN) -------	275	min	HC MOLE FRACTION -------	0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT : Jotul   TEST No. 4

MODEL: C550   DATE: 26-Aug-08

****

AVG DELTA H	-------	0.14	in H2O	AVG PRCNT CO	-------	1.28	%
AVG METER TEMP. Tm	-------	85	deg F	AVG PRCNT CO2	-------	6.52	%
AVG PPM SO2	-------	468	PPM	AVG BAL CO2/CO	-------	5.10	%

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul | TEST No. 4

MODEL: C550 | DATE: 26-Aug-08

****

STD SAMPLE VOL. Vm(std) d) ------	75.96	dscf	STACK GAS FLOW Qsd -------	458.072	dscf/Hr
				&	
				7.63	dscf/min
VOL. WATER VAPOR Vw(s td) -----	5.968	scf	PARTICULATE CONCTRT. C s ------	0.0123	g/dscf
PRCNT MSTR Bws -------	7.28	%	PARTC.EMISS. RATE E -------	5.65	g/Hr
BURN RATE BR -------	1.16	Kg/Hr	MOLES OF GAS PER Lb WOOD Nt ----	0.47	Lb-mole/Lb
CO EMISSION RATE -------	196.02	g/Hr	PART.EMISS. RATE ------	4.88	g/Kgdry fuel
	&				
	169.13	g/Kgdry fuel			

TABLE 5 ---- PROPORTIONAL RATE VARIATION

CLIENT : Jotul — TEST No. : 4

MODEL: C550 — DATE: 26-Aug-08

	TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR		PROPRTN RATE VAR. AVERAGE	
	5	625.5	98		100	
	10	633.4	99			
	15	633.1	99			
	20	635.2	99			
	25	635.3	99			
	30	634.9	99			
	35	635.2	99			
	40	635.2	99			
	45	635.3	99			
	50	634.8	99			
	55	635.3	99			
	60	635.3	99			
	65	633.0	99			
	70	638.2	100			
	75	639.4	100			
	80	640.8	100			
	85	640.9	100			
	90	641.3	100			
	95	640.8	100			
	100	640.9	100			
	105	641.3	100			
	110	640.9	100			
	115	640.8	100			
	120	640.4	100			
	125	644.0	100			
	130	644.0	100			
	135	644.0	100			
	140	644.0	100			
	145	644.0	100			
	150	643.5	100			
	155	644.0	100			
	160	644.0	100			
	165	644.0	100			
	170	644.0	100			
	175	643.5	100			
	180	644.0	100			

185	643.9	100
190	643.9	100
195	643.9	100
200	643.9	100
205	643.9	100
210	643.9	100
215	643.5	100
220	643.9	100
225	643.9	100
230	643.9	100
235	643.9	100
240	643.9	100
245	643.5	100
250	643.9	100
255	643.9	100
260	643.9	100
265	643.9	100
270	643.9	100
275	643.5	100

5.65

COMPUTER INPUT DATA SHEET #1

Client: Jotul North America

Address: 55 Hutcherson

Gorham, ME 04038

Phone: 800-797-5912 Fax: 207-591-6623

Run No.: 4 Date of Test: 8-28-2008 Burn Rate: 1.16

Model No.: C550 ☐ min ☒ min-1.25 ☐ fan

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

Dry Gas Meter Y Factor: .940 (0.000) (Data Sheet #2) Post Leak Rate: .015 cfm (.000) (Data Sheet #2) Time: 275 min. (000) (Data Sheet #2)

Dry Gas Meter Volume: 82.778 cf (00.000) (Data Sheet #2)

Stack Flow: 7.413 dscfm (00.000) (Data Sheet #2) Δ H: .140 in. H_2O (.000) (Data Sheet #2)

Maximum Vac.: 3.0 (0.0) (Data Sheet #2) Barometric Pressure: 30.15 in. Hg (00.00) (Data Sheet #2)

H_2O Captured: 126.8 g (00.0) (Data Sheet #3)

Front Half Catch % Of Total: 51.5 % (00.0) (Data Sheet #6) Total Particulate Catch: .9372 g (0.0000) (Data Sheet #6)

Flue Gas Moisture: 7.2851 % (00.000) (Data Sheet #7)

Particulate Emission: .1904 gr/dscf (0.0000) (Data Sheet #7)

Relative Humidity: 55 % RH (00.0) (Data Sheet #8) Ambient Moisture: 1.75 % H_2O (0.00) (Data Sheet #8)

Preburn Fuel Wt.: 42.9 lbs. (00.0) (Data Sheet #8) Coal Bed Wt.: 3.5 lbs. (00.0) (Data sheet #8) Test Fuel Wt.: 14.1 lbs. (00.0) (Data sheet #8)

Heat Output (EPA Default): 13987.5 BTU/hr (00,000.0) (Data Sheet #8)

Kindling Fuel % Moisture (wet): 12.867 % (00.000) (Data Sheet #10) Pretest Fuel % Moisture (wet): 16.225 % (00.000) (Data Sheet #10)

Test Fuel % Moisture (dry): 20.420 % Test Fuel % Moisture (wet): 16.957 %
(00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove])

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

Stack Static Pressure: -.044 in. H_2O (+/- .000) (Data Sheet #12)

Average Ambient Temperature: 78 °F (00) (Data Sheet #14) Stove Temperature Change: -32.3 °F (+/- 000.0) (Data Sheet #14)

TIME
Test start = 1415
End = 1850

meter temp = 545

10 @ 12   255

METER BOX DATA SHEET PAGE # 2

Page: 1 of 3

UNIT : Jotul C550   RUN : 4   DATE : 8-28-2008

Meter Box: 5H   Y Factor: .940

Leak checks: 15 " Hg @ .016 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: .20			SAMPLING RATIO: 25.5	: 1			BP: 30.20		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1415	941.500	——	7.699	.15	80	450	80	2.0
5	20	943.000	——	13.858	.48	80	250	80	3.0
10	25	945.732	945.732	8.152	.17	80	425	80	2.0
15	30	947.341	947.341	7.685	.15	81	450	81	2.0
20	35	948.867	948.867	8.137	.17	81	425	81	2.0
25	40	950.483	950.483	8.137	.17	81	425	81	2.0
30	45	952.098	952.098	7.685	.15	81	450	81	2.0
35	50	953.624	953.624	7.685	.15	81	450	81	2.0
40	55	955.150	955.150	7.280	.13	81	475	81	2.0
45	1500	956.596	956.596	7.280	.13	81	475	81	2.0
50	05	958.041	958.041	7.280	.13	81	475	81	2.0
55	10	959.487	959.487	7.280	.13	81	475	81	2.0
ROTO PRESS: .20			TOTALS:	98.158	2.11	969	BP.: 30.20		
60	1515	960.933	960.933	7.685	.15	81	450	81	2.0
65	20	962.458	962.458	7.240	.13	84	475	84	2.0
70	25	963.920	963.920	7.628	.15	85	450	85	2.0
75	30	965.469	965.469	7.214	.13	86	475	86	2.0
80	35	966.941	966.941	7.614	.14	86	450	86	2.0
85	40	968.495	968.495	7.614	.14	86	450	86	2.0
90	45	970.050	970.050	8.062	.16	86	425	86	2.0
95	50	971.695	971.695	7.614	.14	86	450	86	2.0
100	55	973.249	973.249	7.614	.14	86	450	86	2.0
105	1600	974.804	974.804	7.614	.14	86	450	86	2.0
110	05	976.358	976.358	7.214	.13	86	475	86	2.0
115	10	977.830	977.830	6.853	.12	86	500	86	2.0
			TOTALS:	89.966	1.67	1024	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	188.124	3.78	1993	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

UNIT: Jotol C550 RUN: 4 DATE: 8-28-2008

Meter Box: SH Y Factor: .940

Leak checks: 15 " Hg @ .016 cfm ______ " Hg @ ____ cfm

15 " Hg @ .015 cfm ______ " Hg @ ____ cfm

Inject SO² @ 100 cc/min. Nozzle : Probe @ 3/8 " od Initial Volume: 1.500

ROTO: PRESS: .20			SAMPLING RATIO: 25.5		: 1		BP: 30.12		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1615	979.229	979.229	6.868	.12	87	500	87	2.0
125	20	980.637	980.637	6.868	.12	87	500	87	2.0
130	25	982.045	982.045	6.868	.12	87	500	87	2.0
135	30	983.453	983.453	6.868	.12	87	500	87	2.0
140	35	984.861	984.861	6.868	.12	87	500	87	2.0
145	40	986.269	986.269	6.868	.12	87	500	87	2.0
150	45	987.676	987.676	6.868	.12	87	500	87	2.0
155	50	989.084	989.084	6.868	.12	87	500	87	2.0
160	55	990.492	990.492	6.868	.12	87	500	87	2.0
165	1700	991.900	991.900	6.868	.12	87	500	87	2.0
170	05	993.308	993.308	6.868	.12	87	500	87	2.0
175	10	994.715	994.715	6.868	.12	87	500	87	2.0
ROTO PRESS:	.20		TOTALS:	82.416	1.44	1044	BP.: 30.12		
180	1715	996.123	996.123	7.229	.13	87	475	87	2.0
185	20	997.605	997.605	7.229	.13	87	475	87	2.0
190	25	999.087	999.087	7.229	.13	87	475	87	2.0
195	30	1000.569	1000.569	7.229	.13	87	475	87	2.0
200	35	1002.051	1002.051	7.229	.13	87	475	87	2.0
205	40	1003.533	1003.533	7.229	.13	87	475	87	2.0
210	45	1005.015	1005.015	7.229	.13	87	475	87	2.0
215	50	1006.496	1006.496	7.229	.13	87	475	87	2.0
220	55	1007.978	1007.978	7.229	.13	87	475	87	2.0
225	1800	1009.460	1009.460	7.229	.13	87	475	87	2.0
230	05	1010.942	1010.942	7.229	.13	87	475	87	2.0
235	10	1012.424	1012.424	7.229	.13	87	475	87	2.0
			TOTALS:	86.748	1.56	1044	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	169.164	3.00	2088	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

UNIT: Jotul C550 RUN: 4 DATE: 8-28-2008

Meter Box: 5H Y Factor: .940

Leak checks: 15 " Hg @ .016 cfm ______ " Hg @ ______ cfm

15 " Hg @ .015 cfm ______ " Hg @ ______ cfm

Inject SO² @ 100 cc/min. Nozzle: Probe @ 3/8 " od Initial Volume: 1.500

ROTO: PRESS: .20			SAMPLING RATIO: 25.5 : 1				BP: 30.12		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
240	1815	1013.906	1013.906	7.229	.13	87	475	87	2.0
245	20	1015.387	1015.387	7.229	.13	87	475	87	2.0
250	25	1016.869	1016.869	7.229	.13	87	475	87	2.0
255	30	1018.351	1018.351	7.229	.13	87	475	87	2.0
260	35	1019.833	1019.833	7.229	.13	87	475	87	2.0
265	40	1021.315	1021.315	7.229	.13	87	475	87	2.0
270	45	1022.797	1022.797	7.229	.13	87	475	87	2.0
275	50	1024.278	1024.278	7.229	.13	87	475	87	2.0
280									
285									
290									
295									
ROTO PRESS:			TOTALS:	57.832	1.04	696	BP.:		
300									
305									
310									
315									
320									
325									
330									
335									
340									
345									
350									
355						4777			
			TOTALS:	415.120	7.82	85	MAX VACC =		3.0
TOTAL Cu Ft.		82.778	TOTALS:	7.413	.140	545	AVG. BP:	30.15	

÷.52

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : C550 RUN : 4 DATE : 8-28-08

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	709.4	588.0	485.8	904.0
INITIAL WT	600.4	582.5	484.0	893.5
NET WT GRAMS	109.0	5.5	1.8	10.5

TOTAL CATCH : 126.8 GRAMS H_2O

FRONT HALF

FILTER #	193F	
FINAL WT g	.8172	
INITIAL WT g	.6168	
NET WT g	.2004	

BEAKER #	86
DESC.	ACETONE
FINAL WT g	105.0263
INITIAL WT g	104.7433
NET WT g	.2830
VOL. DESC. ml	100

.2834

BACK HALF

FILTER #	193B	
FINAL WT g	.4121	
INITIAL WT g	.3565	
NET WT g	.0556	

BEAKER #	87	88	89	90	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	106.0980	100.0650	120.7429	106.4985	
INITIAL WT g	105.9183	100.0028	120.6720	106.4042	
NET WT g	.1797	.0622	.0709	.0943	.1652
VOL. DESC ml	125	75	150	175	325

.0944

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 1-17-2008 Time : 1300 By : Cp W

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

Back Size: 8.2 cm Lot No. :

	DATE: 1-22-08	BY: Cp	DATE: 1-23-08	BY: Cp	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
141F	.6152	1230	.6150	1432	✓	
142F	.6151	1231	.6150	1433	✓	
143F	.6172	1232	.6168	1434	✓ R-4	
144F	.6179	1233	.6177	1435	✓	
145F	.6159	1235	.6159	1436	✓	
146F	.6170	1236	.6170	1437	✓	
147F	.6157	1237	.6156	1438	✓	
148F	.6168	1238	.6168	1439	✓	
149F	.6158	1239	.6158	1440	✓	
150F	.6158	1240	.6158	1441	✓	

141B	.3639	1241	.3639	1442	✓	
142B	.3630	1242	.3632	1443	✓	
143B	.3565	1243	.3565	1445	✓ R-4	
144B	.3606	1244	.3607	1446	✓	
145B	.3658	1245	.3657	1447	✓	
146B	.3599	1246	.3599	1448	✓	
147B	.3625	1247	.3625	1449	✓	
148B	.3611	1248	.3611	1450	✓	
149B	.3642	1249	.3638	1451	✓	
150B	.3626	1250	.3627	1452	✓	

Checked by: Cp W. Date: 2-15-08 Time: 1221

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
1-22-08	1200	Cp		68	47
1-23-08	1400	Cp		74	47

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 1-8-2008 Time : 1100 By : CP

	DATE: 1-18-2008	BY: CP	DATE: 1-21-2008	BY: CP	DATE:	BY:
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
76	103.8038	1235	103.8033	1436	✓	
77	107.3866	1236	107.3864	1437	✓	
78	94.4938	1237	94.4943	1438	✓	
79	97.6167	1238	97.6163	1439	✓	
80	109.1248	1239	109.1245	1440	✓	
81	101.4636	1240	101.4635	1441	✓	
82	97.4749	1242	97.4749	1442	✓	
83	98.3276	1243	98.3275	1444	✓	
84	105.5525	1244	105.5527	1445	✓	
85	97.9922	1245	97.9918	1446	✓	
86	104.7432	1246	104.7433	1447	✓	
87	105.9182	1247	105.9183	1448	✓	
88	100.0030	1248	100.0028	1450	✓ R-4	
89	120.6720	1250	120.6720	1451	✓	
90	106.4039	1251	106.4042	1452	✓	
91	95.0504	1252	95.0502	1453	✓	
92	96.6794	1253	96.6794	1454	✓	
93	107.8846	1255	107.8848	1455	✓	
94	106.3689	1256	106.3687	1456	✓	
95	107.4094	1257	107.4092	1457	✓	
96	103.9824	1258	103.9826	1458	✓	
97	99.9846	1259	99.9844	1459	✓	
98	105.0256	1300	105.0251	1500	✓	
99	104.9354	1301	104.9352	1501	✓	
100	106.7417	1302	106.7416	1502	✓	

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
1-18-2008	1230	CP		76	45
1-21-2008	1430	CP		65	48

Checked by : CW

Date : 2-15-08

Time : 1216

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : C556　　RUN : 4　　DATE : 8-28-08　　Page : 1 of

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
86	8-30	1030	Cp	105.0301	8-31	1024	Cp	105.0290	9-1	1105	Cp	105.0267	9-2	0851	Cp
				105.0263	9-4	1010	Cp								
87	8-30	1030	Cp	106.0985	8-31	1025	Cp	106.0980	9-1	1106	Cp				
88	8-30	1030	Cp	100.0653	8-31	1026	Cp	100.0650	9-1	1107	Cp				
89	8-30	1030	Cp	120.7430	8-31	1027	Cp	120.7429	9-1	1108	Cp				
90	8-30	1030	Cp	106.5006	8-31	1028	Cp	106.4997	9-1	1109	Cp	106.4986	9-2	0852	Cp
				106.4985	9-4	1012	Cp								

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
143F	8-28	2020	Cp	.8177	8-29	1345	Cp	.8172	8-31	1022	Cp				
143B	8-28	2020	Cp	.4125	8-29	1346	Cp	.4121	8-31	1023	Cp				

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	8-29-08	1300	Cp	78	46
2	8-31-08	1015	Cp	76	49
3	9-1-08	1100	Cp	74	44
4	9-2-08	0855	Cp	75	48
5	9-4-08	1000	Cp	77	47

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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 8-27-2008 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
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

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	Cb	10-22	1630	78	46
99.9999	10.0001	1.0000	.1001	Cb	10-23	1000	74	44
100.0002	10.0002	1.0002	.0999	Cb	10-24	1400	73	47
100.0002	10.0000	1.0001	.0998	Cb	10-26	1700	74	40
100.0003	10.0001	1.0001	.0999	Cb	10-27	0820	78	40
99.9999	10.0000	.9999	.0997	Cb	10-28	1200	78	40
100.0000	9.9999	.9999	.0999	C	10-29	1700	76	42
99.9998	9.9999	.9999	.1000	Cb	10-30	1600	78	43
99.9997	10.0000	.9999	.0999	Cb	11-16	1500	68	47
100.0001	10.0002	1.0000	.0999	Cb	11-19	1730	73	40
100.0000	10.0002	.9999	.0999	Cb	11-20	1100	64	44
2008 99.9998	9.9999	.9999	.0998	Cb	1-18-08	1230	76	45
100.0002	10.0002	.9999	.0999	Cb	1-21-08	1430	65	48
99.9999	10.0002	1.0001	.0999	Cb	1-22-08	1200	68	47
100.0002	9.9999	.9999	.0998	Cb	1-23-08	1400	74	47
99.9999	10.0000	1.0002	.1000	Cb	1-31-08	1900	74	44
100.0000	10.0003	1.0000	.0996	Cb	2-1-08	1530	76	45
99.9997	9.9999	.9999	.0999	Cb	2-16-08	1700	68	47
100.0001	10.0002	1.0000	.1000	Cb	2-18-08	1400	72	46
99.9999	10.0001	.9999	.0998	Cb	2-22-08	1800	68	47
99.9999	10.0001	1.0000	.0999	C	2-23-08	1800	78	43
100.0000	10.0000	1.0000	.0999	Cb	5-8-08	1030	78	43
100.0001	10.0001	1.0000	.0999	Cb	5-9-08	0930	69	47
100.0000	10.0001	.9999	.0999	Cb	5-10-08	1330	74	47
99.9998	9.9999	1.0000	.0998	Cb	5-11-08	0900	74	44
100.0003	10.0001	.9999	.0998	Cb	5-12	1400	70	48
99.9999	10.0001	1.0000	.1000	Cb	5-13	1000	77	42
99.9999	9.9997	1.0000	.1000	Cb	5-14	1230	77	42
99.9999	10.0001	.9999	.1000	Cb	6-8-08	1430	72	46
100.0001	10.0000	1.0000	.0999	Cb	6-9-08	1400	74	44
99.9999	9.9999	1.0000	.0999	Cb	6-9-08	1800	73	47
100.0001	10.0001	.9999	.0998	Cb	8-11-08	0930	77	42
100.0003	10.0000	1.0001	.0999	Cb	8-12-08	1011	78	43
100.0000	10.0001	1.0000	.0999	Cb	8-13-08	0950	76	49
100.0002	10.0000	1.0000	.0998	Cb	8-18-08	0930	74	44
100.0001	9.9999	1.0000	.0998	Cb	8-20-08	1110	76	45
100.0000	9.9999	.9999	.0998	Cb	8-21-08	0915	75	48
100.0002	10.0000	1.0000	.1002	Cb	8-22-08	0910	75	45
100.0000	10.0001	1.0001	.0999	Cb	8-26-08	0900	78	43

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 4-26-2007 Through 10-14-2007	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
99.9997	10.0001	1.0001	.0999	CP	4-26	0815	73	47
100.0002	10.0001	1.0000	.0999	CP	4-27	1400	78	46
99.9999	10.0000	1.0000	.1000	CP	4-29	1100	74	44
100.0003	10.0001	.9999	.1000	CP	5-1	1000	71	45
100.0003	10.0001	.9999	.1000	CP	5-7	1530	76	45
100.0001	9.9999	1.0000	.1000	CP	5-9	1400	78	46
100.0001	10.0000	1.0000	.0998	CP	5-13	1630	76	45
100.0002	10.0001	1.0000	.1000	CP	5-18	1350	77	46
100.0003	10.0001	1.0000	.0998	CP	5-21	1300	72	46
99.9999	10.0001	1.0000	.1000	CP	5-22	1600	78	46
99.9999	10.0001	1.0000	.0996	CP	6-5	1530	74	44
100.0000	10.0001	.9998	.0999	CP	6-7	1030	70	48
100.0000	10.0001	1.0000	.1000	CP	6-8	1000	68	47
99.9998	10.0004	1.0000	.1000	CP	6-9	1300	78	40
99.9997	10.0000	1.0000	.1000	CP	6-10	1530	78	49
100.0003	10.0002	1.0000	.0998	CP	6-11	0900	72	46
99.9998	10.0000	.9999	.0998	CP	6-12	2100	78	40
99.9998	9.9998	1.0000	.0998	CP	6-13	1600	74	47
99.9999	9.9999	1.0000	.0999	CP	6-14	1230	77	49
99.9999	10.0000	1.0000	.1000	CP	6-15	1430	75	48
100.0001	10.0007	1.0001	.1000	CP	6-19	1040	78	46
100.0000	10.0001	.9999	.0997	CP	6-20	1050	75	48
99.9996	9.9998	.9999	.0998	CP	8-29	1830	74	48
100.0002	10.0002	1.0001	.0999	CP	8-31	1000	79	46
99.9999	10.0002	1.0001	.1000	CP	9-1	1130	77	46
99.9999	10.0001	.9999	.0999	CP	9-4	1100	78	43
99.9997	9.9999	.9998	.0998	CP	9-5	1000	78	46
100.0000	10.0000	.9999	.0999	CP	9-6	1500	78	46
99.9997	10.0000	1.0000	.1000	CP	9-7	1745	78	43
100.0001	10.0000	1.0000	.0997	CP	9-8	1500	78	46
100.0002	10.0000	.9999	.1000	CP	10-5	0930	75	48
100.0003	10.0003	1.0000	.0999	CP	10-6	1400	78	46
100.0001	10.0000	1.0000	.0999	CP	10-8	1000	75	44
100.0002	10.0001	1.0000	.0999	CP	10-9	1130	78	46
100.0001	10.0002	.9999	.0997	CP	10-10	1500	74	44
99.9999	10.0000	1.0001	.0999	CP	10-11	1120	75	48
100.0000	9.9999	.9999	.0998	CP	10-12	1130	72	45
100.0003	9.9999	1.0000	.1000	CP	10-13	1030	79	46
99.9999	10.0000	1.0000	.1000	CP	10-14	1410	78	46

BLANK PROCESSING DATA SHEET # 5

UNIT: C550 RUN: 4 DATE: 8-28-08

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 Sparkletts 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: C550 RUN: 4 DATE: 8-28-08

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: .2004 g - 1 (.0000 g) = .2004 g
(Total Catch) (# of Filters) (Blank Value / Filter)

BEAKERS: .2830 g - 100 (.000007 g) = .2823 g
(Total Catch) (ml Acetone) (Blank Value / ml Acetone) .0007

TOTAL FRONT HALF CATCH : .4827 g

BACK HALF CATCH

FILTERS: .0556 g - 1 (.0000 g) = .0556 g
(Total Catch) (# of Filters) (Blank Value / Filter)

BEAKERS:

Acetone: .1797 g - 125 (.000007 g) = .1788 g
(Total Catch) (ml Acetone) (Blank Value / ml Acetone) .0009

Extract: .0622 g - 75 (.000019 g) = .0608 g
(Total Catch) (ml Dichloromethane) (Blank Value / Dichloromethane) (.0014)

Water: .1652 g - 325 (.000018 g) = .1593 g
(Total Catch) (ml Water) (Blank Value / Water) .0059

TOTAL BACK HALF CATCH : .4545 g

TOTAL CATCH : .9372 g

% FRONT HALF : 51.5 %

CALCULATIONS DATA SHEET # 7

UNIT: Jotul C550 RUN: 4 DATE: 8-28-2008

1) $Vm(std) = \dfrac{(82.778\ Vm)(17.64)(.940\ mcf)\left(30.15\text{ " Hg} + \dfrac{.140\text{" } H_2O}{13.6}\right)}{(545\ TmA)} = \dfrac{75.9592}{000.0000}$ dscf

2) $Vw(std) = (.04707)(126.8\ ml\ H_2O) = \dfrac{5.9685}{00.0000}$ scf

3) $Asw = \dfrac{(5.9685\ scf)}{(5.9685\ scf + 75.9592\ dscf)} = \dfrac{.0729}{.0000}$ $Bws \times 100 = \dfrac{7.2851}{00.0000}$ % H_2O

4) $Cs = \dfrac{(.9372\ g.)}{(75.9592\ dscf)}(15.43) = \dfrac{.1904}{0.0000}$ gr / dscf

5) Estimated g / hr $= \dfrac{(.9372\ g.)}{(75.9592\ dscf)}\left(\dfrac{7.413}{00.0000}\ dscfm\right)(60) = \dfrac{5.4878}{00.0000}$ 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 C550 RUN : 4 DATE : 8-28-2008

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

Wet Bulb / Dry Bulb

Pre : WB : 65 DB : 76 = 55 % RH 1.7 % H_2O

Post : WB : 67 DB : 78 = 55 % RH 1.8 % H_2O

Average : 55 % RH 1.75 % H_2O

Empty Stove Weight (lbs) : N/A w/ stack & oil seal : Wet : N/A Dry : 0.0

Kindling Weight (lbs) : Paper : .1 Wood : 2.5

Preburn Fuel Weight : 20.1 + 20.3 Total : 40.4

Kindling & Preburn Fuel Weight (wood only) (lbs) : **Total** : 42.9

Coal Bed Wt Range (lbs) : 3.5 - 2.9 **Scale** : 3.5 - 2.9

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

Lower : .20 × fuel weight : Always round UP to nearest tenth **Actual Coal Bed Weight** : 3.5

Maximum Coal Bed Removal (lbs) : ((3.5 Upper + 2.9 Lower) ÷ 2) .25 = .8 round down to nearest tenth

Test Fuel (.75" × 1.5" × 5" spacers) = 18 pcs

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" × 4"	16	3	6.3	44.7
4" × 4"	16	2	7.8	55.3

Test Fuel Weight : 14.1 lbs

Estimated Dry Burn Rate :

$$\frac{14.1 - (14.1 \times .16957)}{2.2046} \times \frac{60}{275 \text{ TIME}} = 1.16 \text{ kg / hr}$$

Estimated BTU's/hr : $19,140 \times \frac{63}{100} \times \frac{1.16}{\text{DBR}} = 13987.5$ BTU's/hr

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

WOOD STOVE OPERATING DATA PAGE #9

Unit : Jotol C550 Run : 4 Date : 8-28-2008

FIRE STARTED: 0920

WARM UP AND PREBURN:

PRIMARY AIR : Set wide open for all warm-up / preburn fuel charges. Then set to .25" 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 25 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 .25".

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

FAN:

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

ON / OFF first 30 minutes of test ON / OFF balance of test run

Fan speed set at LOW

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 10 or 16 inches.

1st warm up / pre-burn fuel charge (20.1 lbs.) added at 0930

2nd warm up / pre-burn fuel charge (20.3 lbs.) added at 1055

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 C550 Run : 4 Date : 8-28-2008

Room Temperature : 74 °F Temperature Correction Set?: (YES) NO

Calibration Check : 12.0% + or- 0.2%? (YES) NO

Time Test Fuel moisture reading taken : 1045

pc #	Dimen.	Use	TOP	BOTTOM	SIDE	Average
1	2"×4"×8'	K	15.7	14.2	14.4	14.767
2						
3						
4	2"×4"×8'	P	18.6	18.7	18.7	18.7
5	2"×4"×8'	P	21.5	20.2	20.3	20.7
6	2"×4"×8'	P	17.9	19.4	18.7	18.7
7	2"×4"×8'	P				58.1
8	2"×4"×8'	P				
9						
10						
11						
12	2x4x16"	T	18.2	17.9	18.2	18.1
13	"	T	21.3	21.0	20.5	20.9
14	"	T	23.8	23.0	23.1	23.3
15	4x4x16"	T	20.1	20.2	20.2	20.2
16	"	T	20.2	20.0	18.7	19.6
17						102.1
18						
19						
20	Spacers	T	21.0	21.3	19.8	20.7

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	14.767 %	19.367 %	20.420 %
Wet Moisture % :	12.867 %	16.225 %	16.957 %

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 with meter corrected for temperature.

GAS DATA SHEET #12

WEIGHT: 3.5 DATE: 8-28-2008

UNIT: Jotul C550 RUN: 4 PAGE: 1 OF 2

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
0 / 1415	17.6	14.1	—	.142	3.5	.647	16.2	.104	1.05	.035	450
5 / 20	17.2	13.7	.4	.129	3.2	.687	17.2	.038	.40	.035	250
10 / 25	17.1	13.6	.1	.115	2.8	699	17.5	.043	.45	.034	425
15 / 30	16.8	13.3	.3	.129	3.2	.683	17.1	.045	.47	.033	450
20 / 35	16.3	12.8	.5	.323	8.0	484	12.1	.060	.61	.042	425
25 / 40	15.7	12.2	.6	.259	6.4	.552	13.8	.053	.55	.045	425
Fan ? 30 / 45	15.2	11.7	.5	.294	7.3	.508	12.7	.077	.78	.046	450
35 / 50	14.7	11.2	.5	.250	6.2	.552	13.8	.073	.74	.045	450
40 / 55	13.8	10.3	.9	.527	13.1	.253	6.3	.138	1.39	.055	475
45 / 1500	13.0	9.5	.8	.441	11.0	.344	8.6	.115	1.16	.055	475
50 / 05	12.3	8.8	.7	.477	11.9	.308	7.7	.115	1.16	.056	475
55 / 10	11.6	8.1	.7	.437	10.9	.364	9.1	.079	.80	.055	475
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.536	*****
60 / 15	11.2	7.7	.4	.349	8.7	.452	11.3	.074	.75	.052	450
65 / 20	10.7	7.2	.5	.357	8.9	.448	11.2	.066	.67	.051	475
70 / 25	10.3	6.8	.4	.379	9.4	.432	10.8	.051	.53	.050	450
75 / 30	9.9	6.4	.4	.376	9.3	.460	11.5	.069	.70	.050	475
80 / 35	9.5	6.0	.4	.380	9.4	.432	10.8	.059	.60	.049	450
85 / 40	9.1	5.6	.4	.382	9.5	.424	10.6	.065	.66	.049	450
90 / 45	8.7	5.2	.4	.387	9.6	.428	10.7	.040	.42	.050	425
95 / 50	8.3	4.8	.4	.372	9.2	.444	11.1	.042	.44	.049	450
100 / 55	8.0	4.5	.3	.386	9.6	.448	11.2	.039	.41	.048	450
105 / 1600	7.6	4.1	.4	.372	9.2	.436	10.9	.064	.65	.047	450
110 / 05	7.3	3.8	.3	.338	8.4	.461	11.5	.075	.76	-.046	475
115 / 10	7.0	3.5	.3	.310	7.7	.484	12.1	.084	.85	-.045	500
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.586	*****
120 / 15	6.7	3.2	.3	.302	7.5	.489	12.2	.096	.97	-.044	500
125 / 20	6.5	3.0	.2	.286	7.1	.498	12.5	.112	1.13	-.041	500
130 / 25	6.4	2.9	.1	.281	7.0	.499	12.5	.121	1.22	-.041	500
135 / 30	6.2	2.7	.2	.292	7.3	.493	12.3	.105	1.06	-.041	500
140 / 35	6.0	2.5	.2	.281	7.0	.493	12.3	.135	1.36	-.041	500
145 / 40	5.8	2.3	.2	.275	6.9	.502	12.6	.132	1.33	-.041	500
150 / 45	5.7	2.2	.1	.256	6.4	.514	12.9	.142	1.43	-.040	500
155 / 50	5.5	2.0	.2	.255	6.4	.522	13.1	.124	1.25	-.039	500
160 / 55	5.4	1.9	.1	.243	6.1	.533	13.3	.130	1.31	-.038	500
165 / 1700	5.3	1.8	.1	.226	5.6	.534	13.4	.170	1.71	-.036	500
170 / 05	5.2	1.7	.1	.213	5.3	.536	13.4	.200	2.01	-.036	500
175 / 10	5.1	1.6	.1	.211	5.3	.536	13.4	.201	2.02	-.035	500
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.473	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-1.595	*****

GAS DATA SHEET #12

WEIGHT: 3.5 DATE: 8-28-2008

UNIT: C550 RUN: 4

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM	
180 1715	5.1	1.6	∅	.207	5.2	.534	13.4	.217	2.18	-.045	475	
185 20	5.0	1.5	.1	.196	4.9	.548	13.7	.208	2.09	-.044	475	
190 25	4.9	1.4	.1	.187	4.7	.556	13.9	.207	2.08	-.044	475	
195 30	4.8	1.3	.1	.184	4.6	.562	14.1	.203	2.04	-.043	475	
200 35	4.7	1.2	.1	.180	4.5	.567	14.2	.200	2.01	-.043	475	
205 40	4.6	1.1	.1	.170	4.2	.573	14.4	.210	2.11	-.043	475	
210 45	4.6	1.1	∅	.170	4.2	.574	14.4	.213	2.14	-.042	475	
215 50	4.5	1.0	.1	.163	4.1	.580	14.5	.201	2.02	-.041	475	
220 55	4.4	.9	.1	.160	4.0	.585	14.6	.206	2.07	-.041	475	
225 1800	4.3	.8	.1	.156	3.9	.587	14.7	.211	2.12	-.042	475	
230 05	4.3	.8	∅	.151	3.8	.597	14.9	.196	1.97	-.042	475	
235 10	4.2	.7	.1	.211	5.3	.557	13.9	.149	1.50	-.042	475	
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.512	*****	
240 1815	4.1	.6	.1	.195	4.9	.567	14.2	.159	1.60	-.042	475	
245 20	4.0	.5	.1	.192	4.8	.565	14.2	.175	1.76	-.042	475	
250 25	3.9	.4	.1	.189	4.7	.570	14.3	.171	1.72	-.042	475	
255 30	3.8	.3	.1	.182	4.5	.579	14.5	.175	1.76	-.042	475	
260 35	3.7	.2	.1	.180	4.5	.578	14.5	.173	1.74	-.042	475	
265 40	3.7	.2	∅	.175	4.4	.587	14.7	.165	1.66	-.042	475	
270 45	3.6	.1	.1	.170	4.2	.583	14.6	.185	1.86	-.042	475	56
275 50	3.5	∅	.1	.208	5.2	.565	14.1	.136	1.37	-.042	475	
280												
285												
290												
295												
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.336	*****	
300										-.848		
305												
310												
315												
320												
325												
330												
335												
340												
345												
350												
355												
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-2.443	*****	
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.044	*****	

PREBURN DATA SHEET #13

UNIT: Jotol C550 RUN: 4 DATE: 8-28-2008 PAGE: 1 of 1

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
0 / 1250	4.5	—	389	605	427	471	478	597			80	-.050	PREBURN START: # 1.0 UP
5 / 55	4.4	.1	297	579	426	459	476	579			79	-.048	COAL BED SCALE RANGE:
10 / 1300	4.4	.0	277	555	414	446	461	546			78	-.045	3.5 → 2.9
15 / 05	4.3	.1	265	530	401	428	455	511			78	-.045	PRIMARY AIR: .25"
20 / 10	4.2	.1	258	517	399	417	448	488			78	-.044	SECONDARY AIR: N/A
25 / 15	4.1	.1	252	487	392	402	442	467			79	-.041	FAN: Low
30 / 20	4.1	.0	241	465	382	387	432	444			78	-.040	PUMPS ON AT:
35 / 25	4.1	.0	233	446	370	369	418	420			78	-.039	CHECK WB/DB: N/A
40 / 30	4.0	.1	227	430	358	354	405	401			78	-.037	389
45 / 35	4.0	.0	222	414	346	339	392	384			78	-.036	375
50 / 40	3.9	.1	214	402	333	328	378	367			77	-.037	361
55 / 45	3.8	.1	208	389	326	317	369	357			77	-.036	351
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	
60 / 50	3.8	.0	201	378	318	306	360	345			77	-.035	341
65 / 55	3.7	.1	198	367	309	296	351	336			76	-.035	331
70 / 1400	3.7	.0	192	357	301	288	343	327			76	-.035	
75 / 05	3.6	.1	189	349	295	280	337	319			76	-.034	316
80 / 10	3.6	.0	186	341	289	272	331	312			76	-.032	309
85 / 15	3.5	.1	202	337	290	266	324	305			77	-.031	
20													
25													
30													

Jotul C550

Temperatue Data Sheet 14

Run 4
8/28/08

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	202	337	280	266	324	305	######	######	77	1367	232	59	231	33	31
5	272	320	277	255	319	320	######	######	77	1351	232	43	231	33	31
10	207	313	270	250	310	324	######	######	76	1337	232	43	232	33	31
15	193	304	266	244	301	322	######	######	76	1323	232	45	232	33	32
20	246	326	261	239	291	318	######	######	76	1311	232	46	231	33	32
25	263	374	259	237	283	314	######	######	75	1301	231	46	231	34	32
30	273	404	260	237	276	309	######	######	75	1291	231	46	232	34	33
35	260	403	262	249	270	287	######	######	75	1285	230	46	232	34	34
40	338	448	263	248	265	273	######	######	75	1281	231	47	232	34	34
45	357	517	266	248	262	265	######	######	76	1278	232	47	232	34	34
50	381	575	269	253	263	259	######	######	76	1277	233	48	232	35	34
55	366	615	271	263	268	256	######	######	76	1275	233	48	231	35	34
60	337	628	272	275	273	253	######	######	77	1275	225	46	233	35	35
65	324	628	278	283	279	251	######	######	78	1276	228	45	236	35	35
70	323	632	281	286	284	249	######	######	78	1277	231	46	238	35	35
75	319	638	282	289	290	246	######	######	79	1277	233	46	241	35	35
80	313	628	284	292	297	245	######	######	78	1278	235	47	242	36	36
85	313	615	285	296	303	244	######	######	79	1278	237	48	243	36	36
90	319	626	286	303	308	244	######	######	79	1278	238	48	244	36	36
95	314	630	287	307	313	245	######	######	79	1279	240	49	246	36	36
100	311	631	290	310	318	247	######	######	79	1280	241	48	246	36	37
105	311	632	290	312	321	250	######	######	80	1281	242	49	248	36	37
110	304	629	291	318	325	251	######	######	80	1283	243	49	248	36	37
115	291	601	292	323	328	254	######	######	80	1284	244	49	248	36	37
120	284	582	294	326	330	256	######	######	81	1285	245	50	248	36	38
125	266	555	294	326	331	256	######	######	80	1286	246	50	248	37	38
130	265	526	294	324	332	256	######	######	81	1286	247	51	248	37	38
135	264	511	294	325	334	256	######	######	80	1287	247	51	247	37	38
140	262	500	293	329	337	258	######	######	80	1286	248	51	248	37	39
145	258	487	293	334	340	259	######	######	80	1285	248	52	247	37	39
150	253	477	292	338	344	259	######	######	80	1285	248	51	248	37	39
155	250	475	291	339	348	263	######	######	80	1285	248	51	248	37	39
160	244	474	292	334	349	277	######	######	81	1285	248	52	247	37	39
165	236	466	291	323	348	296	######	######	80	1287	248	53	247	37	39
170	229	453	290	312	346	310	######	######	80	1289	248	53	247	37	39

175	225	443	287	302	342	320	######	######	80	1290	248	54	248	37	39
180	221	435	285	294	339	326	######	######	80	1291	248	54	248	37	38
185	217	425	282	287	336	329	######	######	79	1291	248	54	248	36	38
190	212	413	280	281	333	328	######	######	79	1290	248	54	248	36	38
195	208	403	279	276	329	325	######	######	79	1290	248	54	248	36	38
200	206	395	275	272	325	320	######	######	79	1290	248	54	248	36	38
205	202	387	273	267	321	314	######	######	79	1290	247	54	248	36	38
210	199	378	272	263	317	307	######	######	79	1290	247	54	248	35	38
215	197	371	268	259	314	300	######	######	78	1289	246	54	248	35	37
220	194	363	267	256	310	292	######	######	79	1288	246	54	248	35	37
225	193	356	265	253	306	284	######	######	77	1287	245	55	245	35	37
230	189	349	263	250	302	278	######	######	77	1286	243	55	243	35	37
235	187	343	261	246	297	271	######	######	76	1284	240	55	241	34	36
240	187	342	258	244	294	265	######	######	76	1282	238	54	239	34	36
245	187	341	257	243	290	263	######	######	76	1281	236	54	238	34	36
250	187	340	257	243	288	262	######	######	76	1279	235	54	237	34	36
255	186	338	256	243	285	260	######	######	76	1277	234	54	236	33	35
260	184	336	257	243	283	259	######	######	75	1276	233	54	235	33	35
265	182	334	257	243	281	257	######	######	76	1275	232	54	234	33	35
270	181	331	256	244	279	254	######	######	75	1274	231	54	234	33	35
275	180	327	255	244	276	250	######	######	76	1272	231	54	233	33	35

TEMPERATURE DATA SHEET #14A

		TEST TIME	275		
STACK AVG	251	TOP AVG	459	LT SIDE AVG	276
BACK AVG	279	RT SIDE AVG	308	BOTTOM AVG	278
FIREBOX AVG	########	SEC/CAT AVG	########	AMBIENT AVG	78

END	270.3	
START	302.6	
	-32.3	DELTA T

CIRCLE: LOSS / GAIN

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 8 - 28 - 2008 Analyte : CO_2 (15-1)

Unit : Jotul C550 Run # : 4

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 % CO_2 Cyl. Press. : 670 PSI

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

Span Cyl. # : 487905 Conc. : 12.20 % CO_2 Cyl. Press. : 1650 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 : Cp Washington Time : 1230 Temp : 80 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-.007	-.007	-.027
SPAN	48.8	.488	12.20	48.8	.488	12.185	-.015	-.062

POST RUN Audit : by : Cp Washington Time : 1910 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	-.007	-.007	-.027
SPAN	48.8	.488	12.20	49.0	.490	12.235	.035	.138

± 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 : 8-28-2008 Analyte : O_2 (15-2)

Unit : Jotul C550 Run # : 4

Zero Cyl. # : 168TAC 3A Conc. : 0.00 % O_2 Cyl. Press. : 676 PSI

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

Span Cyl. # : 487905 Conc. : 12.60 % O_2 Cyl. Press. : 1650 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 : Cp Washington Time : 1230 Temp : 80 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.001	-.005	-.005	-.021
SPAN	12.60	.504	12.6	12.6	.504	12.608	.008	.033

POST RUN Audit : by : Cp Washington Time : 1910 Temp : 75 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.002	.020	.020	.079
SPAN	12.60	.504	12.6	12.6	.505	12.633	.033	.133

± 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 : 8-28-2008 Analyte : CO (15-3)

Unit : Jotul C550 Run # : 4

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 % CO Cyl. Press. : 670 PSI

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

Span Cyl. # : C487905 Conc. : 4.90 % CO Cyl. Press. : 1650 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 : Cjp Washington Time : 1230 Temp : 80 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.023	.023	.225
SPAN	49.0	.490	4.90	48.8	.488	4.877	-.023	-.227

POST RUN Audit : by : Cjp Washington Time : 1910 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	.023	.023	.225
SPAN	49.0	.490	4.90	48.9	.489	4.887	-.013	-.128

± 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 - 28 - 2008 Analyte : SO_2 (15-4)

Unit : Jotul C550 Run # : 4

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 ppm SO_2 Cyl. Press. : 670 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 : Cp Wartinga Time : 1230 Temp : 80 °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	.424	.424	.017
SPAN	50.0	.500	1250	50.1	.501	1258.9	8.900	.356

POST RUN Audit : by : Cp Wartinga Time : 1910 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	.424	.424	.017
SPAN	50.0	.500	1250	50.0	.500	1256.4	6.400	.256

± 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 C550 RUN: 4 DATE: 8-28-2008

Thermocouple Check:

T/C # 1	— °F	T/C # 13	66.5 °F
T/C # 2	— °F	T/C # 14	64.7 °F
T/C # 3	65.9 °F	T/C # 15	66.4 °F
T/C # 4	64.5 °F	T/C # 16	67.5 °F
T/C # 5	64.0 °F	T/C # 17	63.3 °F
T/C # 6	64.2 °F	T/C # 18	67.0 °F
T/C # 7	64.1 °F	T/C # 19	65.4 °F
T/C # 8	63.8 °F	T/C # 20	— °F
T/C # 9	— °F	T/C # 21	— °F
T/C # 10	— °F	T/C # 22	— °F
T/C # 11	63.2 °F	T/C # 23	— °F
T/C # 12	69.4 °F	T/C # 24	— °F

Thermocouple Readout:

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

ZERO 0.0 °F Adj. to 0.0 °F ZERO .9 °F Difference .045 %

SPAN 2001.5 °F Adj. to 2000.0 °F SPAN 1999.7 °F Difference -.015 %

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 200.2 °F	400	= 400.0 °F
600	= 599.8 °F	800	= 799.8 °F	1000	= 999.9 °F
1200	= 1199.8 °F	1400	= 1399.6 °F	1600	= 1599.7 °F
1800	= 1800.0 °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: 13.7 – 3.7 = 10.0

Post: 13.4 – 3.4 = 10.0

Stack Cleaned Prior to Test Run: YES ________ NO X

TABLE 1 ---- RAW DATA 113.10

CLIENT : Jotul TEST No. : 2

MODEL: C550 DATE: 26-Aug-08

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	837.000	0.150	77	0.89	4.20	450
5	838.500	0.330	77	0.45	6.90	300
10	840.767	0.170	78	0.40	3.10	425
15	842.375	0.170	78	0.40	3.70	425
20	843.982	0.170	78	0.58	7.80	425
25	845.590	0.150	79	0.93	9.00	450
30	847.114	0.150	79	0.77	9.20	450
35	848.638	0.160	79	0.53	10.50	425
40	850.252	0.190	79	0.47	10.70	400
45	851.966	0.210	79	0.14	9.80	375
50	853.794	0.210	79	0.10	9.70	375
55	855.622	0.210	80	0.09	9.80	375
60	857.458	0.210	80	0.14	9.00	375
65	859.293	0.180	80	0.24	9.60	400
70	861.013	0.210	80	0.23	10.10	375
75	862.848	0.210	80	0.24	9.10	375
80	864.684	0.210	80	0.21	8.60	375
85	866.519	0.210	80	0.26	8.00	375
90	868.354	0.180	80	0.37	7.40	400
95	870.075	0.180	80	0.30	7.80	400
100	871.795	0.160	80	0.56	7.30	425
105	873.415	0.130	80	0.99	5.30	475
110	874.864	0.150	80	0.96	5.30	450
115	876.394	0.160	80	1.05	5.20	425
120	878.013	0.160	81	1.14	5.20	425
125	879.639	0.160	81	1.22	5.10	425
130	881.265	0.160	81	1.17	5.00	425
135	882.890	0.180	81	1.32	4.90	400
140	884.617	0.180	81	1.48	4.80	400
145	886.344	0.180	81	1.53	4.70	400
150	888.071	0.180	81	1.55	4.70	400
155	889.799	0.180	81	1.40	4.70	400
160	891.526	0.180	81	1.33	4.70	400
165	893.253	0.180	81	1.32	4.60	400
170	894.980	0.180	81	1.34	4.60	400
175	896.707	0.160	81	1.33	4.50	425

180	898.332	0.180	81	1.31	4.40	400
185	900.064	0.160	81	1.39	4.20	425
190	901.694	0.160	81	1.39	4.20	425
195	903.324	0.140	81	1.32	4.20	450
200	904.863	0.140	81	1.30	4.20	450
205	906.403	0.140	81	1.26	4.40	450
210	907.943	0.140	81	1.20	4.00	450
215	909.482	0.140	81	1.11	4.00	450

TABLE 2---RAW DATA

CLIENT :	Jotul	TEST No.	2
MODEL:	C550	DATE:	26-Aug-08

****

METER CAL. FACTOR (Y)	-------	0.94	Wt. WOOD BURNED(LB) -------	13.8	Lbs
BAROMETRIC PRESS.(Pb)	-------	30.15 in Hg	WET,FUEL MOISTURE % -------	16.541	%
LEAK RATE POST (Lp)	-------	0.000 cfm	Wt. PART. COLLECTED -------	0.3726	g
WATER VOL. (V1c)	-------	113.1 Ml	METER VOLUME Vm -------	72.482	mcf
TEST TIME (MIN)	-------	215 min	HC MOLE FRACTION -------	0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT : Jotul TEST No. 2

MODEL: C550 DATE: 26-Aug-08

****

AVG DELTA H	-------	0.18 in H_2O	AVG PRCNT CO	-------	0.86	%
AVG METER TEMP. Tm	-------	80 deg F	AVG PRCNT CO_2	-------	6.32	%
AVG PPM SO_2	-------	412 PPM	AVG BAL CO_2/CO	-------	7.38	%

TABLE 4 ----- CALCULATIONS

CLIENT :	Jotul	TEST No.	2
MODEL:	C550	DATE:	26-Aug-08

****

STD SAMPLE VOL. Vm(std) d) ------	67.17	dscf	STACK GAS FLOW Qsd -------	617.883	dscf/Hr
				&	
				10.30	dscf/min
VOL. WATER VAPOR Vw(s td) -----	5.324	scf	PARTICULATE CONCTRT. C s ------	0.0055	g/dscf
PRCNT MSTR Bws -------	7.34	%	PARTC.EMISS. RATE E -------	3.43	g/Hr
BURN RATE BR -------	1.46	Kg/Hr	MOLES OF GAS PER Lb WOOD Nt ----	0.50	Lb-mole/Lb
CO EMISSION RATE -------	177.34	g/Hr	PART.EMISS. RATE ------	2.35	g/Kgdry fuel
	&				
	121.63	g/Kgdry fuel			

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Jotul | TEST No. : 2

MODEL: C550 | DATE: 26-Aug-08

	TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR		PROPRTN RATE VAR. AVERAGE	
	5	629.0	99		100	
	10	633.4	99			
	15	635.7	100			
	20	635.3	100			
	25	635.1	100			
	30	636.7	100			
	35	636.7	100			
	40	636.8	100			
	45	636.6	100			
	50	636.5	100			
	55	635.9	100			
	60	638.1	100			
	65	637.8	100			
	70	637.6	100			
	75	637.8	100			
	80	638.1	100			
	85	637.8	100			
	90	637.8	100			
	95	638.0	100			
	100	637.6	100			
	105	638.0	100			
	110	637.8	100			
	115	638.0	100			
	120	637.0	100			
	125	639.2	100			
	130	639.2	100			
	135	638.8	100			
	140	639.0	100			
	145	639.0	100			
	150	639.0	100			
	155	639.4	100			
	160	639.0	100			
	165	639.0	100			
	170	639.0	100			
	175	639.0	100			
	180	638.8	100			

185	640.9	100
190	640.8	100
195	640.8	100
200	640.6	100
205	641.0	100
210	641.0	100
215	640.6	100

COMPUTER INPUT DATA SHEET #1

Client: Jotul North America

Address: 55 Hutcherson

Gorham, ME 04038

Phone: 800-797-5912 Fax: 207-591-6623

Run No.: 2 Date of Test: 8-26-2008 Burn Rate: 1.46

Model No.: C556 ☐ min ☐ min-1.25 ☐ fan

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

Dry Gas Meter Y Factor: .940 Post Leak Rate: .000 cfm Time: 215 min.
(0.000) (Data Sheet #2) (.000) (Data Sheet #2) (000) (Data Sheet #2)

Dry Gas Meter Volume: 72.482 cf
(00.000) (Data Sheet #2)

Stack Flow: 8.507 dscfm ΔH: .176 in. H_2O
(00.000) (Data Sheet #2) (.000) (Data Sheet #2)

Maximum Vac.: 3.0 Barometric Pressure: 30.15 in. Hg
(0.0) (Data Sheet #2) (00.00) (Data Sheet #2)

H_2O Captured: 113.1 g
(00.0) (Data Sheet #3)

Front Half Catch % Of Total: 35.7 % Total Particulate Catch: .3726 g
(00.0) (Data Sheet #6) (0.0000) (Data Sheet #6)

Flue Gas Moisture: 7.3473 %
(00.000) (Data Sheet #7)

Particulate Emission: .0856 gr/dscf
(0.0000) (Data Sheet #7)

Relative Humidity: 43 % RH Ambient Moisture: 1.3 % H_2O
(00.0) (Data Sheet #8) (0.00) (Data Sheet #8)

Preburn Fuel Wt.: 44.0 lbs. Coal Bed Wt.: 3.4 lbs. Test Fuel Wt.: 13.8 lbs.
(00.0) (Data Sheet #8) (00.0) (Data sheet #8) (00.0) (Data sheet #8)

Heat Output (EPA Default): 17580.9 BTU/hr
(00,000.0) (Data Sheet #8)

Kindling Fuel % Moisture (wet): 12.229 % Pretest Fuel % Moisture (wet): 16.435 %
(00.000) (Data Sheet #10) (00.000) (Data Sheet #10)

Test Fuel % Moisture (dry): 19.820 % Test Fuel % Moisture (wet): 16.541 %
(00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove])

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

Stack Static Pressure: -.045 in. H_2O
(+/- .000) (Data Sheet #12)

Average Ambient Temperature: 73 °F Stove Temperature Change: -25.1 °F
(00) (Data Sheet #14) (+/- 000.0) (Data Sheet #14)

TIME
Test start = 1235
End = 1610

meter temp = 56

170

251

43

METER BOX DATA SHEET PAGE # 2

UNIT: Jotul C550 RUN: 2 DATE: 8-26-2008

Meter Box: 5H Y Factor: .940

Leak checks: 15 " Hg @ .002 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:	.20		SAMPLING RATIO: 26		: 1		BP: 30.18		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1235	837.000	—	7.788	.15	77	450	77	2.0
5	40	838.500	—	11.683	.33	77	300	78	3.0
10	45	840.767	840.767	8.231	.17	78	425	78	2.0
15	50	842.375	842.375	8.231	.17	78	425	78	2.0
20	55	843.982	843.982	8.231	.17	78	425	78	2.0
25	1300	845.590	845.590	7.759	.15	79	450	79	2.0
30	05	847.114	847.114	7.759	.15	79	450	79	2.0
35	10	848.638	848.638	8.216	.16	79	425	79	2.0
40	15	850.252	850.252	8.729	.19	79	400	79	2.0
45	20	851.966	851.966	9.311	.21	79	375	79	2.0
50	25	853.794	853.794	9.311	.21	79	375	79	2.0
55	30	855.622	855.622	9.294	.21	80	375	80	2.0
ROTO PRESS:	.20		TOTALS:	104.543	2.27	942	BP.: 30.15		
60	1335	857.458	857.458	9.285	.21	80	375	80	2.0
65	40	859.293	859.293	8.705	.18	80	400	80	2.0
70	45	861.013	861.013	9.285	.21	80	375	80	2.0
75	50	862.848	862.848	9.285	.21	80	375	80	2.0
80	55	864.684	864.684	9.285	.21	80	375	80	2.0
85	1400	866.519	866.519	9.285	.21	80	375	80	2.0
90	05	868.354	868.354	8.705	.18	80	400	80	2.0
95	10	870.075	870.075	8.705	.18	80	400	80	2.0
100	15	871.795	871.795	8.193	.16	80	425	80	2.0
105	20	873.415	873.415	7.330	.13	80	475	80	2.0
110	25	874.864	874.864	7.737	.15	80	450	80	2.0
115	30	876.394	876.394	8.193	.16	80	425	80	2.0
			TOTALS:	103.993	2.19	960	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	208.536	4.46	1902	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

UNIT: Jotol C550 RUN: 2 DATE: 8-26-2008

Meter Box: SH Y Factor: .940

Leak checks: 15 " Hg @ .002 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:	.20		SAMPLING RATIO: 26			: 1	BP: 30.15		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1435	878.013	878.013	8.177	.16	81	425	81	2.0
125	40	879.639	879.639	8.177	.16	81	425	81	2.0
130	45	881.265	881.265	8.177	.16	81	425	81	2.0
135	50	882.890	882.890	8.688	.18	81	400	81	2.0
140	55	884.617	884.617	8.688	.18	81	400	81	2.0
145	1500	886.344	886.344	8.688	.18	81	400	81	2.0
150	05	888.071	888.071	8.688	.18	81	400	81	2.0
155	10	889.799	889.799	8.688	.18	81	400	81	2.0
160	15	891.526	891.526	8.688	.18	81	400	81	2.0
165	20	893.253	893.253	8.688	.18	81	400	81	2.0
170	25	894.980	894.980	8.688	.18	81	400	81	2.0
175	30	896.707	896.707	8.177	.16	81	425	81	2.0
ROTO PRESS:		.20	TOTALS:	102.212	2.08	972	BP.: 30.10		
180	1535	898.332	898.332	8.674	.18	81	400	81	2.0
185	40	900.064	900.064	8.164	.16	81	425	81	2.0
190	45	901.694	901.694	8.164	.16	81	425	81	2.0
195	50	903.324	903.324	7.710	.14	81	450	81	2.0
200	55	904.863	904.863	7.710	.14	81	450	81	2.0
205	1600	906.403	906.403	7.710	.14	81	450	81	2.0
210	05	907.943	907.943	7.710	.14	81	450	81	2.0
215	10	909.482	909.482	7.710	.14	81	450	81	2.0
220				63.552	1.20	648			
225									
230				165.764	3.28	1620			
235						3522			
			TOTALS:	374.300	7.74	86	MAX VACC =		3.0
TOTAL Cu Ft.		72.482	TOTALS:	8.507	.176	540	AVG. BP: 30.15		

*44

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : CS50 RUN : 2 DATE : 8-26-08

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	703.4	580.9	485.5	886.5
INITIAL WT	610.8	576.5	483.8	872.1
NET WT GRAMS	92.6	4.4	1.7	14.4

TOTAL CATCH : 113.1 GRAMS H_2O

FRONT HALF

FILTER #	140F	
FINAL WT g	.6885	
INITIAL WT g	.6126	
NET WT g	.0759	

BEAKER #	76
DESC.	ACETONE
FINAL WT g	103.8610
INITIAL WT g	103.8033
NET WT g	.0577
VOL. DESC. ml	80

BACK HALF

FILTER #	140.B	
FINAL WT g	.4061	
INITIAL WT g	.3657	
NET WT g	.0404	

BEAKER #	77	78	79	80	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	107.4945	94.5165	97.6547	109.1629	
INITIAL WT g	107.3864	94.4943	97.6163	109.1245	
NET WT g	.1081	.0222	.0384	.0384	.0768
VOL. DESC ml	150	75	150	150	300

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 1-17-2008 Time : 1300 By : Cp Wi

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

Back Size: 8.2 cm Lot No. :

	DATE: 1-22-08	BY: Cp	DATE: 1-23-08	BY: Cp	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
131F	.6219	1207	.6221	1410	✓	
132F	.6179	1208	.6180	1411	✓	
133F	.6197	1209	.6195	1412	✓	
134F	.6166	1210	.6166	1413	✓	
135F	.6199	1211	.6195	1414	✓	
136F	.6193	1212	.6193	1415	✓	
137F	.6182	1213	.6181	1416	✓	
138F	.6162	1214	.6164	1417	✓	
139F	.6159	1215	.6158	1418	✓	
140F	.6126	1216	.6126	1419	✓ ← R-2	

131B	.3596	1217	.3598	1420	✓	
132B	.3610	1218	.3611	1421	✓	
133B	.3624	1219	.3625	1422	✓	
134B	.3608	1220	.3607	1423	✓	
135B	.3598	1221	.3599	1424	✓	
136B	.3630	1222	.3631	1425	✓	
137B	.3650	1223	.3651	1427	✓	
138B	.3626	1224	.3624	1428	✓	
139B	.3634	1225	.3633	1429	✓	
140B	.3658	1226	.3657	1430	✓ ← R-2	

Checked by: Cp W. Date: 2-15-08 Time: 1220

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
1-22-08	1200	Cp		68	47
1-23-08	1400	Cp		74	47

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 1-8-2008 Time : 1100 By : CP

	DATE: 1-18-2008	BY: CP	DATE: 1-21-2008	BY: CP	DATE:	BY:
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
76	103.8038	1235	103.8033	1436	✓	
77	107.3866	1236	107.3864	1437	✓ R-2	
78	94.4938	1237	94.4943	1438	✓	
79	97.6167	1238	97.6163	1439	✓	
80	109.1248	1239	109.1245	1440	✓	
81	101.4636	1240	101.4635	1441	✓	
82	97.4749	1242	97.4749	1442	✓	
83	98.3276	1243	98.3275	1444	✓	
84	105.5525	1244	105.5527	1445	✓	
85	97.9922	1245	97.9918	1446	✓	
86	104.7432	1246	104.7433	1447	✓	
87	105.9182	1247	105.9183	1448	✓	
88	100.0030	1248	100.0028	1450	✓	
89	120.6720	1250	120.6720	1451	✓	
90	106.4039	1251	106.4042	1452	✓	
91	95.0504	1252	95.0502	1453	✓	
92	96.6794	1253	96.6794	1454	✓	
93	107.8846	1255	107.8848	1455	✓	
94	106.3689	1256	106.3687	1456	✓	
95	107.4094	1257	107.4092	1457	✓	
96	103.9824	1258	103.9826	1458	✓	
97	99.9846	1259	99.9844	1459	✓	
98	105.0256	1300	105.0251	1500	✓	
99	104.9354	1301	104.9352	1501	✓	
100	106.7417	1302	106.7416	1502	✓	

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
1-18-2008	1230	CP		76	45
1-21-2008	1430	CP		65	48

Checked by: Ch W.
Date: 2-15-08
Time: 1216

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT: C550 RUN: 2 DATE: 8-26-08 Page: 1 of

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
76	8-27	0900	Cp	103.8621	8-28	0945	Cp	103.8605	8-29	1309	Cp	103.8610	8-30	1038	Cp
77	8-27	0900	Cp	107.4952	8-28	0946	Cp	107.4942	8-29	1310	Cp	107.4945	8-30	1039	Cp
78	8-27	0900	Cp	94.5170	8-28	0947	Cp	94.5165	8-29	1311	Cp				
79	8-27	0900	Cp	97.6551	8-28	0948	Cp	97.6547	8-29	1312	Cp				
80	8-27	0900	Cp	109.1633	8-28	0950	Cp	109.1629	8-29	1313	Cp				

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
140F	8-26	1700	Cp	.7052	8-27	0921	Cp	.6906	8-28	0943	Cp	.6882	8-29	1308	Cp
				.6885	8-30	1037	Cp		8-31		Cp				
140B	8-26	1700	Cp	.4066	8-27	0922	Cp	.4061	8-28	0944	Cp				

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	8-27-08	0900	Cp	78	46
2	8-28	0930	Cp	78	46
3	8-29	1300	Cp	78	46
4	8-30	1030	Cp	78	46
5	8-15-08	1015	Cp	76	49

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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 8-27-2008 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
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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates:	Scale:	Model:	SN:
From 10-22-07 Through 8-26-2008	Sartorius	A 120 S	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
2008 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	6-8-08	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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 4-26-2007 Through 10-14-2007	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
99.9997	10.0001	1.0001	.0999	Cb	4-26	0815	73	47
100.0002	10.0001	1.0000	.0999	Cb	4-27	1400	78	46
99.9999	10.0000	1.0000	.1000	Cb	4-29	1100	74	44
100.0003	10.0001	.9999	.1000	Cb	5-1	1000	71	45
100.0003	10.0001	.9999	.1000	Cb	5-2	1530	76	45
100.0001	9.9999	1.0000	.1000	Cb	5-9	1400	78	46
100.0001	10.0000	1.0000	.0998	Cb	5-13	1630	76	45
100.0002	10.0001	1.0000	.1000	Cb	5-18	1350	77	46
100.0003	10.0001	1.0000	.0998	Cb	5-21	1300	72	46
99.9999	10.0001	1.0000	.1000	Cb	5-22	1600	78	46
99.9999	10.0001	1.0000	.0996	Cb	6-5	1530	74	44
100.0000	10.0001	.9998	.0999	Cb	6-7	1030	70	48
100.0000	10.0001	1.0000	.1000	Cb	6-8	1000	68	47
99.9998	10.0004	1.0000	.1000	Cb	6-9	1300	78	40
99.9997	10.0000	1.0000	.1000	Cb	6-10	1530	78	48
100.0003	10.0002	1.0000	.0998	Cb	6-11	0900	72	46
99.9998	10.0000	.9999	.0998	Cb	6-12	2100	78	40
99.9998	9.9998	1.0000	.0998	Cb	6-13	1600	74	47
99.9999	9.9999	1.0000	.0999	Cb	6-14	1130	77	49
99.9999	10.0000	1.0000	.1000	Cb	6-15	1430	75	48
100.0001	10.0007	1.0001	.1000	Cb	6-19	1040	78	46
100.0000	10.0001	.9999	.0997	Cb	6-20	1050	75	48
99.9996	9.9998	.9999	.0998	Cb	8-24	1830	74	48
100.0002	10.0002	1.0001	.0999	Cb	8-31	1000	78	46
99.9999	10.0002	1.0001	.1000	Cb	9-1	1130	77	46
99.9999	10.0001	.9999	.0999	Cb	9-4	1100	78	43
99.9997	9.9999	.9998	.0998	Cb	9-5	1000	78	46
100.0000	10.0000	.9999	.0999	Cb	9-6	1500	78	46
99.9997	10.0000	1.0000	.1000	Cb	9-7	1745	78	43
100.0001	10.0000	1.0000	.0997	Cb	9-8	1500	78	46
100.0002	10.0000	.9999	.1000	Cb	10-5	0930	75	48
100.0003	10.0003	1.0000	.0999	Cb	10-6	1400	78	46
100.0001	10.0000	1.0000	.0999	Cb	10-8	1000	75	44
100.0002	10.0001	1.0000	.0999	Cb	10-9	1130	78	46
100.0001	10.0002	.9999	.0997	Cb	10-10	1500	74	44
99.9999	10.0000	1.0001	.0999	Cb	10-11	1120	75	48
100.0000	9.9999	.9999	.0998	Cb	10-12	1130	72	45
100.0003	9.9999	1.0000	.1000	Cb	10-13	1030	78	46
99.9999	10.0000	1.0000	.1000	Cb	10-14	1420	78	46

BLANK PROCESSING DATA SHEET # 5

UNIT : C550 RUN : 2 DATE : 8-26 08

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 Sparkletts 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: C550 RUN: 2 DATE: 8-26-08

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: .0759 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0759 g

BEAKERS: .0577 (Total Catch) g - 80 (ml Acetone) (.000007 g) (Blank Value / ml Acetone) = .0571 g
.0006

TOTAL FRONT HALF CATCH : .1330 g

BACK HALF CATCH

FILTERS: .0404 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0404 g

BEAKERS:

Acetone: .1081 (Total Catch) g - 150 (ml Acetone) (.000007 g) (Blank Value / ml Acetone) = .1070 g
.0011

Extract: .0222 (Total Catch) g - 75 (ml Dichloromethane) (.000019 g) (Blank Value / Dichloromethane) = .0208 g
(.0014)

Water: .0768 (Total Catch) g - 300 (ml Water) (.000018 g) (Blank Value / Water) = .0714 g
.0054

TOTAL BACK HALF CATCH : .2396 g

TOTAL CATCH : .3726 g

% FRONT HALF : 35.7 %

CALCULATIONS DATA SHEET # 7

UNIT: Jotul C550 RUN: 2 DATE: 8-26-2008

1) $Vm\,(std) = \dfrac{(72.482\ Vm)(17.64)(.940\ mcf)\left(30.15\ "Hg + \dfrac{.176"\ H_2O}{13.6}\right)}{(540\ TmA)} = \dfrac{67.1331}{000.0000}$ dscf

2) $Vw\,(std) = (.04707)(113.1\ ml\ H_2O) = \dfrac{5.3236}{00.0000}$ scf

3) $Asw = \dfrac{(5.3236\ scf)}{(5.3236\ scf + 67.1331\ dscf)} = \dfrac{.0735}{.0000}$ $Bws \times 100 = \dfrac{7.3473}{00.0000}$ % H_2O

4) $Cs = \dfrac{(.3726\ g.)}{(67.1331\ dscf)}(15.43) = \dfrac{.0856}{0.0000}$ gr / dscf

5) Estimated $g / hr = \dfrac{(.3726\ g.)}{(67.1331\ dscf)}\left(\dfrac{8.507}{00.0000}\ dscfm\right)(60) = \dfrac{2.8329}{00.0000}$ 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 C550 RUN : 2 DATE : 8-26-2008

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

Wet Bulb / Dry Bulb

Pre : WB : 60 DB : 74 = 43 % RH 1.3 % H_2O

Post : WB : 60 DB : 74 = 43 % RH 1.3 % H_2O

Average : 43 % RH 1.3 % H_2O

Empty Stove Weight (lbs) : N/A w/ stack & oil seal : Wet : N/A Dry : 0.0

Kindling Weight (lbs) : Paper : 1 Wood : 2.0

Preburn Fuel Weight : 23.9 + 18.1 Total : 42.0

Kindling & Preburn Fuel Weight (wood only) (lbs) : Total : 44.0

Coal Bed Wt Range (lbs) : 3.4 - 2.8 Scale : 3.4 - 2.8

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

Lower : .20 × fuel weight : Always round UP to nearest tenth Actual Coal Bed Weight : 3.4

Maximum Coal Bed Removal (lbs) : ((3.4 (Upper) + 2.8 (Lower)) ÷ 2) .25 = .7 (round down to nearest tenth)

Test Fuel (.75" × 1.5" × 5" spacers) = 18 pcs

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" × 4"	16	3	6.1	44.2
4" × 4"	16	2	7.7	55.8

Test Fuel Weight : 13.8 lbs

Estimated Dry Burn Rate :

$$\frac{13.8 - (13.8 \times .16541)}{2.2046} \times \frac{60}{\underset{\text{TIME}}{215}} = 1.458 \text{ kg / hr}$$

$$\text{Estimated BTU's/hr : } 19{,}140 \times \frac{63}{100} \times \frac{1.458}{\text{DBR}} = 17580.9 \text{ BTU's/hr}$$

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

251 = 1.25

WOOD STOVE OPERATING DATA PAGE #9

Unit : Jotol C550 Run : 2 Date : 8-26-2008

FIRE STARTED: 0810

WARM UP AND PREBURN:

PRIMARY AIR : Set wide open for all warm-up / preburn fuel charges. Then set to 5/16" 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 30 sec.

TEST:

DOOR wide open during loading 4 min. 45 sec.

PRIMARY AIR : Opened full for first ______ min., then set to run setting of 5/16".

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

FAN:

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

ON / OFF first 30 minutes of test ON / OFF balance of test run

Fan speed set at LOW

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 10 or 16 inches.

1st warm up / pre-burn fuel charge (23.9 lbs.) added at 0819

2nd warm up / pre-burn fuel charge (18.1 lbs.) added at 0942

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 C550 Run : 2 Date : 8-26-2008

Room Temperature : 73 °F Temperature Correction Set?: YES NO

Calibration Check : 12.0% + or- 0.2%? YES NO

Time Test Fuel moisture reading taken : 1020

pc #	Dimen.	Use	TOP	BOTTOM	SIDE	Average
1	2"x4"x8'	K	14.7	12.9	14.2	13.933
2						
3						
4	2"x4"x8'	P	20.3	20.5	21.0	20.6
5	2"x4"x8'	P	18.1	18.2	18.1	18.1
6	2"x4"x8'	P	20.7	19.9	20.2	20.3
7	2"x4"x8'	P				59.0
8	2"x4"x8'	P				
9						
10						
11						
12	2x4x16"	T	19.0	18.8	19.4	19.1
13	"	T	20.9	21.7	20.5	21.0
14	"	T	22.4	22.4	22.5	22.4
15	4x4x16"	T	17.9	18.2	18.2	18.1
16	"	T	18.4	18.3	18.7	185
17						99.1
18						
19						
20	Spacers	T	21.8	21.5	19.7	21.0

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	13.933 %	19.667 %	19.820 %
Wet Moisture % :	12.229 %	16.435 %	16.541 %

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 with meter corrected for temperature.

GAS DATA SHEET #12

WEIGHT: 3.4

DATE: 8-26-2008

UNIT: Jotul C550

RUN: 2

PAGE: 1 OF 2

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V..	CO	STATIC	SO_2PPM
0 / 35	17.2	13.8	—	.171	4.2	.627	15.7	.088	.89	.033	450
5 / 40	16.3	12.9	.9	.277	6.9	.540	13.5	.035	.37	.045	375
10 / 45	16.0	12.6	.3	.125	3.1	.687	17.2	.045	.47	.040	425
15 / 50	15.7	12.3	.3	.150	3.7	.683	17.1	.043	.45	.040	425
20 / 55	15.1	11.7	.6	.315	7.8	.496	12.4	.056	.58	.046	425
25 / 1300	14.1	10.7	1.0	.361	9.0	.432	10.8	.092	.93	.055	450
Fan ✓ 30 / 05	13.3	9.9	.8	.372	9.2	.432	10.8	.076	.77	.056	450
35 / 10	12.5	9.1	.8	.424	10.5	.388	9.7	.051	.53	.057	425
40 / 15	11.7	8.3	.8	.430	10.7	.384	9.6	.045	.47	.057	400
45 / 20	11.0	7.6	.7	.395	9.8	.432	10.8	.012	.14	.056	375
50 / 25	10.3	6.9	.7	.390	9.7	.440	11.0	.008	.10	.057	375
55 / 30	9.7	6.3	.6	.393	9.8	.436	10.9	.007	.09	.056	375
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.598	*****
60 / 35	9.1	5.7	.6	.361	9.0	.464	11.6	.012	.14	.056	375
65 / 40	8.6	5.2	.5	.388	9.6	.436	10.9	.022	.24	.055	400
70 / 45	8.0	4.6	.6	.408	10.1	.416	10.4	.021	.23	.056	375
75 / 50	7.5	4.1	.5	.365	9.1	.456	11.4	.022	.24	.055	375
80 / 55	7.1	3.7	.4	.347	8.6	.476	11.9	.019	.21	.054	375
85 / 1400	6.8	3.4	.3	.321	8.0	.500	12.5	.024	.26	.053	375
90 / 05	6.4	3.2	.2	.298	7.4	.520	13.0	.035	.37	.052	400
95 / 10	6.1	2.7	.5	.313	7.8	.508	12.7	.028	.30	.051	400
100 / 15	5.9	2.5	.2	.294	7.3	.516	12.9	.054	.56	.050	425
105 / 20	5.6	2.2	.3	.216	5.3	.579	14.5	.098	.99	.048	475
110 / 25	5.5	2.1	.1	.213	5.3	.579	14.5	.095	.96	.045	450
115 / 30	5.4	2.0	.1	.210	5.2	.579	14.5	.104	1.05	.045	425
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.620	*****
120 / 35	5.3	1.9	.1	.209	5.2	.575	14.4	.113	1.14	.045	425
125 / 40	5.1	1.7	.2	.207	5.1	.575	14.4	.121	1.22	.044	425
130 / 45	5.0	1.6	.1	.201	5.0	.583	14.6	.116	1.17	.043	425
135 / 50	4.9	1.5	.1	.199	4.9	.579	14.5	.131	1.32	.042	400
140 / 55	4.8	1.4	.1	.194	4.8	.579	14.5	.147	1.48	.040	400
145 / 1500	4.7	1.3	.1	.190	4.7	.579	14.5	.152	1.53	.040	400
150 / 05	4.6	1.2	.1	.190	4.7	.579	14.5	.155	1.55	.039	400
155 / 10	4.5	1.1	.1	.191	4.7	.587	14.7	.139	1.40	.039	400
160 / 15	4.4	1.0	.1	.189	4.7	.587	14.7	.132	1.33	.038	400
165 / 20	4.3	.9	.1	.186	4.6	.591	14.8	.131	1.32	.038	400
170 / 25	4.2	.8	.1	.185	4.6	.591	14.8	.133	1.34	.037	400
175 / 30	4.1	.7	.1	.184	4.5	.595	14.9	.132	1.33	.036	425
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.481	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	1.699	*****

GAS DATA SHEET #12

WEIGHT: 3.4

DATE: 8-26-08

UNIT: C550

RUN: 2 PAGE: 2 OF 2

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
180 35	4.0	.6	.1	.178	4.4	.599	15.0	.130	1.31	.036	400
185 40	3.9	.5	.1	.172	4.2	.607	15.2	.138	1.39	.035	425
190 45	3.8	.4	.1	.171	4.2	.607	15.2	.138	1.39	.035	425
195 50	3.86	.4	.0	.170	4.2	.607	15.2	.131	1.32	.034	450
200 55	3.7	.3	.1	.170	4.2	.611	15.3	.129	1.30	.033	450
205 1600	3.6	.2	.1	.179	4.4	.603	15.1	.125	1.26	.032	450
210 05	3.5	.1	.1	.162	4.0	.619	15.5	.119	1.20	-.034	450
215 10	3.4	0	.1	.166	4.0	.623	15.6	.110	1.11	-.033	450
220 15											
225 20											
230 25											
235 30											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.272	*****
240											
245											
250											
255											
260											
265											
270											
275											
280											
285											
290											
295											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****		*****
300											
305											
310											
315											
320											
325											
330											
335											
340											
345											
350											
355										1.971	
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****		*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.045	*****

÷44

PREBURN DATA SHEET #13

UNIT: Jotul C550 RUN: 2 DATE: 8-26-2008 PAGE: 1 of

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
0 11:25	4.4	—	358	586	407	426	457	466			76	-.050	PREBURN START: # 1.0 UP
5 30	4.3	.1	260	551	401	418	448	444			76	-.045	COAL BED SCALE RANGE:
10 35	4.2	.1	256	522	395	408	438	422			76	-.044	3.4 → 2.8
15 40	4.1	.1	247	499	386	394	428	401			75	-.043	PRIMARY AIR: 5/16"
20 45	4.1	.0	236	475	375	376	417	380			75	-.040	SECONDARY AIR: N/A
25 50	4.0	.1	230	456	368	364	410	370			76	-.040	FAN: Low
30 55	3.9	.1	223	441	356	356	399	361			76	-.039	PUMPS ON AT:
35 1200	3.9	.0	217	429	345	340	388	346			74	-.038	CHECK WB/DB: N/A
40 05	3.8	.1	212	413	336	330	379	332			74	-.037	
45 10	3.7	.1	208	402	329	323	371	321			74	-.036	349
50 15	3.6	.1	204	391	321	315	364	309			73	-.035	340
55 20	3.6	.0	200	380	316	307	357	298			72	-.035	331
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	
60 25	3.5	.1	197	371	307	300	350	290			72	-.034	323
65 30	3.5	.0	195	364	301	292	344	280			72	-.033	316
70 35	3.4	.1	201	357	299	286	341	276			72	-.033	311.8
75 40													
80 45													
50													
55													
1300													

Jotul C550

Temperatue Data Sheet 14

Run 2
8/26/08

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	201	357	299	286	341	276	######	######	72	1391	232	58	234	39	36
5	388	382	292	277	338	300	######	######	72	1382	232	40	234	39	36
10	247	390	289	279	331	318	######	######	71	1375	232	39	235	39	36
15	223	378	285	275	323	321	######	######	71	1368	233	40	235	39	36
20	268	422	281	268	316	320	######	######	72	1360	233	41	235	38	37
25	349	547	276	267	309	319	######	######	71	1352	233	42	235	38	37
30	348	609	273	271	306	321	######	######	71	1347	232	42	236	38	37
35	375	654	272	285	306	304	######	######	72	1344	233	42	235	38	37
40	384	689	275	290	313	290	######	######	71	1342	233	42	236	38	37
45	384	711	277	294	320	282	######	######	71	1342	235	42	236	38	38
50	385	727	281	297	326	275	######	######	72	1342	237	42	238	38	38
55	381	727	286	298	330	269	######	######	73	1343	239	43	241	38	38
60	370	718	292	299	335	265	######	######	73	1344	241	43	242	37	38
65	368	716	296	302	340	262	######	######	73	1344	241	44	242	37	38
70	376	733	301	306	346	262	######	######	73	1344	243	44	243	37	38
75	364	720	305	316	356	262	######	######	73	1345	244	44	244	37	38
80	350	697	310	327	367	265	######	######	73	1345	244	44	245	37	38
85	337	674	313	337	376	267	######	######	74	1345	245	45	245	37	39
90	326	659	314	345	382	269	######	######	74	1345	245	45	246	37	39
95	319	641	316	350	388	270	######	######	74	1345	246	45	246	37	39
100	315	629	318	355	392	271	######	######	74	1346	246	46	246	37	39
105	289	590	320	359	395	274	######	######	75	1347	246	46	246	38	39
110	272	554	320	360	396	275	######	######	74	1348	247	47	246	38	39
115	261	525	318	357	396	278	######	######	74	1348	246	47	245	38	38
120	252	500	316	350	393	279	######	######	75	1348	246	47	244	38	38
125	246	481	314	344	392	279	######	######	75	1347	245	47	244	38	38
130	244	478	314	338	389	285	######	######	75	1346	245	47	244	38	38
135	240	470	311	328	383	301	######	######	74	1345	245	48	244	38	37
140	235	460	309	317	377	317	######	######	75	1345	245	47	243	37	37
145	230	449	304	307	370	331	######	######	74	1344	245	48	243	37	37
150	226	440	302	298	364	340	######	######	75	1343	245	48	243	37	37
155	222	428	296	291	358	346	######	######	74	1342	244	48	242	37	36
160	219	420	293	285	352	350	######	######	74	1342	244	48	241	37	36
165	216	413	290	280	347	351	######	######	75	1342	244	48	242	37	36
170	213	405	286	276	343	337	######	######	74	1342	243	48	241	36	36

175	211	399	286	272	340	333	######	######	75	1343	244	48	241	36	36
180	210	393	280	268	335	330	######	######	75	1343	244	49	241	36	35
185	207	387	275	264	331	324	######	######	75	1343	243	49	240	36	35
190	202	377	274	261	329	314	######	######	74	1342	243	49	240	36	35
195	199	368	273	258	324	304	######	######	74	1340	242	49	239	35	35
200	197	360	272	255	320	294	######	######	74	1338	242	50	240	35	34
205	195	353	270	253	316	286	######	######	74	1337	243	50	240	35	34
210	193	346	267	250	312	278	######	######	73	1336	242	50	239	34	34
215	190	339	266	248	309	271	######	######	74	1334	242	50	239	34	33

TEMPERATURE DATA SHEET #14A

		TEST TIME	215		
STACK AVG	**278**	TOP AVG	**516**	LT SIDE AVG	**293**
BACK AVG	**299**	RT SIDE AVG	**348**	BOTTOM AVG	**297**
FIREBOX AVG	**########**	SEC/CAT AVG	**########**	AMBIENT AVG	**73**

END	**286.7**	
START	**311.8**	
	-25.1	DELTA T

CIRCLE: **LOSS / GAIN**

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 8-26-2008 Analyte : CO_2 (15-1)

Unit : Jotul C550 Run # : 2

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 % CO_2 Cyl. Press. : 670 PSI

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

Span Cyl. # : 487905 Conc. : 12.20 % CO_2 Cyl. Press. : 1660 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 : Clp Washington Time : 1050 Temp : 79 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.3	.003	.068	.068	.273
SPAN	48.8	.488	12.20	48.8	.488	12.185	-.015	-.062

POST RUN Audit : by : Clp Washington Time : 1630 Temp : 73 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.001	.018	.018	.073
SPAN	48.8	.488	12.20	49.0	.490	12.235	.035	.138

± 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 - 26 - 2008 Analyte : O_2 (15-2)

Unit : Jotul C550 Run # : 2

Zero Cyl. # : 168TAC 3A Conc. : 0.00 % O_2 Cyl. Press. : 670 PSI

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

Span Cyl. # : 487905 Conc. : 12.60 % O_2 Cyl. Press. : 1660 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 : Cp Washington Time : 1050 Temp : 79 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.002	.020	.020	.079
SPAN	12.60	.504	12.6	12.6	.504	12.608	.008	.033

POST RUN Audit : by : Cp Washington Time : 1630 Temp : 73 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.002	.020	.020	.079
SPAN	12.60	.504	12.6	12.6	.505	12.633	.033	.133

± 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 : 8-26-2008 Analyte : CO (15-3)

Unit : Jotul 6550 Run # : 2

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 % CO Cyl. Press. : 670 PSI

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

Span Cyl. # : C487905 Conc. : 4.90 % CO Cyl. Press. : 1660 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 : [signature] Time : 1050 Temp : 79 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	-.001	.013	.013	.126
SPAN	49.0	.490	4.90	49.1	.491	4.907	.007	.071

POST RUN Audit : by : [signature] Time : 1630 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	.023	.023	.225
SPAN	49.0	.490	4.90	48.9	.489	4.887	-.013	-.128

± 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 -2008 Analyte : SO_2 (15-4)

Unit : Jotul C550 Run # : 2

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 ppm SO_2 Cyl. Press. : 670 PSI

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

Span Cyl. # : CC82089 Conc. : 1250 ppm SO_2 Cyl. Press. : 1860 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 : Cp Worthington Time : 1050 Temp : 79 °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	2.936	2.936	.117
SPAN	50.0	.500	1250	50.1	.501	1258.9	8.900	.356

POST RUN Audit : by : Cp Worthington Time : 1630 Temp : 73 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	.00.0	.000	.424	.424	.017
SPAN	50.0	.500	1250	50.2	.502	1261.4	11.400	.456

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

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

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

QUALITY CHECKS DATA SHEET # 16

UNIT: Jotul C550 RUN: 2 DATE: 8-26-2008

Thermocouple Check:

T/C # 1	— °F	T/C # 13	64.3 °F
T/C # 2	— °F	T/C # 14	63.4 °F
T/C # 3	63.3 °F	T/C # 15	64.2 °F
T/C # 4	62.4 °F	T/C # 16	67.5 °F
T/C # 5	61.8 °F	T/C # 17	64.5 °F
T/C # 6	62.1 °F	T/C # 18	65.4 °F
T/C # 7	61.8 °F	T/C # 19	62.7 °F
T/C # 8	61.6 °F	T/C # 20	— °F
T/C # 9	— °F	T/C # 21	— °F
T/C # 10	— °F	T/C # 22	— °F
T/C # 11	59.4 °F	T/C # 23	— °F
T/C # 12	68.4 °F	T/C # 24	— °F

Thermocouple Readout:

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

ZERO .4 °F Adj. to 0.0 °F ZERO Ø °F Difference Ø %

SPAN 1997.1 °F Adj. to 2000.0 °F SPAN 2001.7 °F Difference .085 %

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 200.2 °F	400	= 400.0 °F
600	= 599.9 °F	800	= 799.7 °F	1000	= 999.8 °F
1200	= 1199.8 °F	1400	= 1399.5 °F	1600	= 1599.6 °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: 13.4 − 3.4 = 10.0

Post: 13.4 − 3.4 = 10.0

Stack Cleaned Prior to Test Run: YES ______ NO X

TABLE 1 ----- RAW DATA

CLIENT : Jotul TEST No. : 3

MODEL: C550 DATE: 25-Aug-08

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	910.500	0.150	91	0.66	5.90	275
5	912.000	0.110	92	0.54	6.20	325
10	913.324	0.080	92	1.24	15.50	375
15	914.472	0.080	92	0.82	16.00	375
20	915.620	0.090	92	0.84	16.40	350
25	916.849	0.090	92	0.78	16.60	350
30	918.079	0.080	92	0.60	16.30	375
35	919.227	0.090	92	0.36	15.20	350
40	920.456	0.110	92	0.34	13.60	325
45	921.781	0.130	92	0.14	11.30	300
50	923.215	0.130	92	0.16	9.60	300
55	924.649	0.130	92	0.21	9.20	300
60	926.084	0.130	92	0.19	9.10	300
65	927.518	0.130	92	0.21	8.90	300
70	928.952	0.130	92	0.18	8.50	300
75	930.387	0.130	92	0.47	6.70	300
80	931.821	0.130	92	0.55	6.50	300
85	933.255	0.130	92	0.60	6.40	300
90	934.690	0.130	92	0.68	6.00	300
95	936.124	0.130	92	0.71	5.90	300
100	937.558	0.130	92	0.80	5.60	275
105	939.123	0.150	92	0.84	5.40	275
110	940.687	0.150	92	0.76	5.30	275

TABLE 2---RAW DATA

CLIENT :	Jotul	TEST No.	3
MODEL:	C550	DATE:	25-Aug-08

****

METER CAL. FACTOR (Y)	-------	0.94	Wt. WOOD BURNED(LB) -------	14.6	Lbs
BAROMETRIC PRESS.(Pb)	-------	30.05 in Hg	WET,FUEL MOISTURE % -------	17.533	%
LEAK RATE POST (Lp)	-------	0.015 cfm	Wt. PART. COLLECTED -------	0.2083	g
WATER VOL. (V1c)	-------	59.1 Ml	METER VOLUME Vm -------	30.187	mcf
TEST TIME (MIN)	-------	110 min	HC MOLE FRACTION -------	0.0132	

TABLE 3 ----FIELD DATA AVERAGES

CLIENT : Jotul — TEST No. 3

MODEL: C550 — DATE: 25-Aug-08

****

AVG DELTA H	-------	0.12 in H2O	AVG PRCNT CO	-------	0.55	%
AVG METER TEMP. Tm	-------	92 deg F	AVG PRCNT CO2	-------	9.83	%
AVG PPM SO2	-------	314 PPM	AVG BAL CO2/CO	-------	17.83	%

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul   TEST No. 3

MODEL: C550   DATE: 25-Aug-08

****

STD SAMPLE VOL. Vm(std) d) ------	27.28 dscf	STACK GAS FLOW Qsd -------	917.014 dscf/Hr & 15.28 dscf/min
VOL. WATER VAPOR Vw(s td) -----	2.782 scf	PARTICULATE CONCTRT. C s ------	0.0076 g/dscf
PRCNT MSTR Bws -------	9.26 %	PARTC.EMISS. RATE E -------	7.00 g/Hr
BURN RATE BR -------	2.98 Kg/Hr	MOLES OF GAS PER Lb WOOD Nt ----	0.36 Lb-mole/Lb
CO EMISSION RATE -------	169.30 g/Hr & 56.83 g/Kgdry fuel	PART.EMISS. RATE ------	2.35 g/Kgdry fuel

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Jotul TEST No. : 3

MODEL: C550 DATE: 25-Aug-08

	TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR		PROPRTN RATE VAR. AVERAGE	
	5	373.0	96		100	
	10	388.7	100			
	15	388.9	100			
	20	388.9	100			
	25	388.6	100			
	30	388.9	100			
	35	388.9	100			
	40	388.6	100			
	45	389.0	100			
	50	388.7	100			
	55	388.7	100			
	60	388.9	100			
	65	388.7	100			
	70	388.7	100			
	75	388.9	100			
	80	388.7	100			
	85	388.7	100			
	90	388.9	100			
	95	388.7	100			
	100	388.7	100			
	105	388.8	100			
	110	388.6	100			
	115					

COMPUTER INPUT DATA SHEET #1

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Client: Jotul North America

Address: 55 Hutcherson

Gorham, ME 04038

Phone: 800-797-5912 Fax: 207-591-6623

Run No.: 3 Date of Test: 8-27-2008 Burn Rate: 2.98

Model No.: C550 ☐ min ☐ min-1.25 ☐ fan

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

Dry Gas Meter Y Factor: .940 (0.000) (Data Sheet #2) Post Leak Rate: .015 cfm (.000) (Data Sheet #2) Time: 110 min. (000) (Data Sheet #2)

Dry Gas Meter Volume: 30.187 cf (00.000) (Data Sheet #2)

Stack Flow: 10.914 dscfm (00.000) (Data Sheet #2) Δ H: .120 in. H_2O (.000) (Data Sheet #2)

Maximum Vac.: 2.0 (0.0) (Data Sheet #2) Barometric Pressure: 30.05 in. Hg (00.00) (Data Sheet #2)

H_2O Captured: 59.1 g (00.0) (Data Sheet #3)

Front Half Catch % Of Total: 36.8 % (00.0) (Data Sheet #6) Total Particulate Catch: .2083 g (0.0000) (Data Sheet #6)

Flue Gas Moisture: 9.2607 % (00.000) (Data Sheet #7)

Particulate Emission: .1179 gr/dscf (0.0000) (Data Sheet #7)

Relative Humidity: 40.5 % RH (00.0) (Data Sheet #8) Ambient Moisture: 1.5 % H_2O (0.00) (Data Sheet #8)

Preburn Fuel Wt.: 45.7 lbs. (00.0) (Data Sheet #8) Coal Bed Wt.: 3.1 lbs. (00.0) (Data sheet #8) Test Fuel Wt.: 14.6 lbs. (00.0) (Data sheet #8)

Heat Output (EPA Default): 35933.4 BTU/hr (00,000.0) (Data Sheet #8)

Kindling Fuel % Moisture (wet): 11.269 % (00.000) (Data Sheet #10) Pretest Fuel % Moisture (wet): 16.225 % (00.000) (Data Sheet #10)

Test Fuel % Moisture (dry): 21.260 % (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove]) Test Fuel % Moisture (wet): 17.533 %

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

Stack Static Pressure: -.056 in. H_2O (+/- .000) (Data Sheet #12)

Average Ambient Temperature: 82 °F (00) (Data Sheet #14) Stove Temperature Change: -64.3 °F (+/- 000.0) (Data Sheet #14)

TIME

Test start = 1325

End = 1515

meter temp = 552

METER BOX DATA SHEET PAGE # 2

Page: 1 of

UNIT: Jotul C550 RUN: 3 DATE: 8-27-2008

Meter Box: 5H Y Factor: .940

Leak checks: 15 " Hg @ .017 cfm " Hg @ cfm

15 " Hg @ .015 cfm " Hg @ cfm

Inject SO² @ 100 cc/min. Nozzle: Probe @ 3/8 " od Initial Volume: 1.500

ROTO: PRESS: .20			SAMPLING RATIO: 40 : 1				BP: 30.05		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1325	910.500	—	12.367	.15	91	275	91	2.0
5	30	912.000	—	10.446	.11	92	325	92	2.0
10	35	913.324	913.324	9.053	.08	92	375	92	2.0
15	40	914.472	914.472	9.053	.08	92	375	92	2.0
20	45	915.620	915.620	9.700	.09	92	350	92	2.0
25	50	916.849	916.849	9.700	.09	92	350	92	2.0
30	55	918.079	918.079	9.053	.08	92	375	92	2.0
35	1400	919.227	919.227	9.700	.09	92	350	92	2.0
40	05	920.456	920.456	10.446	.11	92	325	92	2.0
45	10	921.781	921.781	11.316	.13	92	300	92	2.0
50	15	923.215	923.215	11.316	.13	92	300	92	2.0
55	20	924.649	924.649	11.316	.13	92	300	92	2.0
ROTO PRESS:		.20	TOTALS:	123.466	1.27	1103	BP.: 30.05		
60	1425	926.084	926.084	11.316	.13	92	300	92	2.0
65	30	927.518	927.518	11.316	.13	92	300	92	2.0
70	35	928.952	928.952	11.316	.13	92	300	92	2.0
75	40	930.387	930.387	11.316	.13	92	300	92	2.0
80	45	931.821	931.821	11.316	.13	92	300	92	2.0
85	50	933.255	933.255	11.316	.13	92	300	92	2.0
90	55	934.690	934.690	11.316	.13	92	300	92	2.0
95	1500	936.124	936.124	11.316	.13	92	300	92	2.0
100	05	937.558	937.558	12.345	.15	92	275	92	2.0
105	10	939.123	939.123	12.345	.15	92	275	92	2.0
110	15	940.687	940.687	12.345	.15	92	275	92	2.0
115	20			127.563	1.49	1012			
			TOTALS:	251.029	2.76	2115	MAX VACC =		2.0
TOTAL Cu Ft.		30.187	TOTALS:	10.914	.120	92	AVG. BP: 30.05		

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(552)

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : C550 RUN : 3 DATE : 8-27-08

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	656.6	582.1	484.3	893.7
INITIAL WT	607.5	580.0	483.7	886.4
NET WT GRAMS	49.1	2.1	.6	7.3

TOTAL CATCH : 59.1 GRAMS H_2O

FRONT HALF

FILTER #	142F	
FINAL WT g	.6615	
INITIAL WT g	.6150	
NET WT g	.0465	

BEAKER #	81
DESC.	ACETONE
FINAL WT g	101.4942
INITIAL WT g	101.4635
NET WT g	.0307
VOL. DESC. ml	75

BACK HALF

FILTER #	142B	
FINAL WT g	.3940	
INITIAL WT g	.3632	
NET WT g	.0308	

BEAKER #	82	83	84	85	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	97.5335	98.3442	105.5730	98.0036	
INITIAL WT g	97.4749	98.3275	105.5527	97.9918	
NET WT g	.0586	.0167	.0203	.0118	.0321
VOL. DESC ml	100	75	150	100	250

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 1-17-2008 Time : 1300 By : Cp W

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

Back Size: 8.2 cm Lot No. :

FILTER #	FIRST WEIGHT (DATE: 1-22-08)	TIME (BY: Cp)	SECOND WEIGHT (DATE: 1-23-08)	TIME (BY: Cp)	THIRD WEIGHT (DATE:)	TIME (BY:)
141F	.6152	1230	.6150	1432	✓	
142F	.6151	1231	.6150	1433	✓ ← R-3	
143F	.6172	1232	.6168	1434	✓	
144F	.6179	1233	.6177	1435	✓	
145F	.6159	1235	.6159	1436	✓	
146F	.6170	1236	.6170	1437	✓	
147F	.6157	1237	.6156	1438	✓	
148F	.6168	1238	.6168	1439	✓	
149F	.6158	1239	.6158	1440	✓	
150F	.6158	1240	.6158	1441	✓	

141B	.3639	1241	.3639	1442	✓	
142B	.3630	1242	.3632	1443	← R-3	
143B	.3565	1243	.3565	1445	✓	
144B	.3606	1244	.3607	1446	✓	
145B	.3658	1245	.3657	1447	✓	
146B	.3599	1246	.3599	1448	✓	
147B	.3625	1247	.3625	1449	✓	
148B	.3611	1248	.3611	1450	✓	
149B	.3642	1249	.3638	1451	✓	
150B	.3626	1250	.3627	1452	✓	

Checked by: Cp W. Date: 2-15-08 Time: 1221

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
1-22-08	1200	Cp		68	47
1-23-08	1400	Cp		74	47

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 1-8-2008 Time : 1100 By : CP

BEAKER #	DATE: 1-18-2008 FIRST WEIGHT	BY: CP TIME	DATE: 1-21-2008 SECOND WEIGHT	BY: CP TIME	DATE: THIRD WEIGHT	BY: TIME
76	103.8038	1235	103.8033	1436	✓	
77	107.3866	1236	107.3864	1437	✓	
78	94.4938	1237	94.4943	1438	✓	
79	97.6167	1238	97.6163	1439	✓	
80	109.1248	1239	109.1245	1440	✓	
81	101.4636	1240	101.4635	1441	✓	
82	97.4749	1242	97.4749	1442	✓	
83	98.3276	1243	98.3275	1444	✓ R-3	
84	105.5525	1244	105.5527	1445	✓	
85	97.9922	1245	97.9918	1446	✓	
86	104.7432	1246	104.7433	1447	✓	
87	105.9182	1247	105.9183	1448	✓	
88	100.0030	1248	100.0028	1450	✓	
89	120.6720	1250	120.6720	1451	✓	
90	106.4039	1251	106.4042	1452	✓	
91	95.0504	1252	95.0502	1453	✓	
92	96.6794	1253	96.6794	1454	✓	
93	107.8846	1255	107.8848	1455	✓	
94	106.3689	1256	106.3687	1456	✓	
95	107.4094	1257	107.4092	1457	✓	
96	103.9824	1258	103.9826	1458	✓	
97	99.9846	1259	99.9844	1459	✓	
98	105.0256	1300	105.0251	1500	✓	
99	104.9354	1301	104.9352	1501	✓	
100	106.7417	1302	106.7416	1502	✓	

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
1-18-2008	1230	CP		76	45
1-21-2008	1430	CP		65	48

Checked by : CW

Date : 2-15-08

Time : 1216

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT: C550 RUN: 3 DATE: 8-27-08 Page: 1 of

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
81	8-28	0900	cp	101.4951	8-29	1314	cp	101.4938	8-30	1042	cp	101.4947	8-31	1030	cp
82	8-28	0900	cp	97.5346	8-29	1315	cp	97.5330	8-30	1043	cp	97.5335	8-31	1031	cp
83	8-28	0900	cp	98.3455	8-29	1316	cp	98.3437	8-30	1044	cp	98.3442	8-31	1032	cp
84	8-28	0900	cp	105.5739	8-29	1317	cp	105.5726	8-30	1045	cp	105.5730	8-31	1033	cp
85	8-28	0900	cp	98.0044	8-29	1318	cp	98.0031	8-30	1046	cp	98.0036	8-31	1034	cp

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
142F	8-27	1800	cp	.6638	8-28	1000	cp	.6618	8-29	1320	cp	.6615	8-30	1056	cp
142B	8-27	1800	cp	.3958	8-28	1001	cp	.3943	8-29	1321	cp	.3940	8-30	1051	cp

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	8-28-08	0930	cp	78	46
2	8-29-08	1300	cp	78	46
3	8-30-08	1030	cp	72	48
4	8-31-08	1015	cp	76	49
5					

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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 8-27-2008 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
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

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	C	10-29	1700	76	42
	99.9998	9.9999	.9999	.1000	CB	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
RL 08	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	C	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	6-8-08	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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 4-26-2007 Through 10-14-2007	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
99.9997	10.0001	1.0001	.0999	CP	4-26	0815	73	47
100.0002	10.0001	1.0000	.0999	CP	4-27	1400	78	46
99.9999	10.0000	1.0000	.1000	CP	4-29	1100	74	44
100.0003	10.0001	.9999	.1000	CP	5-1	1000	71	45
100.0003	10.0001	.9999	.1000	CP	5-7	1530	76	45
100.0001	9.9999	1.0000	.1000	CP	5-9	1400	78	46
100.0001	10.0000	1.0000	.0998	CP	5-13	1630	76	45
100.0002	10.0001	1.0000	.1000	CP	5-18	1350	77	46
100.0003	10.0001	1.0000	.0998	CP	5-21	1300	72	46
99.9999	10.0001	1.0000	.1000	CP	5-22	1600	78	46
99.9999	10.0001	1.0000	.0996	CP	6-5	1530	74	44
100.0000	10.0001	.9998	.0999	CP	6-7	1030	70	48
100.0000	10.0001	1.0000	.1000	CP	6-8	1000	68	47
99.9998	10.0004	1.0000	.1000	CP	6-9	1300	78	40
99.9997	10.0000	1.0000	.1000	CP	6-10	1530	78	48
100.0303	10.0002	1.0000	.0998	CP	6-11	0900	72	46
99.9998	10.0000	.9999	.0998	CP	6-12	2100	78	40
99.9998	9.9998	1.0000	.0998	CP	6-13	1600	74	47
99.9999	9.9999	1.0000	.0999	CP	6-14	1630	77	49
99.9999	10.0000	1.0000	.1000	CP	6-15	1430	75	48
100.0001	10.0007	1.0001	.1000	CP	6-19	1040	78	46
100.0000	10.0001	.9999	.0997	CP	6-20	1050	75	48
99.9996	9.9998	.9999	.0998	CP	8-29	1830	74	48
100.0002	10.0002	1.0001	.0999	CP	8-31	1000	78	46
99.9999	10.0002	1.0001	.1000	CP	9-1	1130	77	46
99.9999	10.0001	.9999	.0999	CP	9-4	1100	78	43
99.9997	9.9999	.9998	.0998	CP	9-5	1000	78	46
100.0000	10.0000	.9999	.0999	CP	9-6	1500	78	46
99.9997	10.0000	1.0000	.1000	CP	9-7	1745	78	43
100.0001	10.0000	1.0000	.0997	CP	9-8	1500	78	46
100.0002	10.0000	.9999	.1000	CP	10-5	0930	75	48
100.0003	10.0003	1.0000	.0999	CP	10-6	1400	78	46
100.0001	10.0000	1.0000	.0999	CP	10-8	1000	75	44
100.0002	10.0001	1.0000	.0999	CP	10-9	1130	78	46
100.0001	10.0002	.9999	.0997	CP	10-10	1500	74	44
99.9999	10.0000	1.0001	.0999	CP	10-11	1120	75	48
100.0000	9.9999	.9999	.0998	CP	10-12	1130	72	45
100.0003	9.9999	1.0000	.1000	CP	10-13	1030	79	46
99.9999	10.0000	1.0000	.1000	CP	10-14	1410	78	46

BLANK PROCESSING DATA SHEET # 5

UNIT : C550 RUN : 3 DATE : 8-27-08

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 Sparkletts 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: CS50 RUN: 3 DATE: 8-27-08

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: .0465 g (Total Catch) - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0465 g

BEAKERS: .0307 g (Total Catch) - 75 (ml Acetone) (.000007 g) (Blank Value / ml Acetone) [.0005] = .0302 g

TOTAL FRONT HALF CATCH : .0767 g

BACK HALF CATCH

FILTERS: .0308 g (Total Catch) - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0308 g

BEAKERS:

Acetone: .0586 g (Total Catch) - 100 (ml Acetone) (.000007 g) (Blank Value / ml Acetone) [.0007] = .0579 g

Extract: .0167 g (Total Catch) - 75 (ml Dichloromethane) (.000019 g) (Blank Value / Dichloromethane) (.0014) = .0153 g

Water: .0321 g (Total Catch) - 250 (ml Water) (.000018 g) (Blank Value / Water) [.0045] = .0276 g

TOTAL BACK HALF CATCH : .1316 g

TOTAL CATCH : .2083 g

% FRONT HALF : 36.8 %

CALCULATIONS DATA SHEET # 7

UNIT: Jotul C550 RUN: 3 DATE: 8-27-2008

1) $$Vm(std) = \frac{(30.187\ Vm)(17.64)(.940\ mcf)\left(30.05\text{" Hg} + \frac{.120\text{" }H_2O}{13.6}\right)}{(552\ TmA)} = \frac{27.2571}{000.0000}\ dscf$$

2) $$Vw(std) = (.04707)(59.1\ ml\ H_2O) = \frac{2.7818}{00.0000}\ scf$$

3) $$Asw = \frac{(2.7818\ scf)}{(2.7818\ scf + 27.2571\ dscf)} = \frac{.0926}{.0000}\ Bws \times 100 = \frac{9.2607}{00.0000}\ \%\ H_2O$$

4) $$Cs = \frac{(.2083\ g.)}{(27.2571\ dscf)}(15.43) = \frac{.1179}{0.0000}\ gr\ /\ dscf$$

5) $$\text{Estimated } g\ /\ hr = \frac{(.2083\ g.)}{(27.2571\ dscf)}\left(\frac{10.914}{00.0000}\ dscfm\right)(60) = \frac{5.0043}{00.0000}\ g\ /\ hr$$

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 C550 RUN : 3 DATE : 8-27-2008

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

Wet Bulb / Dry Bulb

Pre : WB : 67 DB : 86 = 35 % RH 1.5 % H_2O

Post : WB : 65 DB : 79 = 46 % RH 1.5 % H_2O

Average : 40.5 % RH 1.5 % H_2O

Empty Stove Weight (lbs) : N/A w/ stack & oil seal : Wet : N/A Dry : 0.0

Kindling Weight (lbs) : Paper : .1 Wood : 2.4

Preburn Fuel Weight : 15.0 + 10.1 + 18.2 Total : 43.3

Kindling & Preburn Fuel Weight (wood only) (lbs) : Total : 45.7

Coal Bed Wt Range (lbs) : 3.6 - 3.0 Scale : 3.6 - 3.0

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

Lower : .20 × fuel weight : Always round UP to nearest tenth Actual Coal Bed Weight : 3.1

Maximum Coal Bed Removal (lbs) : (($\underset{\text{Upper}}{3.6}$ + $\underset{\text{Lower}}{3.0}$) ÷ 2) .25 = $\underset{\text{round down to nearest tenth}}{.8}$

Test Fuel (.75" × 1.5" × 5" spacers) = 18 pcs

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" × 4"	16	3	6.7	54.1
4" × 4"	16	2	7.9	45.9

Test Fuel Weight : 14.6 lbs

Estimated Dry Burn Rate :

$$\frac{14.6 - (14.6 \times .17533)}{2.2046} \times \frac{60}{\underset{\text{TIME}}{110}} = 2.98 \text{ kg / hr}$$

Estimated BTU's/hr : $19{,}140 \times \frac{63}{100} \times \frac{2.98}{\text{DBR}} = 35933.4$ BTU's/hr

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

WOOD STOVE OPERATING DATA PAGE #9

Unit: Jotol C550 Run: 3 Date: 8-27-2008

FIRE STARTED: 0845

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 1/2 min. prior to loading last fuel, raked and leveled. In stove 20 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 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 10 or 16 inches.

1st warm up / pre-burn fuel charge (15.0 lbs.) added at 0855

2nd warm up / pre-burn fuel charge (10.1 lbs.) added at 1030

3rd warm up / pre-burn fuel charge (18.2 lbs.) added at 1130

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 C550 Run: 3 Date: 8-27-2008

Room Temperature: 78 °F Temperature Correction Set?: YES NO

Calibration Check: 12.0% + or- 0.2%? YES NO

Time Test Fuel moisture reading taken: 1100

pc #	Dimen.	Use	TOP	BOTTOM	SIDE	Average
1	2"x4"x8'	K	12.6	12.8	12.7	12.700
2						
3						
4	2"x4"x8'	P	18.7	18.1	19.6	18.8
5	2"x4"x8'	P	20.1	19.8	20.3	20.1
6	2"x4"x8'	P	18.2	19.9	19.5	19.2
7	2"x4"x8'	P				58.1
8	2"x4"x8'	P				
9						
10						
11						
12	2x4x16"	T	20.9	20.2	20.3	20.5
13	"	T	19.1	18.7	18.9	18.9
14	"	T	20.2	20.1	20.1	20.1
15	4x4x16"	T	23.2	23.5	23.2	23.3
16	"	T	23.4	23.5	23.5	23.5
17						106.3
18						
19						
20	Spacers	T	21.3	20.9	21.0	21.1

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture %:	12.700 %	19.367 %	21.260 %
Wet Moisture %:	11.269 %	16.225 %	17.533 %

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 with meter corrected for temperature.

GAS DATA SHEET #12

WEIGHT: 3.1

DATE: 8-27-2008

UNIT: Jotul C550

RUN: 3

PAGE: 1 OF 1

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
0 / 1325	17.7	14.6	—	.238	5.9	.565	14.1	.065	.66	-.047	275
5 / 30	17.0	13.9	.7	.248	6.2	.558	14.0	.053	.54	-.047	325
10 / 35	15.9	12.8	1.1	.619	15.5	.155	3.9	.123	1.24	-.061	375
15 / 40	13.9	10.8	2.0	.640	16.0	.156	3.9	.081	.82	-.065	375
20 / 45	12.4	9.3	1.5	.658	16.4	.139	3.5	.083	.84	-.065	350
25 / 50	11.1	8.0	1.3	.663	16.6	.130	3.2	.077	.78	-.065	350
Fan ? 30 / 55	9.5	6.4	1.6	.651	16.3	.153	3.8	.059	.60	-.067	375
35 / 1400	8.6	5.5	.9	.607	15.2	.208	5.9	.035	.36	-.066	350
40 / 05	7.5	4.4	1.1	.543	13.6	.272	6.8	.033	.34	-.064	325
45 / 10	6.8	3.7	.7	.452	11.3	.370	9.3	.013	.14	-.061	300
50 / 15	6.2	3.1	.6	.384	9.6	.437	10.9	.015	.16	-.059	300
55 / 20	5.8	2.7	.4	.367	9.2	.457	11.4	.020	.21	-.057	300
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.724	*****
60 / 1425	5.4	2.3	.4	.363	9.1	.456	11.4	.018	.19	-.056	300
65 / 30	5.0	1.9	.4	.357	8.9	.463	11.6	.020	.21	-.056	300
70 / 35	4.5	1.4	.5	.340	8.5	.481	12.0	.017	.18	-.056	300
75 / 40	4.3	1.2	.2	.269	6.7	.541	13.5	.046	.47	-.055	300
80 / 45	4.2	1.1	.1	.260	6.5	.546	13.7	.054	.55	-.052	300
85 / 50	4.0	.9	.2	.258	6.4	.548	13.7	.059	.60	-.051	300
90 / 55	3.7	.6	.3	.241	6.0	.564	14.1	.067	.68	-.050	300
95 / 1500	3.6	.5	.1	.235	5.9	.563	14.1	.070	.71	-.049	300
100 / 05	3.4	.3	.2	.224	5.6	.575	14.4	.079	.80	-.048	275
105 / 10	3.3	.2	.1	.217	5.4	.578	14.5	.083	.84	-.048	275
110 / 15	3.1	0	.2	.212	5.3	.585	14.6	.075	.76	-.046	275
115 / 20											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.567	*****
120											
125											
130											
135											
140											
145											
150											
155											
160											
165											
170											
175											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-1.291	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.056	*****

÷23

PREBURN DATA SHEET #13

UNIT: Jotul C550 RUN: 3 DATE: 8-27-2008 PAGE: 1 of 1

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
0/1135	20.1	—	376	620	441	483	496	637			78	-.050	PREBURN START: # UP
5/40	18.7	1.4	472	579	429	435	482	501			79	-.056	COAL BED SCALE RANGE:
10/45	16.7	2.0	562	646	411	359	468	415			80	-.061	3.6 → 3.0
15/50	15.0	1.7	576	680	403	333	466	393			78	-.062	PRIMARY AIR: Wide open
20/55	13.4	1.6	622	715	396	308	466	372			77	-.063	SECONDARY AIR: N/A
25/1200	12.4	1.0	629	741	388	291	469	362			80	-.064	FAN: High
30/05	11.0	1.4	623	751	395	286	475	358			80	-.063	PUMPS ON AT:
35/10	9.9	1.1	627	766	400	285	483	357			80	-.064	CHECK WB/DB: N/A
40/15	8.6	1.3	630	775	408	290	490	366			81	-.064	
45/20	7.4	1.2	632	795	416	296	498	373			82	-.064	
50/25	6.6	.8	621	810	424	308	499	381			82	-.064	
55/30	5.9	.7	555	775	437	325	504	389			82	-.060	
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	
60/1235	5.6	.3	516	723	438	338	503	394			80	-.059	
65/40	5.2	.4	481	676	446	351	503	399			82	-.057	
70/45	4.8	.4	466	635	450	361	497	400			80	-.057	
75/50	4.5	.3	457	613	453	365	492	399			84	-.056	
80/55	4.2	.3	426	596	455	366	488	402			83	-.053	
85/1300	4.0	.2	414	581	450	363	481	405			83	-.053	
90/1305	3.7	.3	397	556	442	353	472	412			83	-.051	
95/10	3.5	.2	375	529	436	344	465	409			82	-.050	
100/15	3.4	.1	361	508	428	335	458	402			83	-.049	
105/20	3.2	.2	351	486	420	324	451	395			83	-.048	
110/25	3.1	.1	342	454	411	312	439	387			83	-.047	

Jotul C550

Temperatue Data Sheet 14

Run 3
8/27/08

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	342	454	411	312	439	387	######	######	83	1321	243	58	246	35	36
5	321	404	398	302	429	364	######	######	83	1323	244	45	246	35	36
10	558	498	382	277	410	324	######	######	82	1323	246	47	245	36	36
15	621	607	376	261	394	296	######	######	82	1323	248	48	245	36	37
20	655	671	379	256	393	282	######	######	82	1326	247	49	245	36	38
25	668	718	388	259	401	275	######	######	83	1326	246	49	245	36	38
30	661	754	398	268	412	274	######	######	86	1328	245	49	245	36	38
35	635	771	398	279	420	271	######	######	85	1328	245	49	245	37	38
40	601	766	402	291	428	266	######	######	83	1330	246	49	245	37	39
45	549	715	407	304	439	269	######	######	83	1334	246	50	246	37	39
50	499	661	416	317	457	268	######	######	83	1339	247	50	246	37	39
55	470	619	418	331	467	269	######	######	84	1342	247	49	246	37	39
60	455	595	414	338	468	262	######	######	83	1344	248	50	246	37	39
65	448	584	413	344	473	262	######	######	84	1347	248	51	245	37	39
70	442	573	412	341	470	257	######	######	83	1350	248	51	245	38	39
75	422	557	405	340	466	261	######	######	83	1353	248	51	246	38	38
80	396	525	407	327	461	262	######	######	82	1355	248	51	246	38	38
85	380	498	395	311	445	263	######	######	80	1358	248	51	247	38	38
90	365	473	392	297	443	271	######	######	81	1358	248	52	246	38	37
95	354	452	390	286	433	271	######	######	81	1359	247	52	245	38	37
100	346	433	383	276	423	268	######	######	81	1361	247	52	244	39	37
105	337	416	372	266	410	259	######	######	79	1364	247	52	243	39	37
110	324	398	364	260	404	255	######	######	80	1365	246	58	241	39	36

TEMPERATURE DATA SHEET #14A

		TEST TIME	110		
STACK AVG	**472**	TOP AVG	**571**	LT SIDE AVG	**396**
BACK AVG	**297**	RT SIDE AVG	**434**	BOTTOM AVG	**280**
FIREBOX AVG	**########**	SEC/CAT AVG	**########**	AMBIENT AVG	**82**

END	336.4	
START	400.7	
	-64.3	DELTA T

CIRCLE: LOSS / GAIN

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 8-27-2008 Analyte : CO_2 (15-1)

Unit : Jotul C550 Run # : 3

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 % CO_2 Cyl. Press. : 690 PSI

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

Span Cyl. # : 487905 Conc. : 12.20 % CO_2 Cyl. Press. : 1700 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 : [signature] Time : 1150 Temp : 78 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-.007	-.007	-.027
SPAN	48.8	.488	12.20	48.8	.488	12.185	-.015	-.062

POST RUN Audit : by : [signature] Time : 1540 Temp : 77 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-.007	-.007	-.027
SPAN	48.8	.488	12.20	49.0	.490	12.235	.035	.138

± 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 : 8-27-2008 Analyte : O_2 (15-2)

Unit : Jotul C550 Run # : 3

Zero Cyl. # : 168TAC 3A Conc. : 0.00 % O_2 Cyl. Press. : 690 PSI

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

Span Cyl. # : 487905 Conc. : 12.60 % O_2 Cyl. Press. : 1700 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 : Cp Washington Time : 1150 Temp : 78 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.002	.020	.020	.079
SPAN	12.60	.504	12.6	12.6	.504	12.608	.008	.033

POST RUN Audit : by : Cp Washington Time : ________ Temp : ________ °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.001	-.005	-.005	-.021
SPAN	12.60	.504	12.6	12.6	.503	12.583	-.017	-.068

± 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 : 8-27-2008 Analyte : CO (15-3)

Unit : Jotul C550 Run # : 3

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 % CO Cyl. Press. : 690 PSI

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

Span Cyl. # : C487905 Conc. : 14.90 % CO Cyl. Press. : 1700 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 : [signature] Time : 1150 Temp : 78 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.023	.023	.225
SPAN	49.0	.490	4.90	49.0	.490	4.897	-.003	-.028

POST RUN Audit : by : [signature] Time : _____ Temp : _____ ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.023	.023	.225
SPAN	49.0	.490	4.90	49.1	.491	4.907	.007	.071

± 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 -2008 Analyte: SO_2 (15-4)

Unit: Jotul C550 Run #: 3

Zero Cyl. #: 168TAC 3-A Conc.: 0.00 ppm SO_2 Cyl. Press.: 690 PSI

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

Span Cyl. #: CC82089 Conc.: 1250 ppm SO_2 Cyl. Press.: 1870 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: Cp Wadingt Time: 1150 Temp: 78 °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	.424	.424	.017
SPAN	50.0	.500	1250	49.7	.497	1248.9	-1.100	-.044

POST RUN Audit: by: Cp Wadingt Time: ______ Temp: ______ °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	-.001	-2.088	-2.088	-.084
SPAN	50.0	.500	1250	50.2	.502	1261.4	11.437	.457

± 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 C550 RUN: 3 DATE: 8-28-2008

Thermocouple Check:

T/C # 1	— °F	T/C # 13	68.3 °F
T/C # 2	— °F	T/C # 14	65.4 °F
T/C # 3	68.0 °F	T/C # 15	68.4 °F
T/C # 4	64.5 °F	T/C # 16	65.9 °F
T/C # 5	64.0 °F	T/C # 17	60.8 °F
T/C # 6	64.2 °F	T/C # 18	68.8 °F
T/C # 7	64.0 °F	T/C # 19	65.9 °F
T/C # 8	64.0 °F	T/C # 20	— °F
T/C # 9	— °F	T/C # 21	— °F
T/C # 10	— °F	T/C # 22	— °F
T/C # 11	62.6 °F	T/C # 23	— °F
T/C # 12	70.6 °F	T/C # 24	— °F

Thermocouple Readout:

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

ZERO -.4 °F Adj. to 0.0 °F ZERO 2.2 °F Difference .110 %

SPAN 2000.3 °F Adj. to 2000.0 °F SPAN 2001.7 °F Difference .085 %

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	= 1199.9 °F	1400	= 1399.9 °F	1600	= 1599.5 °F
1800	= 1800.2 °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: 13.4 - 3.4 = 10.0

Post: 12.8 - 2.8 = 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		Item(s) Submitted:	See Table Below
934 Elliott Ave. W		Specification:	NIST HB 105-1, Class F
Seattle, WA 98119-3608		Condition:	Good
Contact:	Todd Mackie	Temperature:	21.0 °C
Phone:	206-284-6090	Pressure:	762.0 mmHg
PO Number:	2-2-009237	Humidity:	35 % RH
SOP:	8	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 t 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

Established 1974

QUALITY CONTROL SERVICES

LABORATORY AND METROLOGY EQUIPMENT: SALES AND SERVICE
2340 S.E. 11th Avenue • Portland, Oregon 97214
P.O. Box 14831 • Portland, Oregon 97293 • (503) 236-2712 • FAX: (503) 235-2535

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 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

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

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

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: 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:	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	100.0006	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

INSTRUMENT(S) LISTED ABOVE WERE CALIBRATED USING STANDARDS TRACEABLE TO THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (N.I.S.T.).

Established 1974

QUALITY CONTROL SERVICES
LABORATORY AND METROLOGY EQUIPMENT: SALES AND SERVICE
2340 S.E. 11th Avenue • Portland, Oregon 97214
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 71
Barometric Pressure 30.07
DATE: 6-3-2008

TC	Location	Ice Bath Temp	Boiling Water Temp
1	Wet Bulb	32.0	212.0
2	Dry Bulb	32.0	212.0
3	Stack	32.4	210.9
4	Stove Top	32.1	211.7
5	Left Side	32.1	211.6
6	Back	32.0	211.1
7	Right Side	32.5	209.9
8	Bottom	32.1	211.4
9	Firebox	33.0	211.9
10	Secondary/Cat	31.9	212.1
11	Ambient	32.1	211.9
12	Tube Furnace	33.6	212.9
13	Sample Box	32.2	211.7
14	Impinger Out	32.0	211.6
15	C. Gas Box	32.1	212.1
16	C. Gas Out	31.8	212.0
17	SO2 Out	32.4	211.9
18	Upper Ambient	32.2	211.1
19			
20			
21			
22			
23	Calibrator	32.0	212.0
24	Oven	32.0	211.3

Thermocouple Readout Semi-Annual Calibration Data Sheet

Date: 6-3-2008
Ambient Temperature: 71
Technician: CPW.

Thermocouple Number: T/C Readout
Barometric Pressure: 30.07
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	∅
212	Boiling Water	212.0	212.0	∅
250	Omega	250.0	249.9	.04
300	Omega	300.0	299.9	.033
400	Omega	400.0	399.8	.05
500	Omega	500.0	499.8	.04
600	Omega	600.0	599.7	.05
700	Omega	700.0	699.7	.043
800	Omega	800.0	799.7	.038
900	Omega	900.0	899.8	.022
1000	Omega	1000.0	999.7	.030
1200	Omega	1200.0	1199.7	.025
1400	Omega	1400.0	1399.8	.014
1600	Omega	1600.0	1599.8	.013
1800	Omega	1800.0	1799.9	.006
2000	Omega	2000.0	2000.0	∅

[a] Every 50°F for each reference point
[b] Type of Calibration System Used
[c] $\frac{\text{(reference temperature)} - \text{(thermocouple temperature)}}{\text{reference temperature}} * 100$

c:\winword\report\cal.doc

TRACEABILITY DOCUMENTATION Semi-Annual

S02 INJECTION ROTAMETER, DRY GAS METER AND SLING PSYCHROMETER THERMOMETERS IN LAB. CHECKED AGAINST FISHER SN 9123454 (NIST).

DATE: 6-3-2008

SO2 INJECTION ROTAMETER FISHER SN 9123454

NIST Traceable

Actual	°C = °F	°F
0.0	32.0	32.0
21.2	70.2	70.0
36.8	98.2	98.0
45.6	114.1	113.9

DRY GAS METER THERMOCOUPLES

Actual	°C = °F	5H in	5H out	KK
0.0	32.0	32.2	32.0	32.0
20.8	69.4	69.9	69.5	69.4
35.8	96.4	96.1	96.5	96.3
45.0	113.0	113.0	112.7	112.9

SLING PSYCHROMETER

Actual	°C = °F	Wet Bulb	Dry Bulb
0.0	32.0	32.0	32.0
20.6	69.1	69.0	69.0
35.0	95.0	95.0	95.0
43.8	110.8	110.8	110.8

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.

POST TEST METER BOX AUDIT DATA SHEET # 32

UNIT: Jotul C550 DATE: 9-3-2008

TEST DATA

RUN #	1	2	3	4	5	6	7	8	9	10
AVG. Δ H	.162	.176	.120	.140						
MAX VAC	3.0	3.0	2.0	3.0						

Avg. Test Series Δ H : .150 in H_2O Test Series Max Vac: 3.0 in Hg

Audit Dry Gas Meter : K2 Correction (Y) Factor : 1.019 (mcf)

Test Dry Gas Meter : H Correction (Y) Factor : .940 (mcf)

AUDIT DATA

		Audit # 1	Audit #2	Audit #3
BP		30.20	30.20	30.20
VAC		3.0	3.0	3.0
AUDIT METER :				
VOL.	**Final**	934.505	939.273	945.019
(Vw)	**Initial**	929.868	934.505	939.273
	Vol.	4.637	4.768	5.746
TEMP (°F)	**Initial**	70	76	80
(Tw)	**Mid**	73	78	81
	Final	76	80	82
(°F / °A)	**Avg.**	533	78 538	81 541
Δ H	**Initial**	.150	.150	.150
	Mid	.150	.150	.150
	Final	.150	.150	.150
	Avg.	.150	.150	.150
DRY GAS METER :				
VOL.	**Final**	29.600	34.600	40.600
(Vd)	**Initial**	24.600	29.600	34.600
	Vol.	5.000	5.000	6.000
TEMP (°F)	**Initial**	66	68	70
(Tm)	**Mid**	67	69	72
	Final	68	70	73
(°F / °A)	**Avg.**	67 527	69 529	72 532

$$Y = \frac{(Vw)(mcf)(BP)(Tm)}{(Vd)\left(BP + \frac{DH}{13.6}\right)(Tw)}$$

$$\text{Y Factor \% Diff.} = \frac{\text{Act - Exp}}{\text{Exp}} \text{ X } 100$$

NOTE : mcf = meter correction (Y) factor for Dry Gas Meter used as a transfer standard

RUN 1

$$Y = \frac{(4.637)(1.019)(30.20)(527)}{(5.000)\left(30.20 + \frac{.150}{13.6}\right)(533)} = \frac{75201.9}{80512.4} = .934$$

$$\Delta\,\% = \frac{(.934 - .925)}{.925} \text{ X } 100 = .973\ \%$$

RUN 2

$$Y = \frac{(4.768)(1.019)(30.20)(529)}{(5.000)\left(30.20 + \frac{.150}{13.6}\right)(538)} = \frac{77619.9}{81267.7} = .955$$

$$\Delta\,\% = \frac{(.955 - .925)}{.925} \text{ X } 100 = 3.243\ \%$$

RUN 3

$$Y = \frac{(5.746)(1.019)(30.20)(532)}{(6.000)\left(30.20 + \frac{.150}{13.6}\right)(541)} = \frac{94071.6}{98065.0} = .959$$

$$\Delta\,\% = \frac{(.959 - .925)}{.925} \text{ X } 100 = 3.676\ \%$$

NOTE : The Y factor % difference must be < ± 5.0 % to be acceptable

INTERPOLATED Y FACTOR

$\underset{(A)}{.1}$ inch H_2O ΔH = $\underset{(C)}{.930}$ Calculated calibration Y factor from calibrations

$\underset{(B)}{.2}$ inch H_2O ΔH = $\underset{(D)}{.919}$ Calculated calibration Y factor from calibrations

$\underset{(B)}{.2} - \underset{(A)}{.1} = .1 \text{ X } 100 = \underset{(E)}{10}$

$\underset{(D)}{.919} - \underset{(C)}{.930} = -.011 \div \underset{(E)}{10} = \underset{(F)}{-.0011}$

$\underset{\text{Avg }\Delta H}{.150} - \underset{(A)}{.1} = .050 \text{ X } 100 = \underset{(G)}{5.0}$

$\left[\underset{(F)}{-.0011} \text{ X } \underset{(G)}{5.0}\right] + \underset{(C)}{.930} = \underset{\text{Interpolated Y factor}}{.925}$

Volume Metering System Leak Check : 0.000 inch H_2O in one minute

DRY GAS METER CALIBRATION

DATE : 6-2-2008 DRY GAS METER : H BOX : 5

BAROMETRIC PRESSURE 29.88 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	898.183	905.770	910.453	920.270	925.022	929.780
	Initial	893.500	898.183	905.770	910.453	920.270	925.022
	Vw ft^3	4.683	7.587	4.683	9.817	4.752	4.758
Gas Volume Dry Test Meter Vd ft^3	Final	510.100	518.400	523.400	533.800	538.800	543.800
	Initial	505.000	510.100	518.400	523.400	533.800	538.800
	Vw ft^3	5.100	8.300	5.000	10.400	5.000	5.000
Wet Test Meter Temperature tw	Initial	84	92	96	98	98	98
	Middle	88	94	97	98	98	98
	Final	92	96	98	98	98	98
	Average	548	554	557	558	558	558
Dry Test Meter Temperature tm	Initial	84	85	87	88	89	91
	Middle	85	86	88	89	90	91
	Final	85	87	88	89	91	92
	Average	85 545	547	548	549	550	551
$Y = \frac{(W_{mcf})(Vw)(Pb)(tm)}{Vd\left(Pb + \frac{\Delta H}{13.6}\right)(tw)}$		77709.74 / 83529.17	126360.7 / 137461.8	78137.50 / 83277.23	164099.0 / 173613.0	79578.2 / 83519.1	79823.5 / 83570.3
		.930	.919	.938	.945	.953	.955

Average Y= .940

METER BOX CALIBRATION

Date : 8/24/2007
Calibrated By : JG
Dry Gas Meterbox ID : Lokee

Barometric Pressure, Pb = 27.42 in. Hg
Vacuum = 0 in. Hg

Orifice Manometer Setting, Delta H in. H20		0.1	0.2	0.3	0.5	0.75	1
Gas Volume Wet Test Meter Vw, cu. ft.		1	1	1	2.003	3.002	4.003
Gas Volume Dry Gas Meter							
	M Final	387.481	397.924	408.43	418.834	429.056	439.171
	M Initial	377.481	387.914	398.422	408.879	419.155	429.321
	Vd, cu. ft.	0.966	0.958	0.952	1.909	2.881	3.945
Wet Test Meter							
tw	Deg F	87	84	82	82	82	84
tw	Deg A	547	544	542	542	542	544
Dry Gas Meter							
Outlet,	tmo 1	85	74	68	68	80	80
	2)	85	74	68	76	80	80
	3)	89	74	68	76	80	80
Dry Gas Meter							
Inlet	tmi 1	87	83	80	81	82	85
	2)	88	83	80	82	82	86
	3)	88	85	83	82	82	86
Mean tm, Deg F		87	78.8	74.5	77.5	81	82.8
Mean tm, Deg A		547	538.8	534.5	537.5	541	542.8
Time, Minutes		5.85	3.74	2.96	4.6	5.82	6.78
Results :							
	Y =	0.997	0.997	1.035	1.039	1.038	1.01
		0.022	0.022	-0.016	-0.02	-0.019	0.009
	Delta H @	1.8	1.78	1.67	1.67	1.77	1.81
		-0.05	-0.03	0.08	0.08	-0.02	-0.06

Averages :
Y = 1.019 K2
Delta H = 1.75

WET TEST METER CALIBRATION LOG

Wet Test Meter Serial Number AA455 Date 12-1-2007

Range of Wet Test Meter Flow Rate 0 - 0.25

Volume of Test Flask Vs 37.850

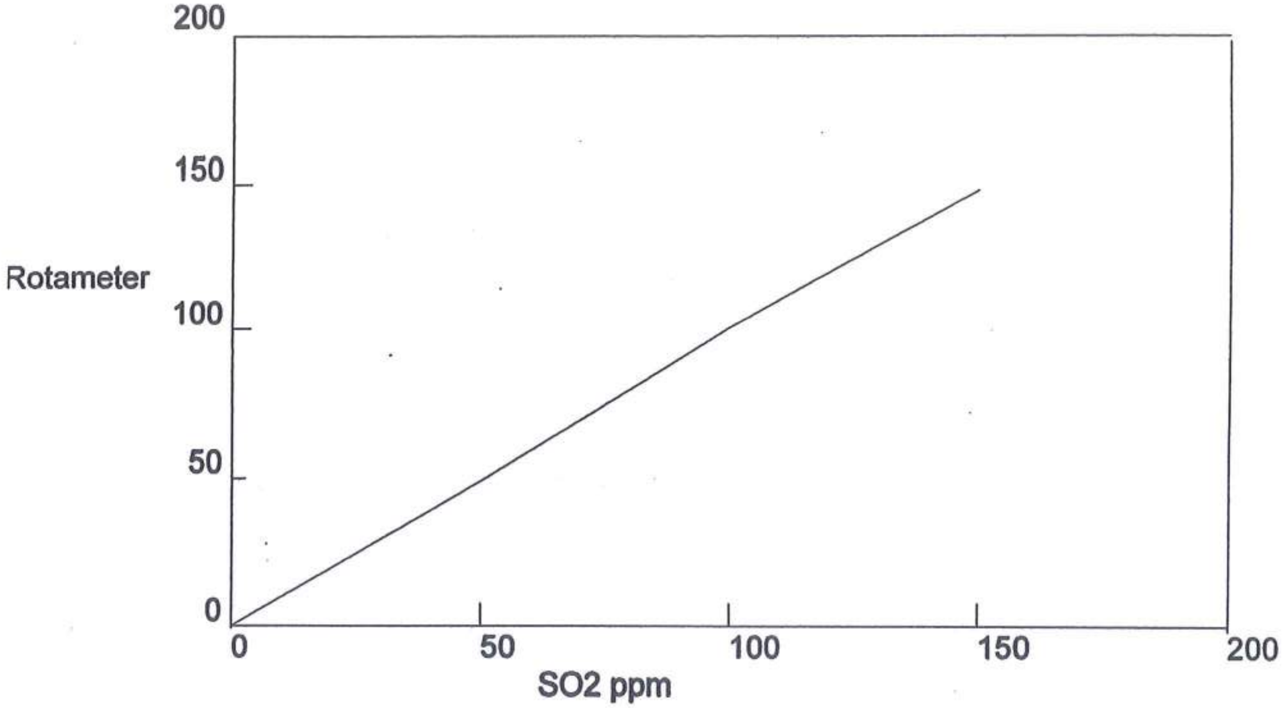
Satisfactory Leak Check? Yes

Ambient Temperature of Equilibrate Liquid in Wet Test Meter and Reservoir 71

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	∅	3.0	∅ ALL RESET	3.0	3.002	-.067
2	∅	3.0	∅	3.0	3.001	-.033
3	∅	3.0	∅	3.0	3.002	-.067

a - Must be less than 10 mm H_2O (0.4 ' H_2O)
Calculations:
b - Vm - Vf - Vi
c - % error = $\frac{100(V_m - V_s)}{V_s}$ = -.056 (± 1 %)

SO2 Rotameter
06/04/08



Regression Output:

Constant		0.18
Std Err of Y Est		5.2878634627
R Squared		0.9966552605
No. of Observations		4
Degrees of Freedom		2
X Coefficient(s)	1.1546	
Std Err of Coef.	0.0472960886	

SO_2 ROTAMETER CALIBRATION

Last Cal. : 11-12-2007 By : Cp Date : 6-4-2008 By : Cp

Manufacturer : SKC-WEST
SKC ACCUFLOW Digital Flow Calibrator: Model 712 SN : 311325

Barometric Pressure : 30.13 " Hg Temperature : 72

RUN #	50 CC/MINUTE DIGICAL VOLUME	100 CC/MINUTE DIGICAL VOLUME	150 CC/MINUTE DIGICAL VOLUME
1	55.0	121.7	170.0
2	55.2	121.9	170.5
3	54.8	121.5	170.4
4	55.1	121.6	170.1
5	55.3	122.0	170.0
6	55.2	121.8	170.7
7	54.9	121.7	170.2
8	55.0	122.0	169.9
9	55.1	121.8	170.1
10	55.1	121.6	170.2
AVERAGE	55.1 cc/min	121.8 cc/min	170.2 cc/min

SETTING	cc/min
0	0.0
50	55.1
100	121.8
150	170.2

Rotometer setting for 100 cc/minute based on regression with this data.

100 CC / MINUTE = 86.4

TRACER GAS TRAIN RESPONSE TIME

DATE: 6-4-2008

Elapsed Time	SO_2 Conc. (v.)	SO_2 Conc. (v.)	SO_2 Conc. (v.)
00 sec	.493	.490	.490
15	.334	.342	.341
30	.172	.180	.169
45	.046	.070	.065
60	.017	.019	.017
75	.004	.003	.003
90	.001	.001	.000
105	.000	.000	
120			
135			
150			
165			
180			
Initial Response	7	7	7
95 % Response	55	55	55
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	.485	.485	.486	.000	.000	.000	.491	.491	.491
15	.485	.486	.485	.392	.400	.390	.243	.245	.245
30	.421	.418	.420	.688	.692	.699	.071	.065	.066
45	.180	.181	.180	.770	.775	.775	.011	.009	.009
60	.091	.095	.092	.815	.816	.815	.002	.001	.001
75	.042	.047	.045	.821	.823	.822	.000	.000	.000
90	.027	.025	.026	.825	.827	.827			
105	.018	.019	.018	.828	.829	.828			
120	.007	.009	.007						
135	.004	.005	.004						
150	.002	.002	.002						
165	.001	.001	.001						
180	Ø	Ø	Ø						
Initial Response	19	18	19	6	6	6	6	6	6
95 % Response	95	95	95	50	50	50	40	40	40
Flow Rate	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5

ORSAT ANALYSIS DATA SHEET DATE : 6-4-08

Gas	1	2	3	AVE	CONC	TANK ID
CO_2	Ø	Ø	Ø	Ø	Ø	1L8TAC 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	CA06641
O_2					20.9	
CO					8.63	Exp 1-5-2012
CO_2	6.2	6.2	6.2	6.2	6.22	CC-12730
O_2	6.2	6.2	6.2	6.2	6.25	
CO	2.0	2.0	2.0	2.0	1.98	
CO_2						
O_2						
CO						

CO_2 ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Date: 8-20-2008

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

Calibration by: Cp Wadmyr

Cal Gas Flow: 1.5 SCFH Measured by: Rotameter

BP: 29.71 Instrument ID: PRINCO

Temp: 69 Instrument ID: TR

Cylinders:

1. # 168TAC 3-A Concentration: 00.00 % CO_2 Cyl. Press.: 690 PSI
   Certified by: AIR LIQUIDE Date: 04-19-04
2. # 487905 Concentration: 12.20 % CO_2 Cyl. Press.: 1700 PSI
   Certified by: AIR LIQUIDE Date: 11-1-07
3. # CA06641 Concentration: 21.1 % CO_2 Cyl. Press.: 1580 PSI
   Certified by: AIR LIQUIDE Date: 1-5-2007
4. # CC-12731 Concentration: 6.22 % CO_2 Cyl. Press.: 1180 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	-.004	00.0	.000
2	2	12.20	48.8	.488	48.6	.486	48.8	.488
3	3	21.1	84.4	.844	84.5	.845		
4	4	6.22	24.9	.249	25.0	.250		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 12.484

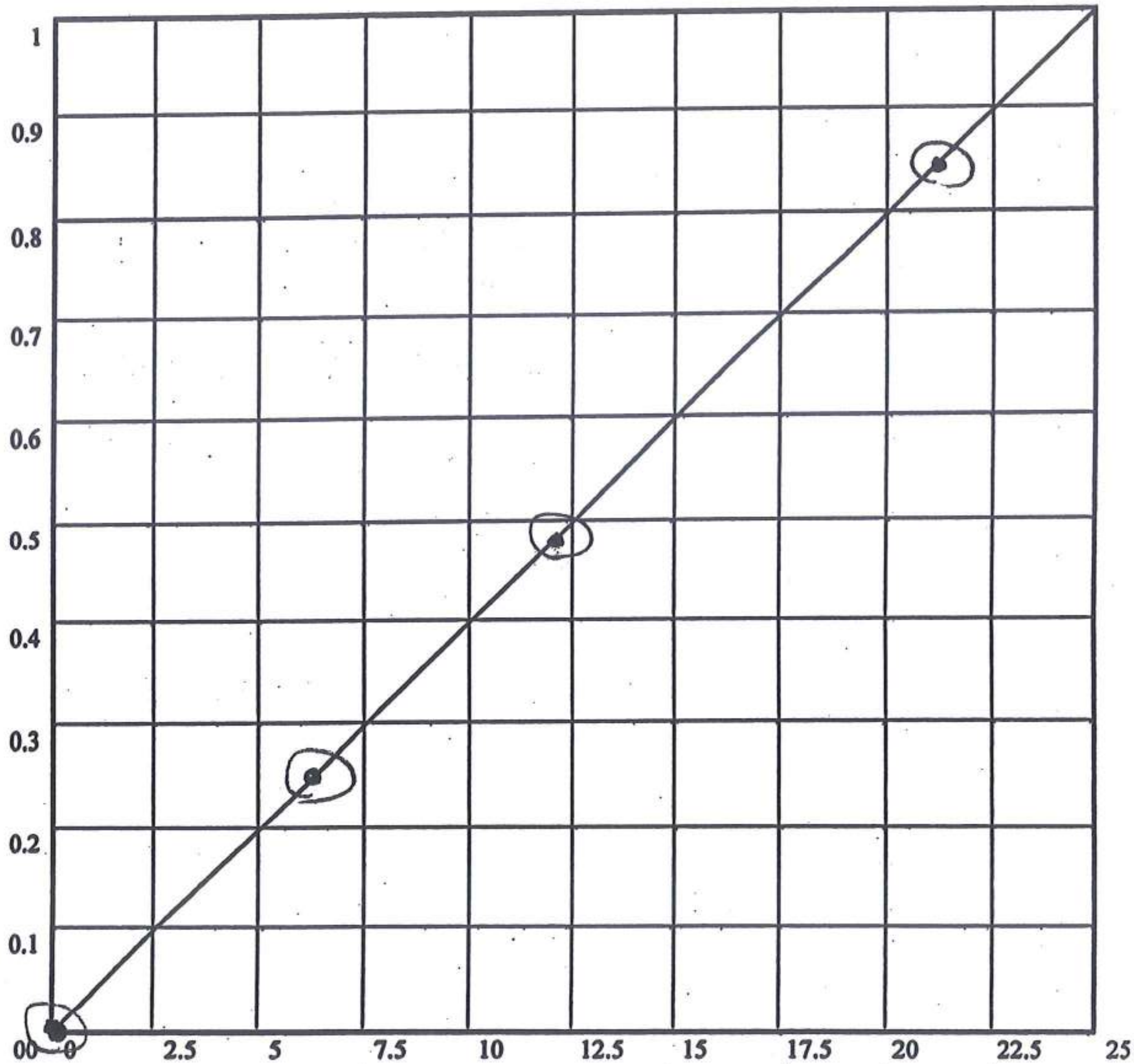
CO_2 Linear Regression Results:

Y = MX +B
Slope (M) = .0002716

Y Intercept (B) = .0400282

Correlation Coefficient (r) = .9999987

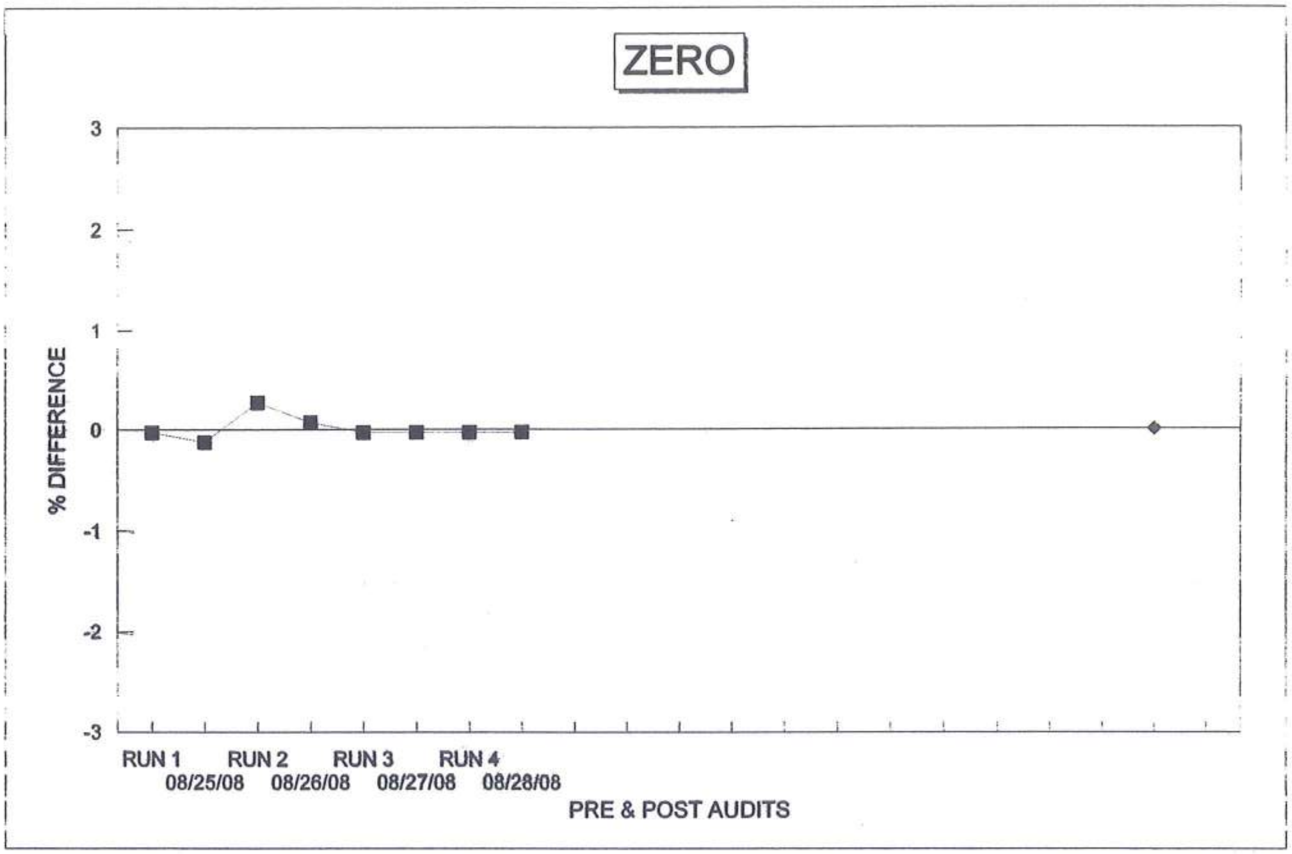
r^2 = .9999973

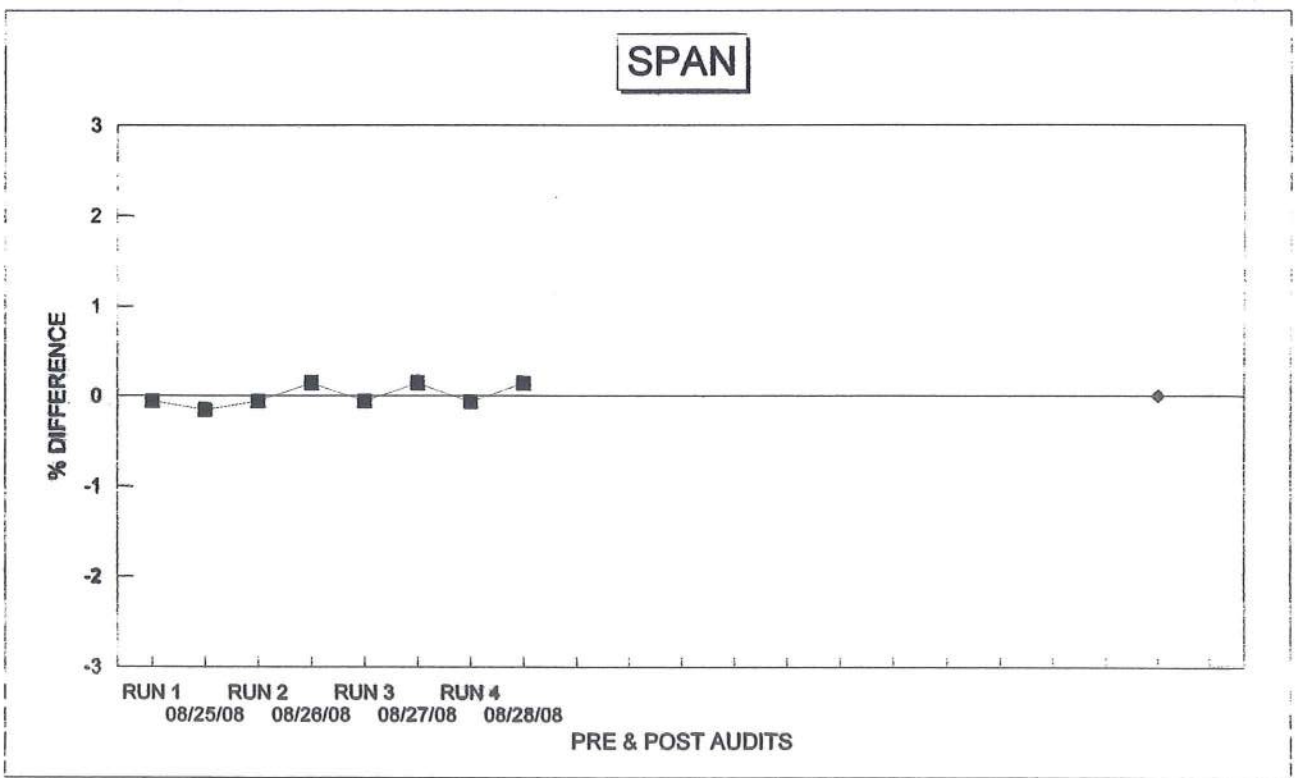


EPA Span Value = ± 2.0% of 25% CO_2 = ± .5%

Cal Volts = Cal Volt Conc - Std Conc = ± Conc Diff = ± Δ %

	Cal Volts		Cal Volt Conc		Std Conc		± Conc Diff		± Δ %
HIGH VOLTS	.845	=	21.13	-	21.1	=	.030	=	.120
LOW VOLTS	.250	=	6.25	-	6.22	=	.030	=	.120


ZERO
3
2
1
0
-1
-2
-3
% DIFFERENCE
RUN 1
RUN 2
RUN 3
RUN 4
08/25/08
08/26/08
08/27/08
08/28/08
PRE & POST AUDITS


SPAN
3
2
1
0
-1
-2
-3
% DIFFERENCE
RUN 1
RUN 2
RUN 3
RUN 4
08/25/08
08/26/08
08/27/08
08/28/08
PRE & POST AUDITS

O$_2$ ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Date: 8-20-2008

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

Calibration by: [illegible signature]

Cal Gas Flow: 1.5 SCFH Measured by: Rotameter

BP: 29.71 Instrument ID: PRINCO

Temp: 69 Instrument ID: TR

Cylinders:

1. # 168TAC 3-A Concentration: 00.00 % O$_2$ Cyl. Press.: 690 PSI
   Certified by: AIR LIQUIDE Date: 04-19-04
2. # C487905 Concentration: 12. 0 % O$_2$ Cyl. Press.: 1700 PSI
   Certified by: AIR LIQUIDE Date: 11-1-07
3. # CA06641 Concentration: 20.9 % O$_2$ Cyl. Press.: 1580 PSI
   Certified by: AIR LIQUIDE Date: 1-5-2007
4. # CC-12731 Concentration: 6.25 % O$_2$ Cyl. Press.: 1180 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		ACTUAL		ADJ.	
			METER	DVM	METER	DVM	METER	DVM
1	1	0.00	00.0	.000	0.1	.002	00.0	.000
2	2	12.60	12.60	.504	12.5	.501	12.6	.504
3	3	20.9	20.9	.836	20.9	.834		
4	4	6.25	6.25	.250	6.3	.252		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 12.508

O_2 Linear Regression Results:

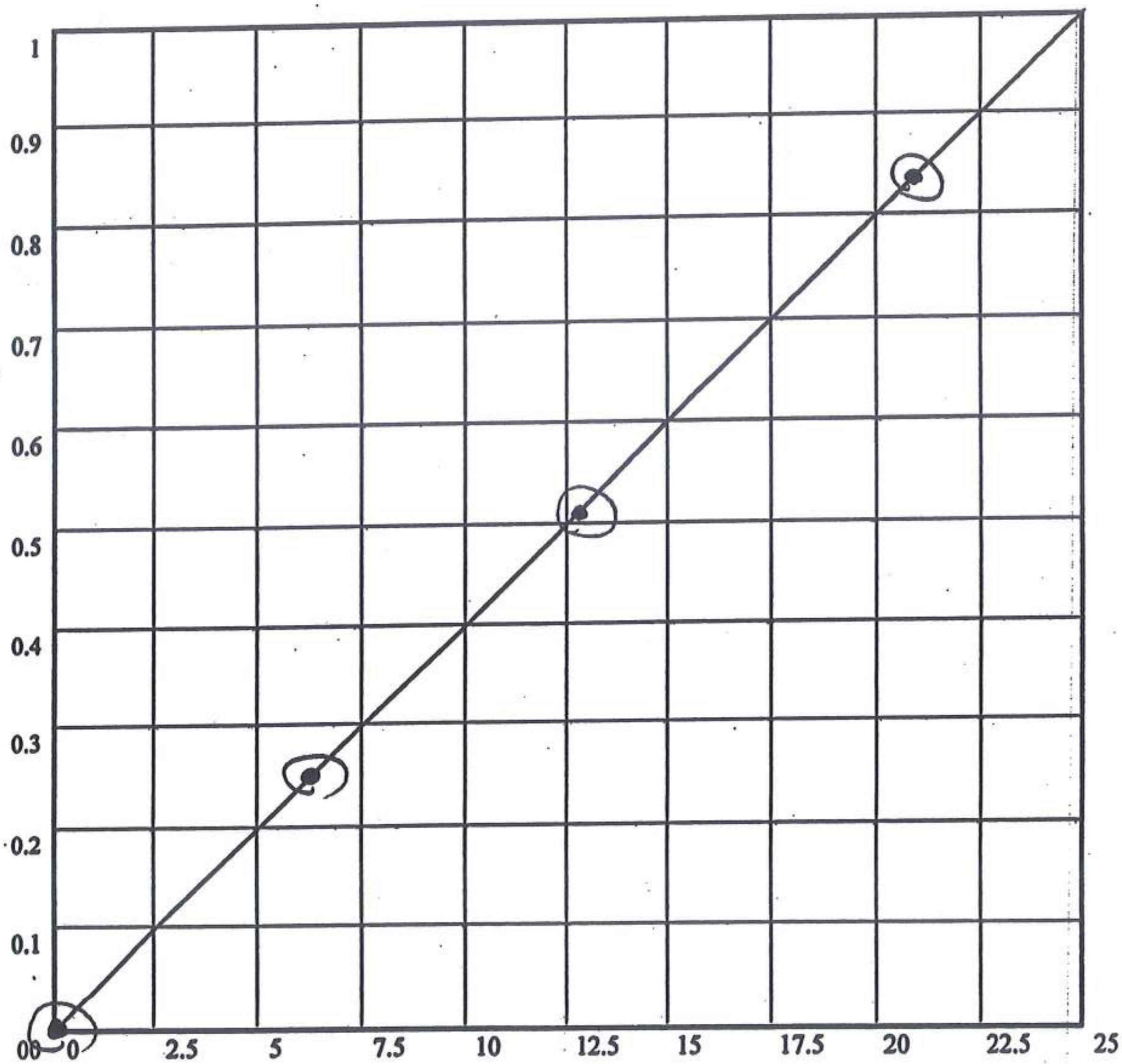
Y = MX + B

Slope (M) = .0012151

Y Intercept (B) = .0398777

Correlation Coefficient (r) = .9999942

r^2 = .9999884

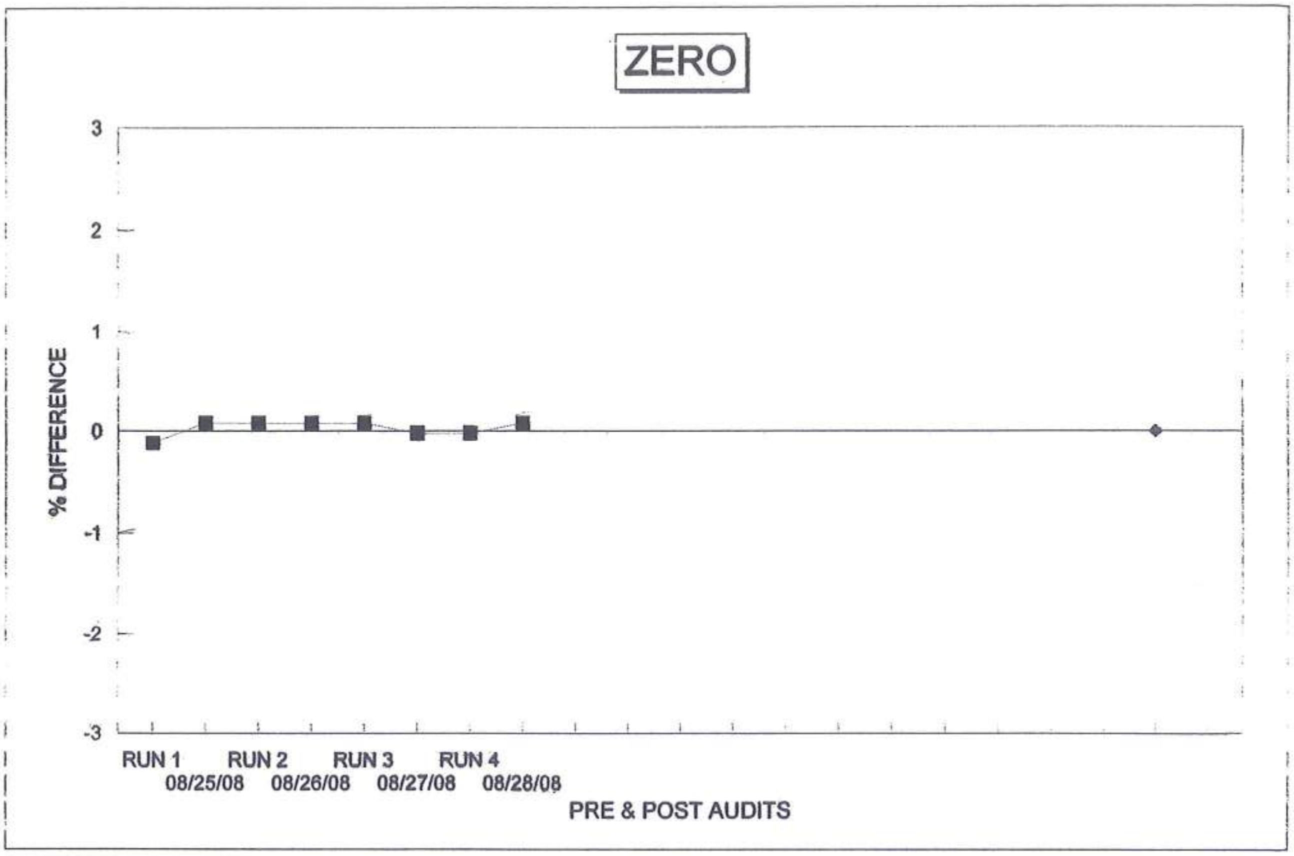


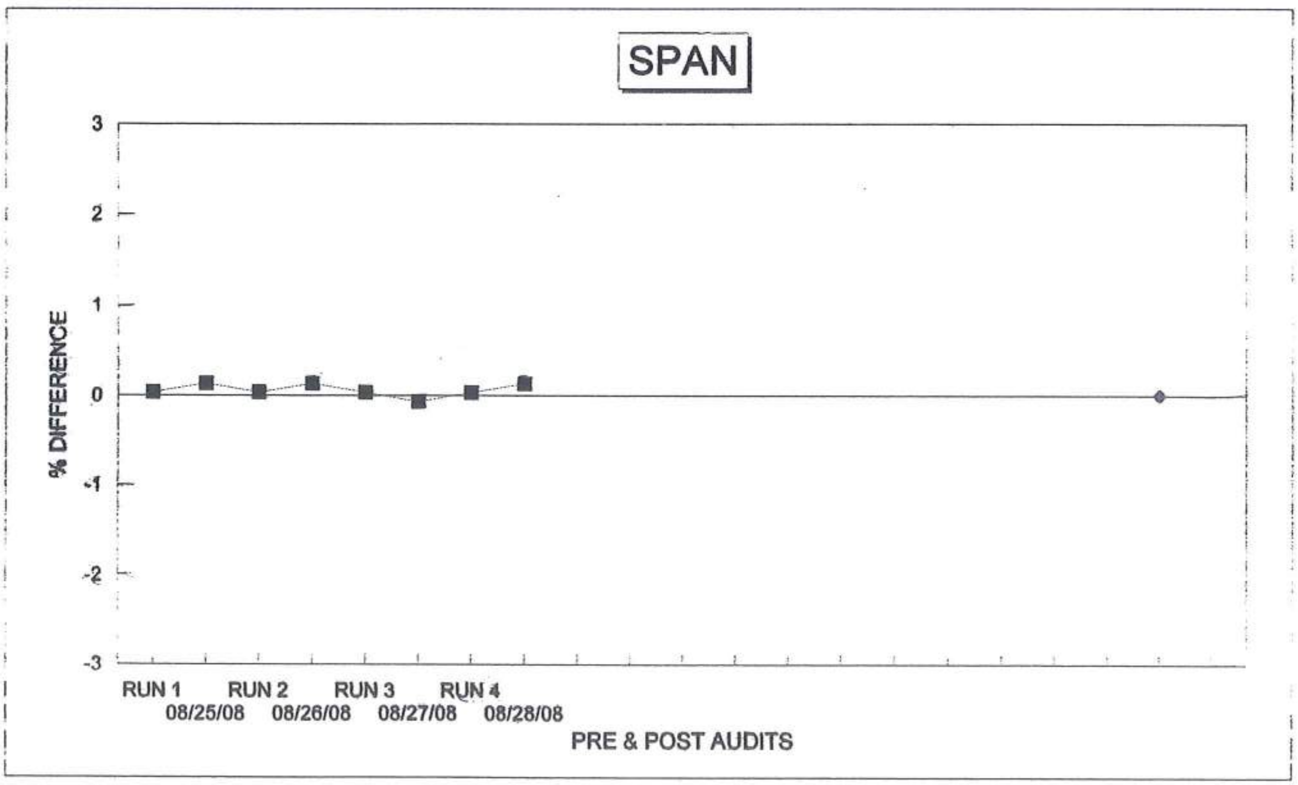
EPA Span Value = ± 2.0% of 25% O_2 = ± .5%

Cal Volts = Cal Volt Conc - Std Conc = ± Conc Diff = ± Δ%

	Cal Volts	Cal Volt Conc	Std Conc	± Conc Diff	± Δ%
HIGH VOLTS	.834	20.195	20.9	-.705	-2.82
LOW VOLTS	.252	6.80	6.25	.550	2.20

O2


ZERO
3
2
1
0
-1
-2
-3
% DIFFERENCE
RUN 1
RUN 2
RUN 3
RUN 4
08/25/08
08/26/08
08/27/08
08/28/08
PRE & POST AUDITS


SPAN
3
2
1
0
-1
-2
-3
% DIFFERENCE
RUN 1
RUN 2
RUN 3
RUN 4
08/25/08
08/26/08
08/27/08
08/28/08
PRE & POST AUDITS

CO ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Date: 8-20-2008

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

Calibration by: Cp Wadmgth

Cal Gas Flow: 1.5 SCFH Measured by: Rotameter

BP: 29.71 Instrument ID: PRINCO

Temp: 69 Instrument ID: TR

Cylinders:

1. # 168TAC 3-A Concentration: 00.00 % CO Cyl. Press.: 690 PSI
   Certified by: AIR LIQUIDE Date: 04-19-04
2. # 487905 Concentration: 4.90 % CO Cyl. Press.: 1700 PSI
   Certified by: AIR LIQUIDE Date: 11-1-07
3. # CA06641 Concentration: 8.63 % CO Cyl. Press.: 1580 PSI
   Certified by: AIR LIQUIDE Date: 1-5-2007
4. # CC-12731 Concentration: 1.98 % CO Cyl. Press.: 1180 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		ACTUAL		ADJ.	
			METER	DVM	METER	DVM	METER	DVM
1	1	0.00	00.0	.000	00.0	.000	00.0	.000
2	2	4.90	49.0	.490	48.1	.481	49.0	.490
3	3	8.63	86.3	.863	86.6	.866		
4	4	1.98	19.8	.198	19.4	.194		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 4.997

CO Linear Regression Results:

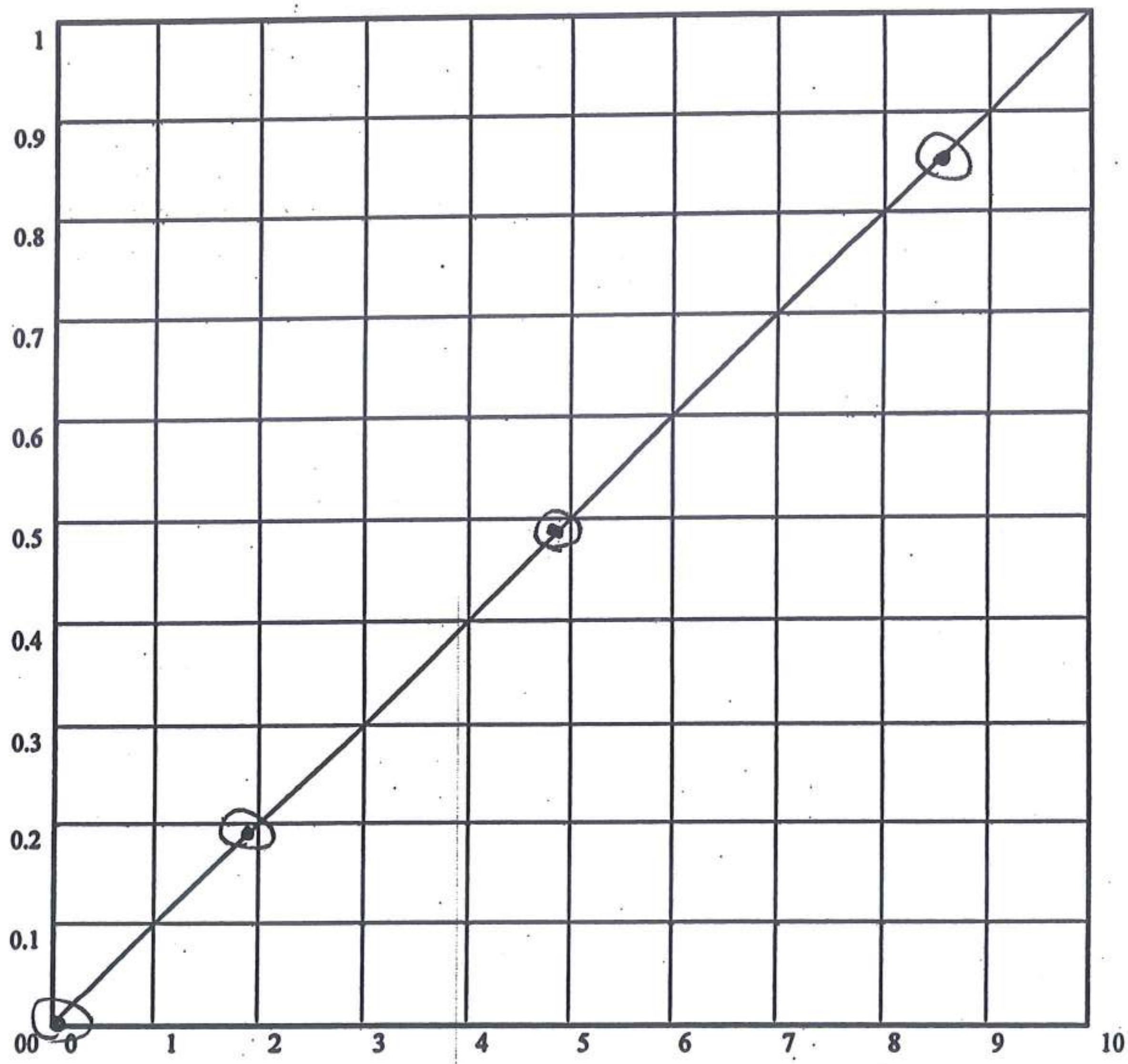
Y = MX + B

Slope (M) = –.0022542

Y Intercept (B) = .1005169

Correlation Coefficient (r) = .9999842

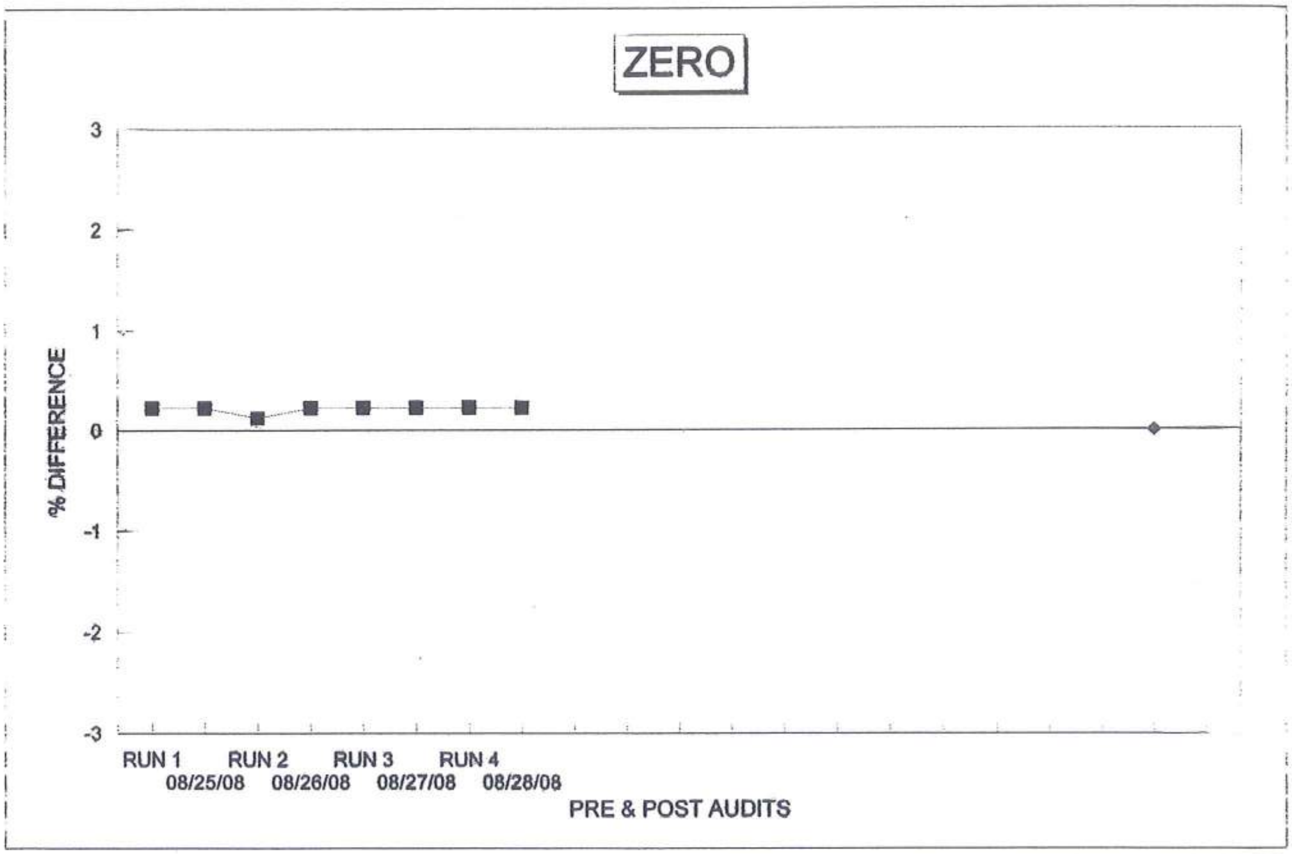
r^2 = .9999685

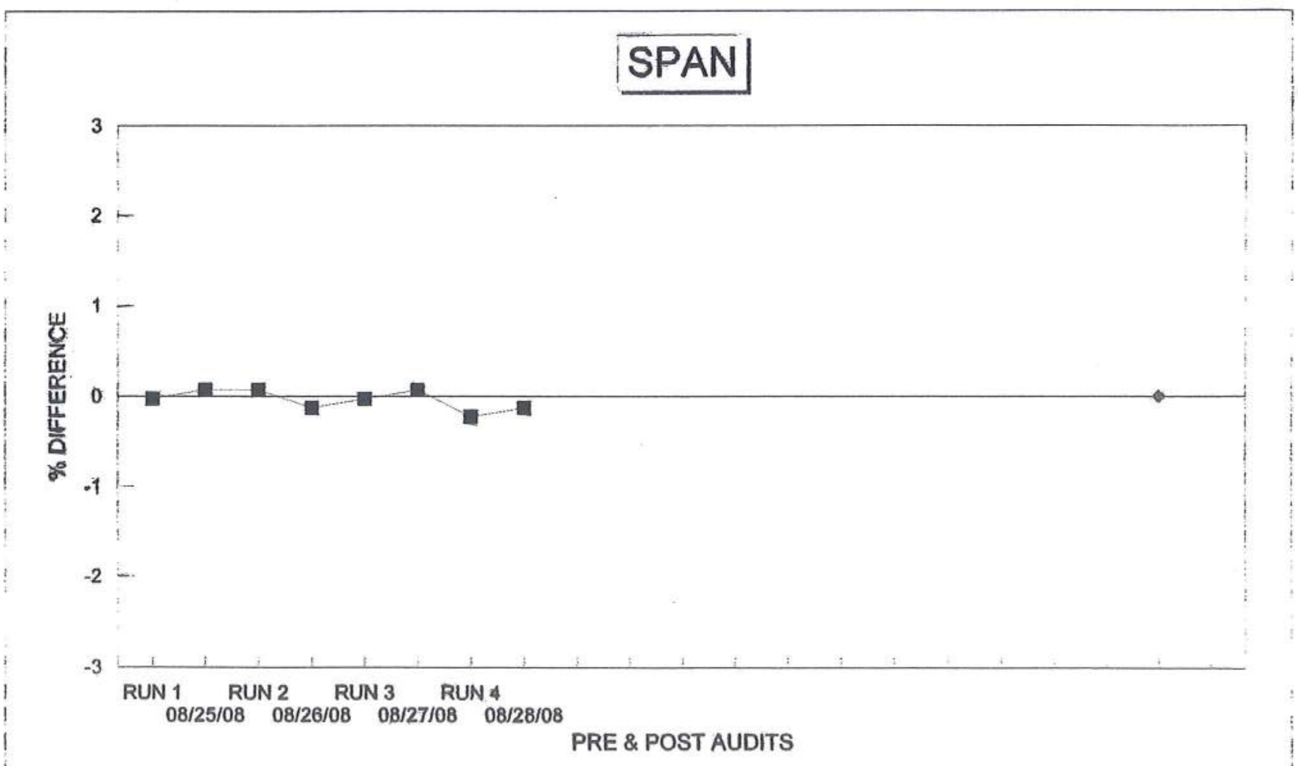


EPA Span Value = ± 2.0% of 10% CO = ± .2%

Cal Volts = Cal Volt Conc - Std Conc = ± Conc Diff = ± Δ %

	Cal Volts	Cal Volt Conc	Std Conc	± Conc Diff	± Δ %
HIGH VOLTS	.866	8.66	8.63	.030	.300
LOW VOLTS	.194	1.94	1.98	–.040	–.400


ZERO
3
2
1
0
-1
-2
-3
% DIFFERENCE
RUN 1
RUN 2
RUN 3
RUN 4
08/25/08
08/26/08
08/27/08
08/28/08
PRE & POST AUDITS


SPAN
3
2
1
0
-1
-2
-3
% DIFFERENCE
RUN 1
RUN 2
RUN 3
RUN 4
08/25/08
08/26/08
08/27/08
08/28/08
PRE & POST AUDITS

SO_2 ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Date: 8-20-2008

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

Calibration by: Cly Widmyer

Cal Gas Flow: 1.5 SCFH Measured by: Rotameter

BP: 29.71 Instrument ID: PRINCO

Temp: 69 Instrument ID: TR

Cylinders:

1. # 168TAC 3A Concentration: 00.00 % SO_2 Cyl. Press.: 690 PSI
   Certified by: AIR LIQUIDE Date: 04-19-04
2. # CC82089 Concentration: 1250 % SO_2 Cyl. Press.: 1870 PSI
   Certified by: AIR LIQUIDE Date: 1-3-2007
3. # ALMO 49127 Concentration: 1770 % SO_2 Cyl. Press.: 190 PSI
   Certified by: SCOTT SPECIALTY GASES Date: 05-15-97
4. # ALMO 52285 Concentration: 506 % SO_2 Cyl. Press.: 720 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	00.0	.000	00.0	.000
2	2	1250	50.0	.500	49.6	.490	50.0	.500
3	3	1770	70.8	.708	70.3	.703		
4	4	506	20.2	.202	20.0	.200		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 1256.4

SO_2 Linear Regression Results:

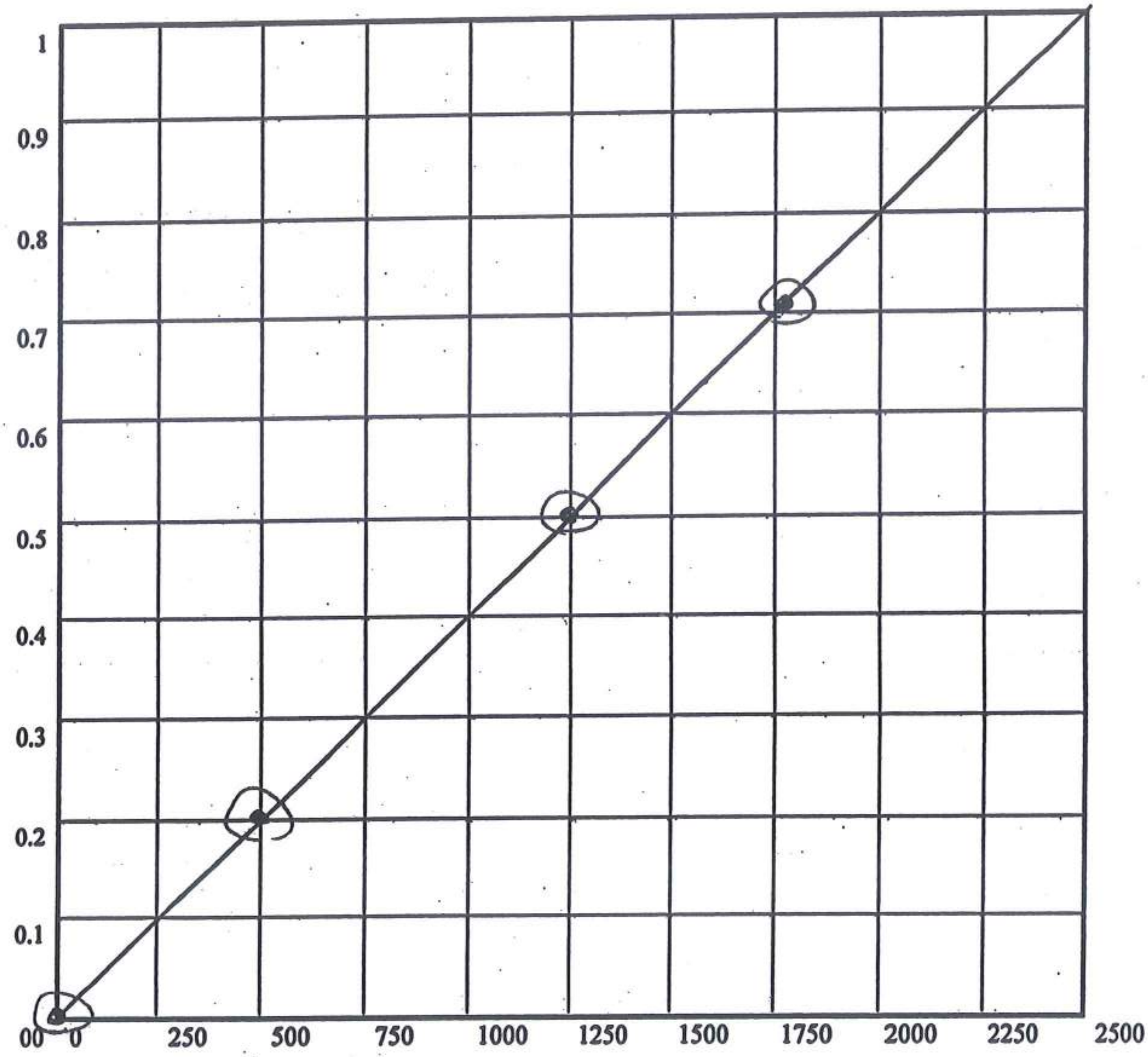
Y = MX +B

Slope (M) = −.0001565

Y Intercept (B) = .0003981

Correlation Coefficient(r) = .9999824

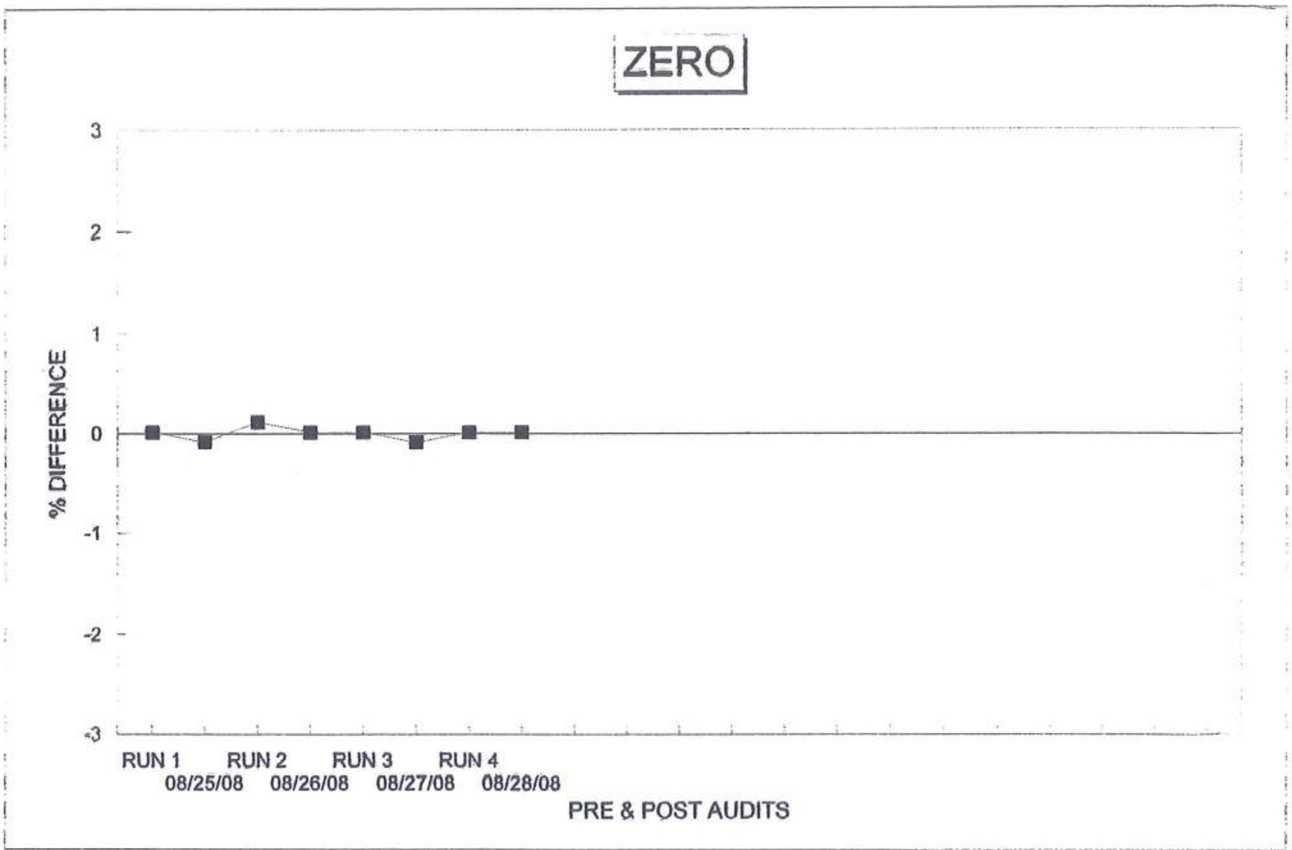
r^2 = .9999649

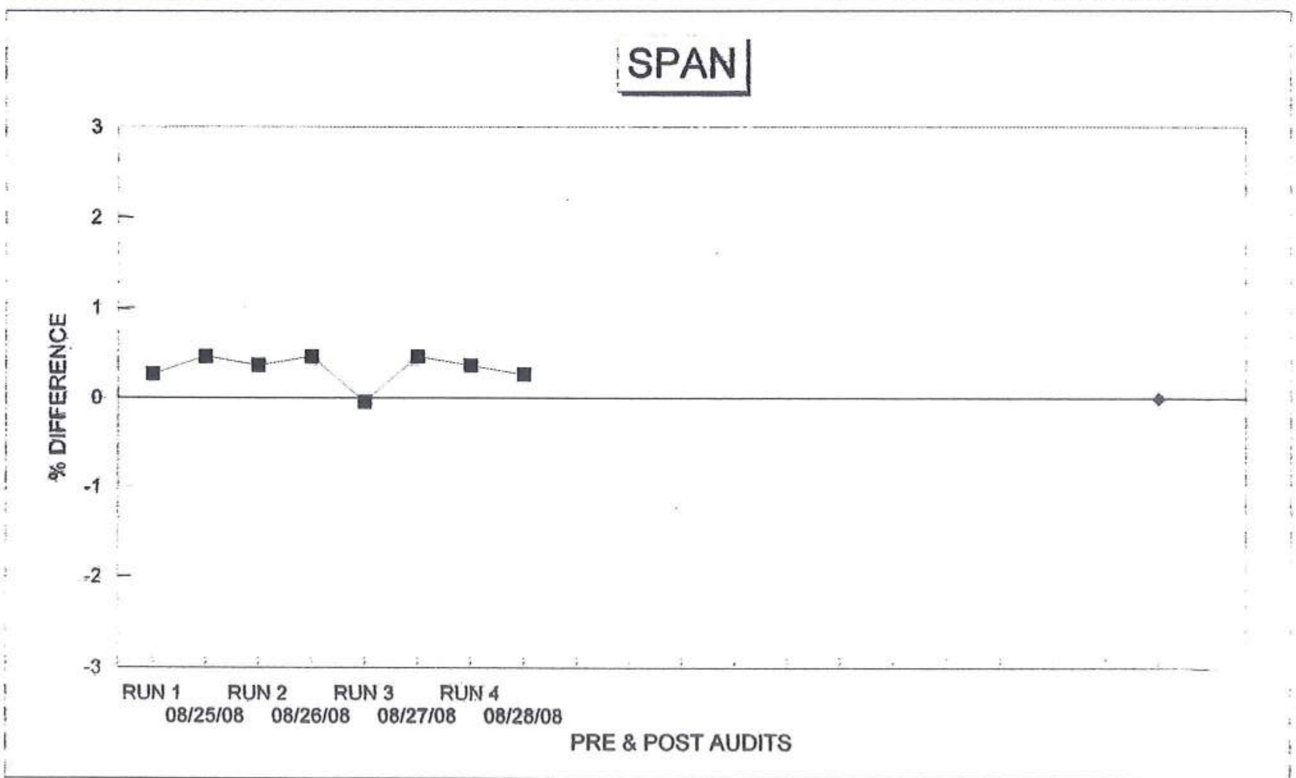


EPA Span Value = ± 2.0% of 2500 PPM SO_2 = ± 50 PPM

Cal Volts = Cal Volt Conc - Std Conc = ± Conc Diff = ± Δ %

	Cal Volts		Cal Volt Conc		Std Conc		± Conc Diff		± Δ %
HIGH VOLTS	.703	=	1757.5	-	1770.0	=	−12.50	=	−.500
LOW VOLTS	.200	=	500.0	-	506.0	=	−6.000	=	−.240


ZERO
3
2
1
0
-1
-2
-3
% DIFFERENCE
RUN 1
RUN 2
RUN 3
RUN 4
08/25/08
08/26/08
08/27/08
08/28/08
PRE & POST AUDITS


SPAN
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-3
% DIFFERENCE
RUN 1
RUN 2
RUN 3
RUN 4
08/25/08
08/26/08
08/27/08
08/28/08
PRE & POST AUDITS

LOW SPAN

AIR LIQUIDE

GASES FOR RESEARCH AND DEVELOPMENT

CYL # CC-12731 CGA: 590

PRES 1665 VOL 130c.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 [signature]

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						

.his mixture was certified by analysis using one or more calibration standards prepared with scales certified against weights traceable to N.I.S.T.

omments:

ᴗewpoint 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
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	Assay Laboratory	
ENERGY & ENV MEASUREMENT	SCOTT SPECIALTY GASES	Project No.: 08-34135-001
C/O ED WADINGTON	500 WEAVER PARK RD	P.O. No.: VERBAL
3730 N. PELLEGRINO DR.	LONGMONT,CO 80501	
TUCSON,AZ 85749		

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

Date: 04/14/97	Response Unit: PPM	
Z1=0.3847	R1=487.72	T1=505.77
R2=488.79	Z2=1.8201	T2=505.89
Z3=1.8425	T3=505.78	R3=488.99
Avg. Concentration:	505.8	PPM

Second Triad Analysis

Date: 04/21/97	Response Unit: PPM	
Z1=0.3241	R1=488.29	T1=506.43
R2=488.83	Z2=1.6098	T2=505.75
Z3=0.8340	T3=505.74	R3=488.60
Avg. Concentration:	505.9	PPM

Calibration Curve

Concentration = A + Bx + Cx2 + Dx3 + Ex4	
r=0.999980	
Constants:	A=0.000000
B=1.000000	C=0.000000
D=0.000000	E=0.000000

Special Notes:

ANALYST: Devon VonFeldt
Devon VonFeldt

SO2 concentration analysis
06/05/08

Vm(std)	1.500			
mcf	1.004		dscf=	1.500
Hg	30.02			
DH	0.12			
temp	75	535	ppm =	521
ml BA ++	182			
Normality	0.0101		Run1	493
			Run 2	521
			Run3	507
Tank I.D. #	ALMO52285		avg.	507

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	Scale	Equipment Used: Analyt. Inst.	Equipment Used: 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 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: 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: 303-772-7673

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)

SULFUR DIOXIDE *

First Triad Analysis

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 = 0.999980	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
06/05/08

Vm(std)	1.500			
mcf	1.004		dscf=	1.500
Hg	30.11			
DH	0.12			
temp	75	535	ppm =	1767
ml BA ++	617			
Normality	0.0101		Run1	1787
			Run 2	1775
			Run3	1767
Tank I.D. #	ALMO49127			
			avg.	1776

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:

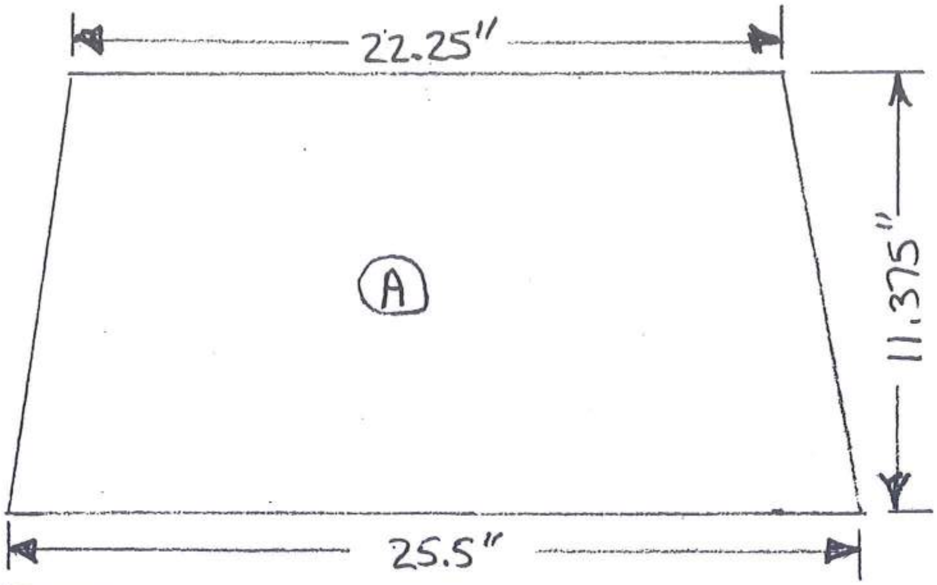
TESTS		ACTUAL ANALYSIS
Assay		99.9%
Color		5 APHA
Description		Clear, Colorless Liquid
Free Halogens		Pass Test
Identification		Pass Test
Fluorescence Background (as Quinine Sulfate)		Not more than 1 ppb
Certified for EPA Test #1625		Pass Test
Pesticide Residue Analysis (as Heptachlor Epoxide)		Not more 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%

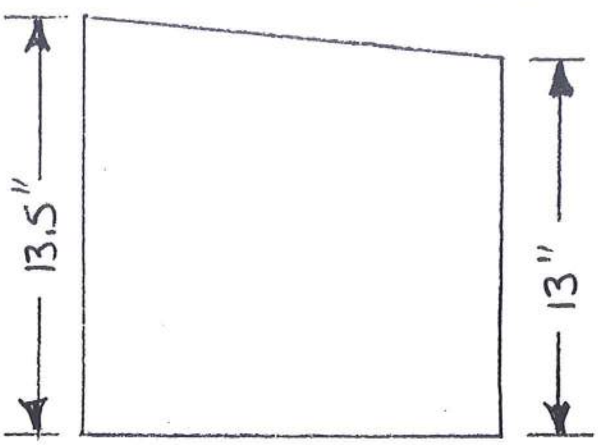
Fisher Scientific
Chemical Division
1 Reagent Lane
Fair Lawn, N.J. 07410
201-796-7100

Approved By: Edgar E. Hess

Edgar E Hess
Q.C. Laboratory Manager

Firebox Volume and Fuel Load Calculations for the Jotul C550





$$A = \left(\frac{\overset{23.875}{22.25 + 25.5}}{2}\right) \times 11.375'' \times \left(\frac{\overset{13.25}{13.5 + 13}}{2}\right) = 3598.41 \text{ in}^3$$

$$= 2.082 \text{ ft}^3$$

Fuel Load Range

Low	IDEAL	High
13.2	14.577	16.035

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):

$$Nt = \frac{K_3Nc}{(YCO_2 + YCO + YHC)}$$

Stack Flow Rate (Q_{sd}):

$$Q_{sd} = K_4N_tBr$$

Particulate Concentration (C_s):

$$C_s = \frac{M_n}{V_{m(std)}}$$

Particulate Emission Rate (E):

$$E = C_sQ_{sd}$$

Proportional Rate Variation (Pr):

$$Pr = \left(\frac{\theta\, S_i * V_{mi(std)}}{10\sum_{i=1}^{n}\left[S_i * V_{mi(std)}\right]} \right) * 100$$

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.

Appendix B

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. <u>Flue Pipe</u>

   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. <u>Insulated Flue Pipe</u>

   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. <u>Liquid Seal</u>

   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. <u>Supports</u>

   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. <u>Platform Scale</u>

   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. <u>Filters</u>

The filters used are the same as EPA M5H filters.

6. <u>Manifold and Exhaust</u>

The gas stream is delivered to each analyzer through a manifold and flowmeter with the excess gases being routed to an exhaust.

7. <u>CO Analyzer</u>

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. <u>CO_2 Analyzer</u>

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. <u>Pretest Preparation, Checks and Audit Procedures</u>

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. <u>Operation During Testing</u>

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. <u>Post Test Checks and Audit Procedures</u>

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. <u>Calibration Gases</u>

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. <u>Sample Probe</u>

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. <u>Combustor</u>

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. <u>Sample Condenser</u>

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. <u>Filter</u>

A standard EPA M5H 3" or 4" filter.

10. <u>SO_2 Analyzer</u>

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. <u>Flow Control</u>

Flow through the tracer gas sampling train is controlled by a SS flowmeter.

TRACER GAS TRAIN OPERATING INSTRUCTIONS

A. <u>Pretest Preparation and Checks and Audit Procedures</u>

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. <u>Operation</u>

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.

X

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. <u>Post Test Checks and Audit (Zero/Span) Procedures</u>

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. <u>Determination of Tracer Gas Train's Response Time</u>

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. <u>Calibration and Audit Procedures for the Tracer Gas (SO_2) Analyzer</u>

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.

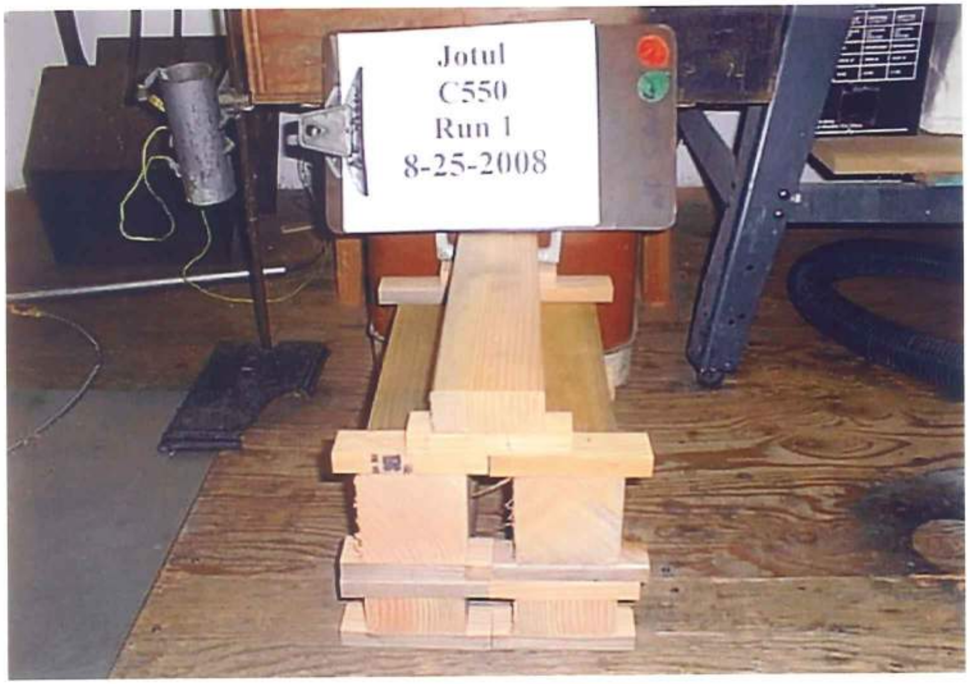
N. Document all stove operating data from ignition through loading and test start up on Data Sheet #9.

Photograph Pages

Photograph Pages

Photograph
Pages

Photograph Pages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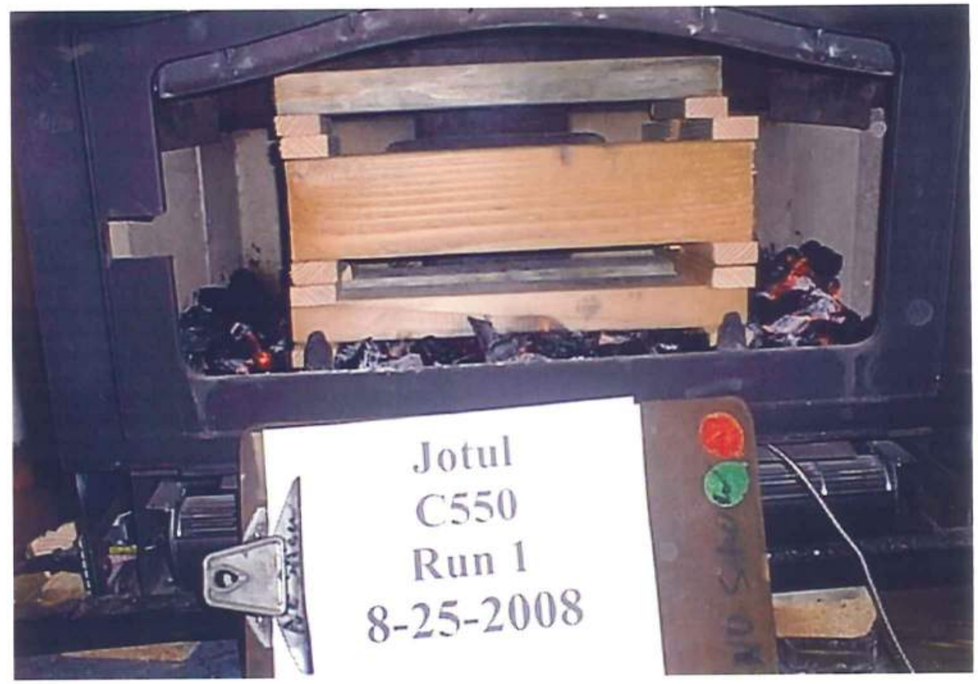
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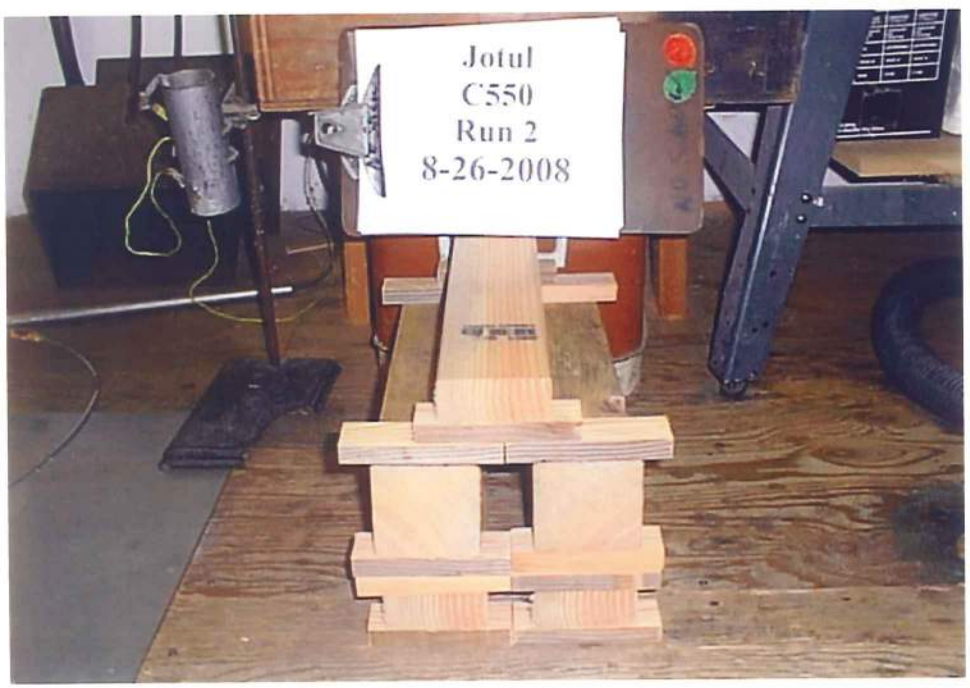
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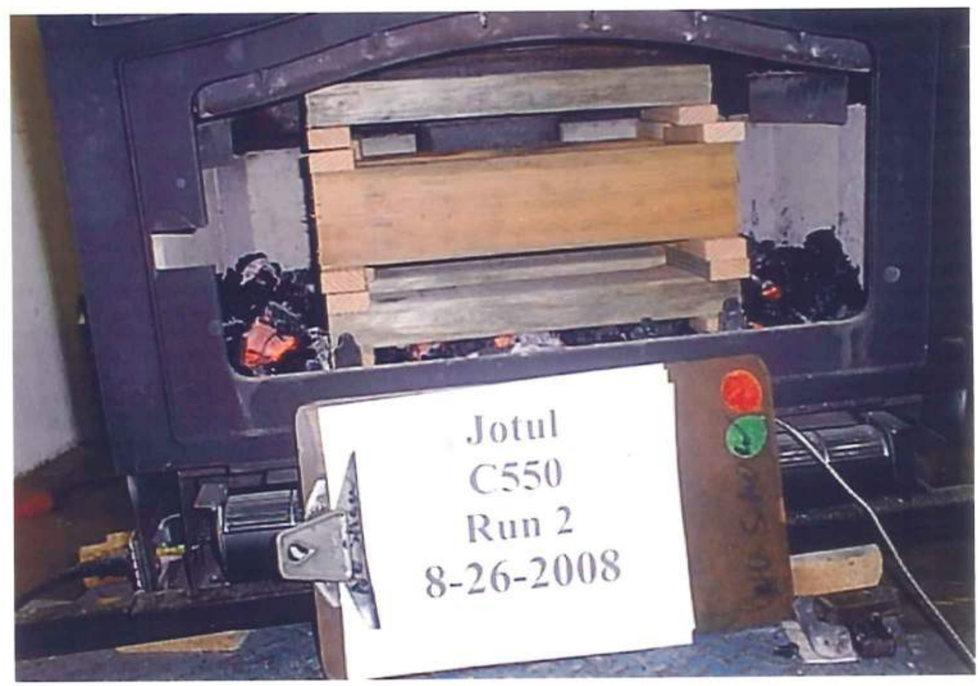
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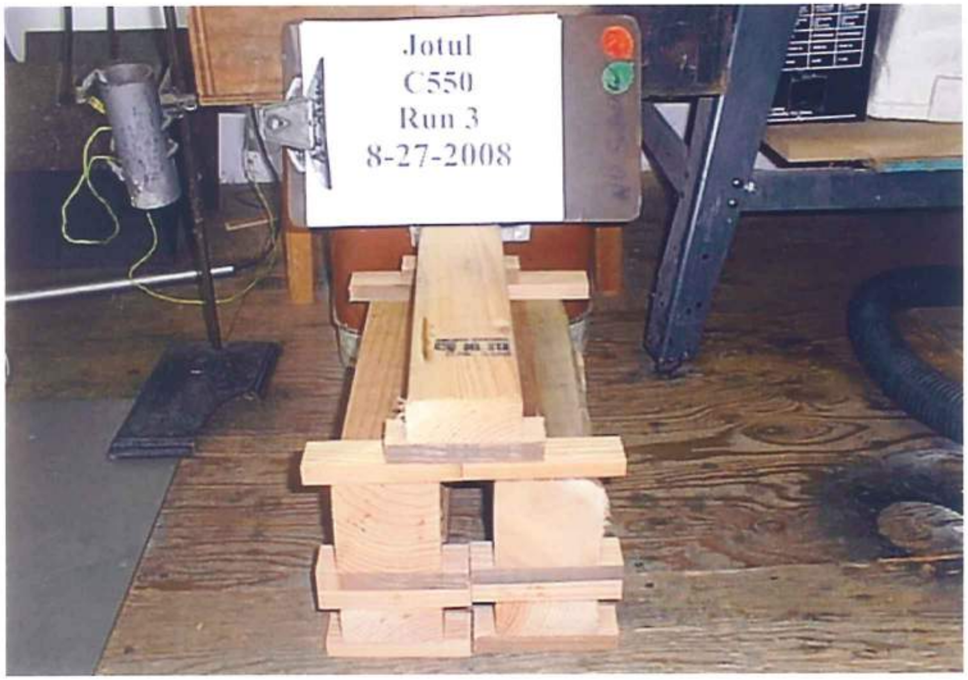
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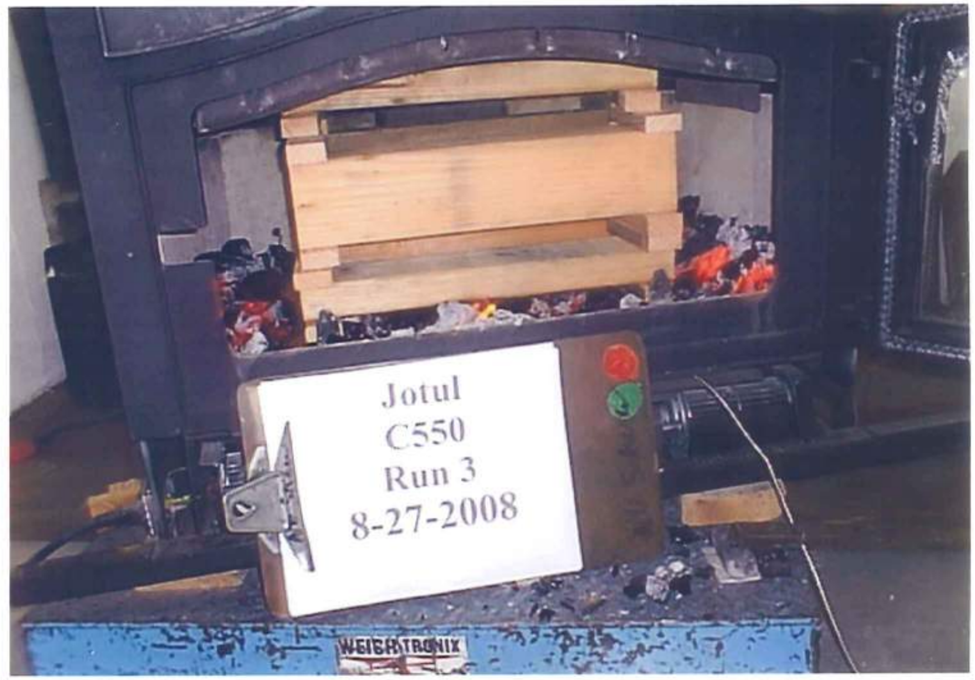
Run 3
8-27-2008


Jotul
C550
Run 3
8-27-2008
WEIGH-TRONIX


C550
Run 4
8-28-2008


Jotul
C550
Run 4
8-28-2008