LOKEE TESTING Laboratory

United States
Environmental Protection Agency
Wood Heater Certification Test Report

Jotul North America

F 55 TL

Volume 1 of 1

13235 PRAIRIE CIRCLE EAST, BONNEY LAKE, WASHINGTON 98391-7250
TELEPHONE: 360-897-9685

United States
Environmental Protection Agency
Wood Heater Certification Test Report

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

Report By:

Chip Wadington

CONFIDENTIAL

RELEASED ONLY BY
AUTHORIZED PERSONNEL

10/18/2011

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TEST SERIES INFORMATION

Unit name and model number: F 55 TL

Type of unit: Wood Heater

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

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

Observers: None

Date Received: 8-15-2011 Aged: 8/18/2011 Dates Tested: 8/21-29/2011

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

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

LoKee's Field Team

Team Members: Chip Wadington
Armando Vedoy

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

STOVE STORAGE INFORMATION

1. **Temporary Storage at LoKee**

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

2. **Permanent Storage**

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

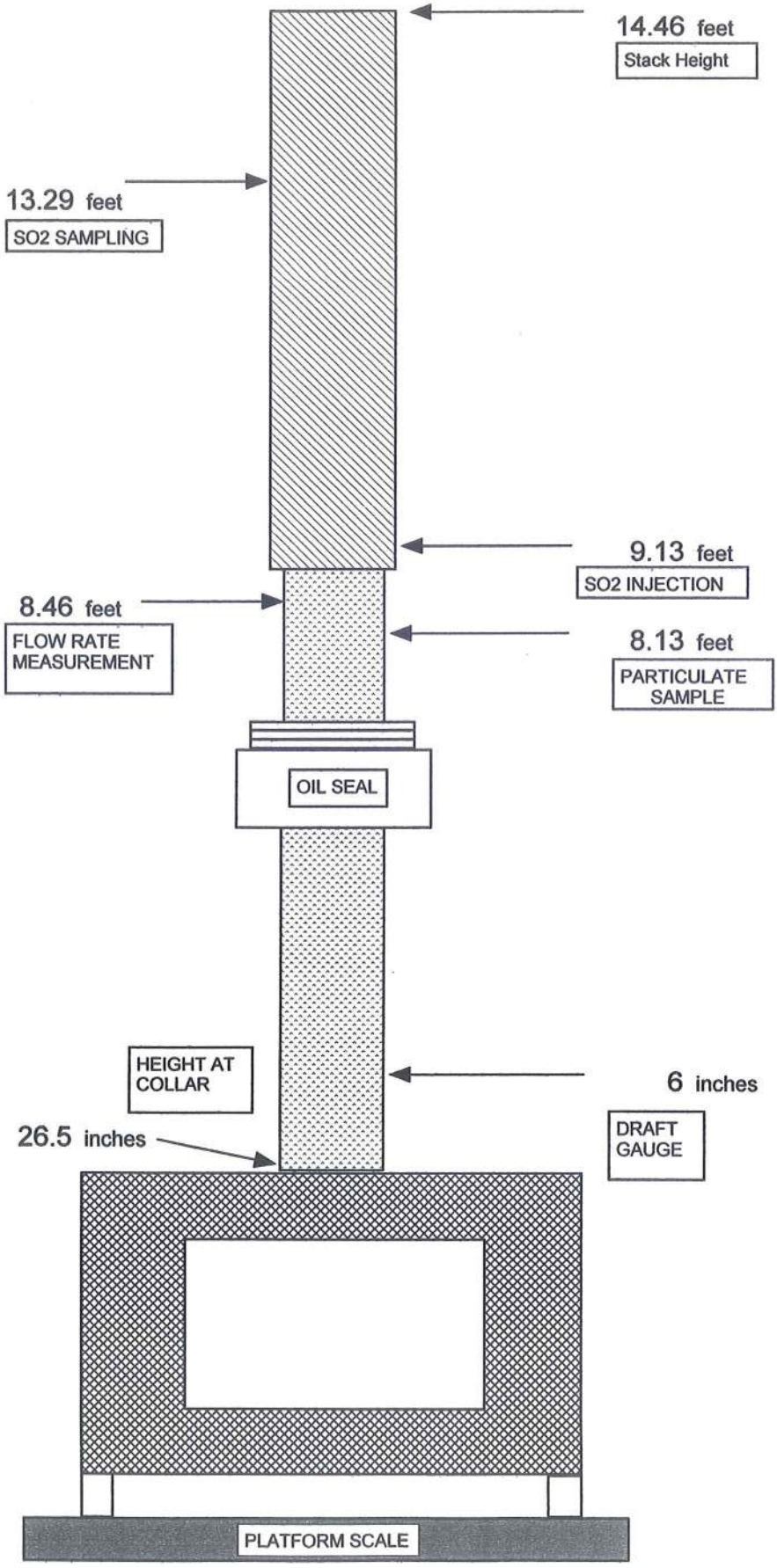
WARNING

SEALED EPA TEST UNIT

DO NOT TAMPER WITH SEALS
TO DO SO WILL VOID CERTIFICATION

JOTUL NORTH AMERICA
F 55 TL

Model: Jotul F55 **Date:** 09/21/11



AGING DATA SHEET

UNIT : Jotul F55 DATE: 8/18/2010

Hr #	DATE	TIME	TEMP Stack 1	TEMP Top 2
1	6-28-11	1200	265	227
2	11	1300	302	307
3	11	1400	433	371
4	11	1500	271	248
5	11	1600	240	215
6	11	1700	222	189
7	6-29-11	1035	176	300
8	11	1135	220	386
9	11	1235	202	418
10	11	1335	159	274
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				

Hr #	DATE	TIME	TEMP 1	TEMP 2
26				
27				
28				
29				
30				
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COMMENTS:

LOKEE TESTING Laboratory

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

September 20, 2011

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:F55

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

September 20, 2011

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 September 20, 2011 at 11:00 am PST, you 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: F55

If you have any questions please feel free to call.

Sincerely,

Chip Wadington
Owner

LOKEE TESTING Laboratory

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

September 20, 2011

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:

Testing was not done on consecutive work days for the:

Jotul North America :
Model: F55

This was because prep time was needed between the longest of the tests.

If you have any questions please feel free to call.

Sincerely,

Chip Wadington
Owner

LOKEE TESTING Laboratory

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

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Jotul North America :
Model: F55

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If you have any questions please feel free to call.

Sincerely,

Chip Wadington
Owner

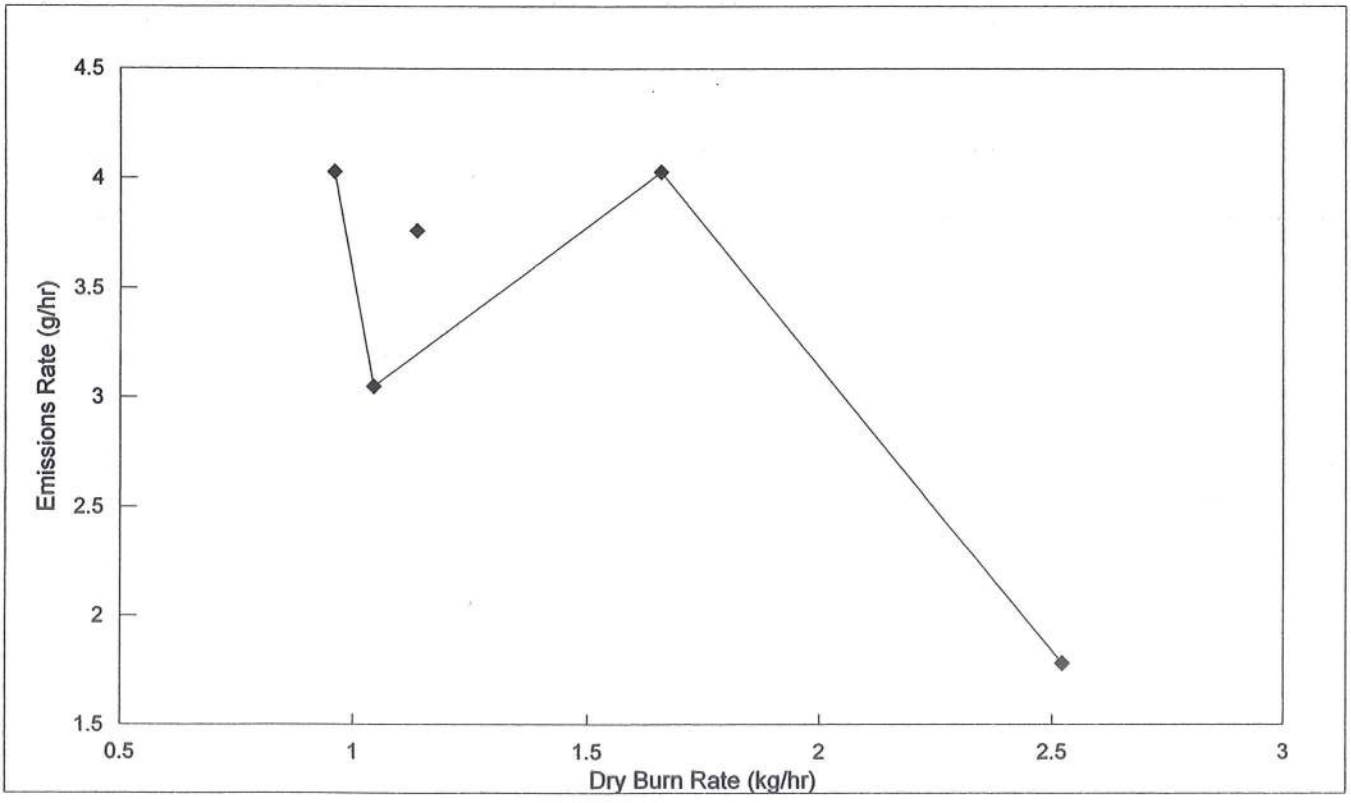
Data Summary

Wood Heater Emission Test Summary

Laboratory/Wood Heater Information

Stove Manufacturer:	Jotul
Model Identification:	F 55 TL
Stove Type> 1=cat, 2=noncat, 3=pellet:	2
Laboratory Name:	LoKee Testing
Laboratory Contact:	CHIP WADINGTON
Telephone no.:	360-897-9685
Test Dates:	9/21-9/29/11
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) 3.50
1	0.960	4.03	11576	
2	1.044	3.05	12589	
4	1.657	4.03	19980	
5	2.521	1.78	30399	
			NA	
			NA	
			NA	
3	1.14	3.76	13698	



Unit:Jotul F55

DATA SUMMARY

	RUN #	1	2	4	5	3			
Particulate Emissions:									
Concentration:	grains/dscf:	.1385	.1005	.0933	.0319	.1094			
Emissions Rate	grams/hr:	4.03	3.05	4.03	1.79	3.76			
Emissions Factor	grams/kg:	4.19	2.92	2.43	0.71	3.31			
Front Half Catch	% of total	42.3	42.6	31.9	59.8	56.0			
Total Mass Captured	total catch:	.9620	.6605	.4796	.0958	.6934			
Heat Output (EPA Default):	BTU/hr	11575.9	12588.8	19980.4	30398.7	13698.1			
Fuel Burn Rates:									
Average kg/hr (dry)	Kg/hr	.96	1.04	1.66	2.52	1.14			
Fuel Moisture Content:									
Kindling (wet basis)	%	13.068	12.943	13.144	12.816	12.255			
Pretest Fuel (wet basis)	%	16.411	17.219	16.580	16.921	16.597			
Test Fuel (wet basis)	%	16.378	15.926	16.218	16.448	15.804			
Air to Fuel Ratio		-	-	-	-	-			
Average Stack Gas									
Avg CO_2	%	5.50	5.48	5.80	8.64	5.25			
Avg O_2	%	-	-	-	-	-			
Avg CO	%	.94	1.23	0.83	0.50	1.13			
Avg Moisture	%	5.68	5.94	5.57	5.13	4.87			
Avg Stack Gas Emissions:									
CO	g/Kg	145.82	185.08	112.01	57.82	176.71			
	g/hr	139.98	193.22	185.61	145.76	200.75			

Unit: Jotul F55

	RUN #	1	2	4	5	3			
Avg Stack Gas Flow Rate									
EPA CMB	dscfm	7.43	7.80	11.11	14.46	8.86			
Tracer Gas	dscfm	7.063	6.641	7.950	16.172	7.040			
Draft (static)	in H_2O	-.037	-.041	-.047	-.055	-.039			
Proportionality Average	%	100	100	100	100	100	100	100	100
Average Temperatures									
Stack Gas	°F	160	164	230	326	171			
Firebox	°F	311	322	366	451	309			
Secondary	°F	479	509	612	758	497			
Catalytic Combustor	°F	-	-	-	-	-			
Top	°F	255	279	343	445	271			
Left Side	°F	260	269	314	398	266			
Back	°F	279	283	297	353	275			
Right Side	°F	344	361	417	507	346			
Bottom	°F	276	242	302	355	269			
Temperature Change	°F	-113.2	-124.7	-111.8	-124.0	-85.6			
Test Chamber Enviroment									
Average Barometer	in. Hg	30.04	30.10	30.32	30.00	29.83			
Average Temperature	°F	77	84	85	86	80			
Ambient Moisture	% H_2O	1.75	1.95	1.55	1.45	1.1			
Relative Humidity	%RH	49.0	44.8	47.0	43.0	52.0			
Air Velocity	m/sec	0	0	0	0	0	0	0	0
Fuel Weight and Burn Time									
Density (dry basis)	gm/cm^3	-	-	-	-	-			
Coal Bed Weight	lbs	4.3	4.3	3.9	4.8	4.3			
Pre Test Fuel (inc kindling)	lbs	49.6	56.0	37.0	41.5	44.2			
Test Fuel	lbs	17.3	17.8	17.8	19.4	17.6			
Burn Time	min	410	390	245	175	355			

Unit: Jotul F55

	RUN #	1	2	4	5	3			
Avg Stack Gas Flow Rate									
EPA CMB	dscfm	7.43	7.80	11.11	14.46	8.86			
Tracer Gas	dscfm	7.063	6.641	7.950	16.172	7.040			
Draft (static)	in H_2O	-.037	-.041	-.047	-.055	-.039			
Proportionality Average	%	100	100	100	100	100	100	100	100
Average Temperatures									
Stack Gas	°F	160	164	230	326	171			
Firebox	°F	311	322	366	451	309			
Secondary	°F	479	509	612	758	497			
Catalytic Combustor	°F	-	-	-	-	-			
Top	°F	255	279	343	445	271			
Left Side	°F	260	269	314	398	266			
Back	°F	279	283	297	353	275			
Right Side	°F	344	361	417	507	346			
Bottom	°F	276	242	302	355	269			
Temperature Change	°F	-113.2	-124.7	-111.8	-124.0	-85.6			
Test Chamber Enviroment									
Average Barometer	in. Hg	30.04	30.10	30.32	30.00	29.83			
Average Temperature	°F	77	84	85	86	80			
Ambient Moisture	% H_2O	1.75	1.95	1.55	1.45	1.1			
Relative Humidity	%RH	49.0	44.8	47.0	43.0	52.0			
Air Velocity	m/sec	0	0	0	0	0	0	0	0
Fuel Weight and Burn Time									
Density (dry basis)	gm/cm^3	-	-	-	-	-			
Coal Bed Weight	lbs	4.3	4.3	3.9	4.8	4.3			
Pre Test Fuel (inc kindling)	lbs	49.6	56.0	37.0	41.5	44.2			
Test Fuel	lbs	17.3	17.8	17.8	19.4	17.6			
Burn Time	min	410	390	245	175	355			

Minimum DBR

TABLE 1 ----- RAW DATA

CLIENT : Jotul TEST No. : 1

MODEL: F55 DATE: 21-Sep-11

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	375.000	0.150	82	0.69	4.10	450
5	376.500	0.500	82	0.58	11.00	250
10	379.254	0.100	84	0.42	2.70	550
15	380.517	0.120	84	0.48	2.80	500
20	381.907	0.090	84	0.77	2.70	575
25	383.115	0.090	84	0.82	4.40	575
30	384.324	0.080	84	0.99	4.10	625
35	385.436	0.060	84	1.42	4.30	750
40	386.362	0.060	84	0.82	6.40	725
45	387.321	0.170	84	0.20	12.40	425
50	388.955	0.250	84	0.12	11.10	350
55	390.939	0.250	84	0.21	12.80	350
60	392.923	0.250	84	0.13	12.40	350
65	394.907	0.220	84	0.19	12.80	375
70	396.759	0.220	84	0.26	13.50	375
75	398.611	0.250	85	0.18	12.50	350
80	400.602	0.220	85	0.10	10.60	375
85	402.460	0.220	85	0.32	10.20	375
90	404.319	0.250	85	0.18	10.00	375
95	406.310	0.120	85	0.76	7.80	500
100	407.705	0.120	86	0.65	6.80	500
105	409.105	0.120	86	1.37	4.80	500
110	410.505	0.080	86	1.36	5.90	625
115	411.625	0.070	86	2.14	5.40	650
120	412.702	0.090	86	1.93	5.60	575
125	413.919	0.100	86	1.72	5.60	550
130	415.192	0.110	86	1.58	5.50	525
135	416.525	0.110	87	1.55	5.60	525
140	417.863	0.120	87	1.54	5.70	500
145	419.268	0.120	87	1.54	5.60	500
150	420.673	0.120	87	1.50	5.50	500
155	422.078	0.100	87	1.59	5.70	550
160	423.356	0.080	87	1.55	5.40	600
165	424.527	0.100	87	1.38	5.40	550
170	425.804	0.110	87	1.30	5.30	525
175	427.142	0.120	87	1.26	5.30	500

180	428.547	0.120	87	1.23	5.30	500
185	429.954	0.120	87	1.36	5.30	500
190	431.362	0.120	87	1.31	5.40	500
195	432.769	0.130	87	1.24	5.40	475
200	434.250	0.120	87	1.19	5.40	500
205	435.657	0.120	87	1.17	5.40	500
210	437.065	0.130	87	1.18	5.30	475
215	438.546	0.130	87	1.14	5.20	475
220	440.027	0.130	87	1.15	5.10	475
225	441.509	0.130	87	1.14	4.90	475
230	442.990	0.130	87	1.03	4.60	475
235	444.471	0.130	87	0.97	4.50	475
240	445.953	0.130	87	0.98	4.50	475
245	447.434	0.130	87	0.94	4.50	475
250	448.915	0.130	87	0.92	4.50	475
255	450.396	0.130	87	0.92	4.30	475
260	451.878	0.130	87	0.91	4.30	475
265	453.359	0.130	87	0.89	4.30	475
270	454.840	0.013	87	0.87	4.20	475
275	456.322	0.130	87	0.90	4.30	475
280	457.803	0.130	87	0.89	4.30	475
285	459.284	0.130	87	0.87	4.30	475
290	460.765	0.130	87	0.86	4.20	475
295	462.247	0.130	87	0.88	4.20	475
300	463.728	0.130	87	0.89	4.20	475
305	465.209	0.130	87	0.85	4.00	475
310	466.691	0.130	87	0.84	4.00	475
315	468.172	0.120	87	0.82	3.80	500
320	469.579	0.120	87	0.82	3.80	500
325	470.986	0.120	87	0.82	3.90	500
330	472.394	0.120	87	0.83	3.90	500
335	473.801	0.120	87	0.83	3.90	500
340	475.208	0.110	87	0.84	3.90	525
345	476.549	0.110	87	0.87	3.70	525
350	477.889	0.110	87	0.82	3.60	525
355	479.229	0.110	87	0.78	3.60	525
360	480.570	0.110	87	0.75	3.50	525
365	481.910	1.000	87	0.80	3.60	550
370	483.190	0.100	87	0.79	3.60	550
375	484.469	0.100	87	0.79	3.60	550
380	485.749	0.100	87	0.75	3.50	550
385	487.028	0.100	87	0.75	3.50	550
390	488.308	0.100	87	0.96	3.50	550
395	489.587	0.100	87	0.95	3.50	550
400	490.867	0.100	87	0.95	3.50	550
405	492.146	0.100	87	0.87	3.30	550

410	493.426	0.100	87	0.87	3.30	550

TABLE 2---RAW DATA

CLIENT : Jotul TEST No. 1

MODEL: F55 DATE: 21-Sep-11

METER CAL. FACTOR (Y)	-------	0.927	Wt. WOOD BURNED(LB)	-------	17.3 Lbs
BAROMETRIC PRESS.(Pb)	-------	30.04 in Hg	WET,FUEL MOISTURE %	-------	16.378 %
LEAK RATE POST (Lp)	-------	0.004 cfm	Wt. PART. COLLECTED	-------	0.962 g
WATER VOL. (V1c)	-------	136.4 Ml	METER VOLUME Vm	-------	118.426 mcf
TEST TIME (MIN)	-------	410 min	HC MOLE FRACTION	-------	0.0132

TABLE 3 -----FIELD DATA AVERAGES

CLIENT : Jotul TEST No. 1

MODEL: F55 DATE: 21-Sep-11

****

AVG DELTA H	-------	0.14	in H2O	AVG PRCNT CO	-------	0.94	%
AVG METER TEMP. Tm	-------	86	deg F	AVG PRCNT CO2	-------	5.50	%
AVG PPM SO2	-------	499	PPM	AVG BAL CO2/CO	-------	5.86	%

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul TEST No. 1

MODEL: F55 DATE: 21-Sep-11

****

STD SAMPLE VOL. Vm(std) d) ------	106.60	dscf	STACK GAS FLOW Qsd -------	446.064	dscf/Hr & 7.43 dscf/min
VOL. WATER VAPOR Vw(s td) -----	6.420	scf	PARTICULATE CONCTRT. C s ------	0.0090	g/dscf
PRCNT MSTR Bws -------	5.68	%	PARTC.EMISS. RATE E -------	4.03	g/Hr
BURN RATE BR -------	0.96	Kg/Hr	MOLES OF GAS PER Lb WOOD Nt ----	0.55	Lb-mole/Lb
CO EMISSION RATE -------	139.98 g/Hr & 145.82	g/Kgdry fuel	PART.EMISS. RATE ------	4.19	g/Kgdry fuel

TABLE 5 ---- PROPORTIONAL RATE VARIATION

CLIENT : Jotul TEST No. : 1

MODEL: F55 DATE: 21-Sep-11

TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR	PROPRTN RATE VAR. AVERAGE
5	612.3	97	100
10	624.0	99	
15	627.8	99	
20	628.1	99	
25	627.7	99	
30	628.2	99	
35	628.1	99	
40	627.6	99	
45	628.3	100	
50	627.7	99	
55	627.8	99	
60	627.8	99	
65	627.8	99	
70	627.8	99	
75	627.2	99	
80	628.8	100	
85	628.7	100	
90	629.0	100	
95	673.7	107	
100	628.6	100	
105	630.3	100	
110	630.3	100	
115	630.3	100	
120	630.3	100	
125	630.1	100	
130	630.4	100	
135	629.6	100	
140	631.3	100	
145	631.4	100	
150	631.4	100	
155	631.4	100	
160	631.7	100	
165	631.4	100	
170	631.2	100	
175	631.3	100	
180	631.4	100	

185	632.3	100
190	632.8	100
195	632.3	100
200	632.3	100
205	632.3	100
210	632.8	100
215	632.3	100
220	632.3	100
225	632.7	100
230	632.3	100
235	632.3	100
240	632.7	100
245	632.3	100
250	632.3	100
255	632.3	100
260	632.7	100
265	632.3	100
270	632.3	100
275	632.5	100
280	632.3	100
285	632.3	100
290	632.3	100
295	632.7	100
300	632.3	100
305	632.3	100
310	632.7	100
315	632.3	100
320	632.3	100
325	632.3	100
330	632.8	100
335	632.3	100
340	632.3	100
345	632.8	100
350	632.3	100
355	632.3	100
360	632.8	100
365	632.3	100
370	634.1	100
375	632.2	100
380	632.7	100
385	632.2	100
390	632.7	100
395	632.2	100
400	632.7	100
405	632.2	100
410	632.7	100

COMPUTER INPUT DATA SHEET #1

Client: Jotul North America

Address: 55 Hutcherson
Gorham, ME. 04038

Phone: 1-800-797-5912 Fax: _____

Run No.: 1 Date of Test: 9-21-2011 Burn Rate: .960 4.03

Model No.: F55 ☒ min ☐ min-1.25 ☐ fan

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

Dry Gas Meter Y Factor: .927 (0.000) (Data Sheet #2) Post Leak Rate: .004 cfm (.000) (Data Sheet #2) Time: 410 min. (000) (Data Sheet #2)

Dry Gas Meter Volume: 118.426 cf (00.000) (Data Sheet #2)

Stack Flow: 7,063 dscfm (00.000) (Data Sheet #2) Δ H: .132 in. H_2O (.000) (Data Sheet #2)

Maximum Vac.: 3.0 (0.0) (Data Sheet #2) Barometric Pressure: 30.04 in. Hg (00.00) (Data Sheet #2)

H_2O Captured: 136.4 g (00.0) (Data Sheet #3)

Front Half Catch % Of Total: 42.3 % (00.0) (Data Sheet #6) Total Particulate Catch: .9620 g (0.0000) (Data Sheet #6)

Flue Gas Moisture: 5.6522 % (00.000) (Data Sheet #7)

Particulate Emission: .1385 gr/dscf (0.0000) (Data Sheet #7)

Relative Humidity: 49.0 % RH (00.0) (Data Sheet #8) Ambient Moisture: 1.75 % H_2O (0.00) (Data Sheet #8)

Preburn Fuel Wt.: 49.6 lbs. (00.0) (Data Sheet #8) Coal Bed Wt.: 4.3 lbs. (00.0) (Data sheet #8) Test Fuel Wt.: 17.3 lbs. (00.0) (Data sheet #8)

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

Kindling Fuel % Moisture (wet): 13.068 % (00.000) (Data Sheet #10) Pretest Fuel % Moisture (wet): 16.411 % (00.000) (Data Sheet #10)

Test Fuel % Moisture (dry): 19.586 % (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove]) Test Fuel % Moisture (wet): 16.378 %

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

Stack Static Pressure: -.037 in. H_2O (+/- .000) (Data Sheet #12)

Average Ambient Temperature: 77 °F (00) (Data Sheet #14) Stove Temperature Change: -113.2 °F (+/- 000.0) (Data Sheet #14)

Start = 1010

End = 1700

meter temp = 543

METER BOX DATA SHEET PAGE # 2

Page: 1 of 4

UNIT: Jotul F55 RUN: 1 DATE: 9-21-2011

Meter Box: 5H Y Factor: .1927

Leak checks: 15 " Hg @ .006 cfm _____ " Hg @ _____ cfm

15 " Hg @ .004 cfm _____ " Hg @ _____ cfm

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

ROTO: PRESS: .18			SAMPLING RATIO: 25 : 1				BP: 30.07		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1010	375.000	—	7.688	.15	82	450	82	2.0
5	15	376.500	—	13.838	.50	82	250	82	3.0
10	20	379.254	379.254	6.267	.10	84	550	84	2.0
15	25	380.517	380.517	6.894	.12	84	500	84	2.0
20	30	381.907	381.907	5.995	.09	84	575	84	2.0
25	35	383.115	383.115	5.995	.09	84	575	84	2.0
30	40	384.324	384.324	5.515	.08	84	625	84	2.0
35	45	385.436	385.436	4.596	.06	84	750	84	2.0
40	50	386.362	386.362	4.754	.06	84	725	84	2.0
45	55	387.321	387.321	8.110	.17	84	425	84	2.0
50	1100	388.455	388.455	9.848	.25	84	350	84	2.0
55	05	390.939	390.939	9.848	.25	84	350	84	2.0
ROTO PRESS: .18			TOTALS:	89.348'	1.92'	1004'	BP.: 30.07		
60	1110	392.923	392.923	9.848	.25	84	350	84	2.0
65	15	394.907	394.907	9.192	.22	84	375	84	2.0
70	20	396.759	396.759	9.192	.22	84	375	84	2.0
75	25	398.611	398.611	9.830	.25	85	350	85	2.0
80	30	400.602	400.602	9.175	.22	85	375	85	2.0
85	35	402.460	402.460	9.175	.22	85	375	85	2.0
90	40	404.319	404.319	9.830	.25	85	350	85	2.0
95	45	406.310	406.310	6.881	.12	85	500	85	2.0
100	50	407.705	407.705	6.869	.12	86	500	86	2.0
105	55	409.105	409.105	6.869	.12	86	500	86	2.0
110	1200	410.505	410.505	5.495	.08	86	625	86	2.0
115	05	411.625	411.625	5.283	.07	86	650	86	2.0
			TOTALS:	97.639'	2.14'	1021'	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	186.987'	4.06'	2025'	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 2 of 4

UNIT: Total FSS RUN: 1 DATE: 9-21-2011

Meter Box: 517 Y Factor: 1.927

Leak checks: 15 " Hg @ 1.006 cfm _____ " Hg @ _____ cfm

15 " Hg @ 1.004 cfm _____ " Hg @ _____ cfm

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

ROTO: PRESS: 1.18			SAMPLING RATIO: 25 : 1				BP: 30.07		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1210	412.702	412.702	5.973	.09	86	575	86	2.0
125	15	413.919	413.919	6.244	.10	86	550	86	2.0
130	20	415.192	415.192	6.541	.11	86	525	86	2.0
135	25	416.525	416.525	6.541	.11	87	525	87	2.0
140	30	417.863	417.863	6.856	.12	87	500	87	2.0
145	35	419.268	419.268	6.856	.12	87	500	87	2.0
150	40	420.673	420.673	6.856	.12	87	500	87	2.0
155	45	422.078	422.078	6.233	.10	87	550	87	2.0
160	50	423.356	423.356	5.713	.08	87	600	87	2.0
165	55	424.527	424.527	6.233	.10	87	550	87	2.0
170	1300	425.804	425.804	6.529	.11	87	525	87	2.0
175	05	427.142	427.142	6.856	.12	87	500	87	2.0
ROTO PRESS: 1.18			TOTALS:	77.431	1.28	1041	BP.: 30.02		
180	1310	428.547	428.547	6.845	.12	87	500	87	2.0
185	15	429.954	429.954	6.845	.12	87	500	87	2.0
190	20	431.362	431.362	6.845	.12	87	500	87	2.0
195	25	432.769	432.769	7.205	.13	87	475	87	2.0
200	30	434.250	434.250	6.845	.12	87	500	87	2.0
205	35	435.657	435.657	6.845	.12	87	500	87	2.0
210	40	437.065	437.065	7.205	.13	87	475	87	2.0
215	45	438.546	438.546	7.205	.13	87	475	87	2.0
220	50	440.027	440.027	7.205	.13	87	475	87	2.0
225	55	441.509	441.509	7.205	.13	87	475	87	2.0
230	1400	442.990	442.990	7.205	.13	87	475	87	2.0
235	10	444.471	444.471	7.205	.13	87	475	87	2.0
			TOTALS:	84.660	1.51	1044	MAX VACC =		
TOTAL Cu Ft			TOTALS:	162.091	2.79	2085	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 3 of 4

UNIT: F55 RUN: 1 DATE: 9-21-21

Meter Box: SH Y Factor: 1927

Leak checks: 15 " Hg @ .006 cfm _____ " Hg @ _____ cfm

15 " Hg @ .004 cfm _____ " Hg @ _____ cfm

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

ROTO: PRESS: .18			SAMPLING RATIO: 25 : 1				BP: 30.02		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
240	1410	445.953	445.953	7.205	.13	87	475	87	2.0
245	15	447.434	447.434	7.205	.13	87	475	87	2.0
250	20	448.915	448.915	7.205	.13	87	475	87	2.0
255	25	450.396	450.396	7.205	.13	87	475	87	2.0
260	30	451.878	451.878	7.205	.13	87	475	87	2.0
265	35	453.359	453.359	7.205	.13	87	475	87	2.0
270	40	454.840	454.840	7.205	.13	87	475	87	2.0
275	45	456.322	456.322	7.205	.13	87	475	87	2.0
280	50	457.803	457.803	7.205	.13	87	475	87	2.0
285	55	459.284	459.284	7.205	.13	87	475	87	2.0
290	1500	460.765	460.765	7.205	.13	87	475	87	2.0
295	05	462.247	462.247	7.205	.13	87	475	87	2.0
ROTO PRESS: .18			TOTALS:	86.460	1.56	1044	BP.: 30.02		
300	1510	463.728	463.728	7.205	.13	87	475	87	2.0
305	15	465.209	465.209	7.205	.13	87	475	87	2.0
310	20	466.691	466.691	7.205	.13	87	475	87	2.0
315	25	468.172	468.172	6.845	.12	87	500	87	2.0
320	30	469.579	469.579	6.845	.12	87	500	87	2.0
325	35	470.986	470.986	6.845	.12	87	500	87	2.0
330	40	472.394	472.394	6.845	.12	87	500	87	2.0
335	45	473.801	473.801	6.845	.12	87	500	87	2.0
340	50	475.208	475.208	6.519	.11	87	525	87	2.0
345	55	476.549	476.549	6.519	.11	87	525	87	2.0
350	1600	477.889	477.889	6.519	.11	87	525	87	2.0
355	05	479.229	479.229	6.519	.11	87	525	87	2.0
			TOTALS:	81.916	1.43	1044	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	168.376	2.99	2088	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 4 of 4

UNIT: F-55 RUN: 1 DATE: 9-21-2011

Meter Box: 5H Y Factor: .927

Leak checks: 15 " Hg @ .006 cfm _____ " Hg @ _____ cfm

15 " Hg @ .004 cfm _____ " Hg @ _____ cfm

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

ROTO: PRESS: .18 SAMPLING RATIO: 25 : 1 BP: 30.02

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
360	1610	480.570	480.570	6.519	.11	87	525	87	2.0
365	15	481.910	481.910	6.222	.10	87	550	87	2.0
370	20	483.190	483.190	6.222	.10	87	550	87	2.0
375	25	484.469	484.469	6.222	.10	87	550	87	2.0
380	30	485.749	485.749	6.222	.10	87	550	87	2.0
385	35	487.028	487.028	6.222	.10	87	550	87	2.0
390	40	488.308	488.308	6.222	.10	87	550	87	2.0
* 395	45	489.587	489.587	6.222	.10	87	550	87	2.0
400	50	490.867	490.867	6.222	.10	87	550	87	2.0
405	53	492.146	492.146	6.222	.10	87	550	87	2.0
410	1700	493.426	493.426	6.222	.10	87	550	87	2.0
415									
ROTO PRESS:			TOTALS:	68.739	1.11	957	BP.:		
420									
425									
430									
435									
440									
445									
450									
455									
460									
465									
470						7155			
475				586.193	10.95				
			TOTALS:			83	MAX VACC =		3.0
TOTAL Cu Ft.		118.426	TOTALS:	7.063	.132	543	AVG. BP:		30.04

1.83

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : F55 RUN : 1 DATE : 9-21-11

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	682.8	606.3	488.2	871.6
INITIAL WT	600.0	580.0	483.5	849.0
NET WT GRAMS	82.8	26.3	4.7	22.6

TOTAL CATCH : 136.4 GRAMS H_2O

FRONT HALF

FILTER #	29F	
FINAL WT g	.9227	
INITIAL WT g	.6245	
NET WT g	.2982	

BEAKER #	91
DESC.	ACETONE
FINAL WT g	95.1588
INITIAL WT g	95.0490
NET WT g	.1098
VOL. DESC. ml	75

BACK HALF

FILTER #	29B	
FINAL WT g	.3531	
INITIAL WT g	.3508	
NET WT g	.0023	

BEAKER #	92	93	94	95	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	96.8484	107.9702	106.5125	107.5570	
INITIAL WT g	96.6767	107.8823	106.3610	107.4070	
NET WT g	.1717	.0879	.1515	.1500	(.3015)
VOL. DESC ml	125	75	150	150	300

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 11-4-2010 Time : 1640 By : CP

Manufacturer S & S Grade : # 25 Glass Front Size : 11 cm Lot No. : 3935588

Back Size: 8.2 cm Lot No. : J11441535

	DATE: 10-12-2010	BY: AV	DATE: 11.15.10	BY: AV	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
21F	0.6199	9:45	0.6199	10:30		
22F	0.6268	9:46	0.6267	10:31		
23F	.0.6260	9:47	0.6256	10:32		
24F	0.6229	9:48	0.6228	10:33		
25F	0.6255	9:49	0.6255	10:34		
26F	0.6260	9:50	0.6262	10:35		
27F	0.6230	9:51	0.6230	10:36		
28F	0.6273	9:52	0.6274	10:37		
29F	0.6246	9:53	0.6245	10:38	R-1	
30F	0.6241	9:54	0.6241	10:39		
21B	0.3495	9:55	0.3494	10:40		
22B	0.3499	9:56	0.3499	10:41		
23B	0.3469	9:57	0.3467	10:42		
24B	0.3447	9:58	0.3447	10:43		
25B	0.3524	9:59	0.3522	10:44		
26B	0.3503	10:00	0.3500	10:45		
27B	0.3538	10:01	0.3537	10:46		
28B	0.3501	10:02	0.3502	10:47		
29B	0.3508	10:03	0.3508	10:48	R-1	
30B	0.3487	10:04	0.3488	10:49		

Checked by: CP Date: 11-15-10 Time: 1510

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
11-11-10	0840	CP		67	42
11-15-10	0930	CP		70	48

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 11-15-2010 Time : 1000 By : CP

	DATE: 11-19-10	BY: AV	DATE: 11-23-10	BY: CP	DATE: 11-24	BY: CP
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
76	103,8023	11:20	03.7990	1415	103.7992	1420
77	107,3857	11:21	07.3828	1416	107.3833	1421
78	94,4935	11:22	94.4900	1417	94.4904	1422
79	97,6174	11:23	97.6115	1418	97.6120	1423
80	109,1245	11:24	09.1200	1419	109.1205	1424
81	101,4640	11:25	01.4600	1420	101.4605	1425
82	97,4742	11:26	97.4706	1421	97.4710	1426
83	98,3270	11:27	98.3231	1422	98.3235	1427
84	105,5520	11:28	05.5478	1423	105.5482	1428
85	97,9928	11:29	97.9880	1424	97.9885	1429
86	104,7445	11:30	04.7406	1425	104.7410	1430
87	105,9180	11:31	05.9158	1426	105,9163	1431
88	100,0025	11:32	00.0001	1427	100.0005	1432
89	120,6722	11:33	120.6683	1428	120.6688	1433
90	106,4045	11:34	06.4017	1429	106.4021	1434
91	95,0515	11:35	95.0485	1430	95.0490	1435
92	96,6781	11:36	96.6763	1431	96.6767	1436
93	107,8838	11:37	07.8818	1432	107.8823	1437
94	106,3634	11:38	06.3605	1433	106.3610	1438
95	107,4089	11:39	07.4065	1434	107.4070	1439
96	103,9833	11:40	03.9802	1435	103.0207	1440
97	99,9850	11:41	99.9816	1436	99.9820	1441
98	105,0246	11:42	05.0219	1437	105.0224	1442
99	104,9354	11:43	04.9319	1438	104.9323	1443
100	106,7415	11:44	06.7393	1439	106.7398	1444

R-1

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
11-19	0930	CW	-	65	18
11-23	1400	CW	-	66	19
11-24	1400	CW	-	65	16

Checked by : CP
Date : 11-15-2010
Time : 1515

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : F55 RUN : 1 DATE : 9-21-11 Page : 1 of 1

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
91	9-22	1500	CJ	95.1556	9-23	1207	CJ	95.1553	9-25	1307	CJ				
92	9-22	1500	CJ	96.8484	9-23	1208	CJ	96.8484	9-25	1308	CJ				
93	9-22	1500	CJ	107.9701	9-23	1209	CJ	107.9702	9-25	1309	CJ				
94	9-22	1500	CJ	106.5120	9-23	1210	CJ	106.5125	9-25	1310	CJ				
95	9-22	1500	CJ	107.5566	9-23	1211	CJ	107.5570	9-25	1312	CJ				

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
29F	9-21	1800	CJ	.9256	9-22	1705	CJ	.9227	9-24	1205	CJ	.9227	9-25	1305	CJ
29B	9-21	1800	CJ	.3532	9-22	1706	CJ	.3531	9-24	1206	CJ				

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	9-22-11	1700	CJ	77	46
2	9-24-11	1200	CJ	77	49
3	9-25-11	1300	CJ	76	49
4			CJ		
5			CJ		

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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 4-13-2011 Through	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0000	10.0001	1.0000	.0998	CP	4-13-11	1030	66	49
100.0001	10.0002	1.0000	.0999	CP	4-15-11	1330	75	48
100.0004	10.0000	.9999	.0998	CP	4-19-11	1600	74	44
100.0003	10.0000	1.0000	.0999	CP	4-20-11	1815	72	46
100.0000	10.0001	.9999	.1000	CP	6-16-11	0900	76	39
99.9997	9.9999	.9998	.0999	CP	6-18-11	1530	74	44
99.9996	10.0002	1.0000	.0999	CP	6-20-11	1600	73	47
100.0000	10.0000	.9998	.0999	CP	6-21-11	1400	73	47
100.0000	10.0000	1.0001	.0999	CP	6-22-11	1200	72	46
99.9999	9.9998	1.0000	.1000	CP	6-23-11	1700	76	49
100.0000	10.0002	1.0000	.0999	CP	6-24-11	1400	75	48
100.0000	10.0000	1.0000	.0999	CP	6-27-11	1230	78	46
100.0001	10.0002	.9999	.0998	CP	6-30-11	1030	78	46
99.9995	10.0000	.9999	.0999	CP	7-1-11	1030	70	48
99.9999	9.9999	1.0000	.1000	CP	7-2-11	1145	75	45
100.0000	9.9999	.9999	.0999	CP	7-5-11	1000	73	47
99.9999	10.0001	1.0000	.0999	CP	7-6-11	0930	76	49
100.0000	9.9997	1.0000	.0997	CP	9-22-11	1700	77	46
100.0000	10.0001	1.0000	.0999	CP	9-24-11	1700	77	49
100.0000	9.9998	1.0001	.1000	CP	9-25-11	1300	76	49
100.0000	9.9999	1.0001	.0998	CP	9-27-11	1000	77	49
99.9996	9.9999	1.0000	.0998	CP	9-29-11	0840	72	42
99.9997	9.9998	.9999	.1000	CP	9-30-11	1000	70	48
99.9996	9.9998	1.0000	.0999	CP	10-1-11	1520	70	45
99.9998	10.0002	1.0000	.0997	CP	10-2-11	1430	74	47

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 11-11-10 Through 4-7-11	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0000	10.0002	1.0000	.0998	CP	11-11	0840	67	42
100.0000	10.0000	1.0001	.1000	CP	11-15	0930	70	48
100.0000	10.0001	1.0000	.0999	CP	11-19	0930	65	48
100.0000	10.0000	1.0000	.1000	CP	11-23	1400	66	45
100.0000	9.9997	1.0000	.0998	CP	11-24	1400	65	48
100.0000	10.0000	.9999	.0998	CP	11-26	1100	67	46
100.0000	10.0001	1.0001	.0997	CP	12-14	1000	75	41
100.0001	10.0003	1.0000	.0999	CP	12-16	1100	75	48
100.0000	10.0002	1.0000	.0999	CP	12-18	1000	77	46
100.0000	10.0000	1.0000	.0999	CP	12-21	1100	66	49
100.0000	10.0004	1.0000	.0997	CP	12-22	1400	72	48
100.0000	10.0001	1.0000	.1001	CP	12-23	1100	76	38
100.0000	10.0000	.9999	.0999	CP	12-24	1000	67	46
100.0000	10.0001	1.0001	.0999	CP	12-25	1100	70	49
100.0000	10.0000	1.0000	.0999	CP	1-19-11	0930	66	49
100.0000	9.9999	1.0000	.0999	CP	1-21-11	1400	77	44
99.9996	10.0000	1.0000	.0998	CP	1-25-11	0900	75	48
100.0000	10.0002	1.0001	.1000	CP	1-26-11	1400	74	44
100.0000	10.0001	.9998	.0998	CP	1-27-11	1200	65	48
100.0000	10.0002	1.0000	.0999	CP	1-28-11	1630	70	48
100.0000	10.0001	1.0001	.0999	CP	1-29-11	1200	68	48
100.0000	10.0002	1.0000	.0999	CP	1-30-11	1500	66	49
100.0000	9.9999	1.0000	.0999	CP	2-15-11	0930	75	41
100.0000	10.0000	1.0001	.1000	CP	2-16-11	0930	66	49
100.0000	10.0002	1.0000	.0999	CP	2-22-11	1000	70	48
100.0000	10.0001	1.0002	.0999	CP	3-4-11	1200	69	47
100.0000	10.0004	.9999	.1000	CP	3-5-11	1000	70	48
100.0000	10.0001	1.0000	.0999	CP	3-8-11	1000	74	47
100.0000	10.0000	1.0000	.1000	CP	3-9-11	1600	67	46
100.0000	10.0002	0.9999	.0999	CP	3-10-11	1600	66	49
100.0000	10.0000	1.0000	.0999	CP	3-12-11	1530	73	47
100.0000	10.0001	.9999	.0998	CP	3-13-11	1200	65	48
100.0000	10.0001	1.0000	.0999	CP	3-29-11	1120	76	49
100.0000	10.0000	.9999	.0998	CP	3-30-11	0800	74	47
100.0000	10.0001	1.0000	.0999	CP	3-31-11	1080	70	48
100.0000	10.0002	.9998	.0999	CP	4-4-11	0830	74	47
100.0000	10.0003	1.0000	.1000	CP	4-5-11	1130	73	47
100.0000	9.9999	1.0001	.0999	CP	4-6-11	1030	77	49
100.0000	10.0000	9.9999	.1001	CP	4-7-11	1000	78	40

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 2-26-2010 Through 11-10-2010	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0001	10.0004	.9999	.0999	CP	2-26	0840	72	46
100.0001	9.9999	.9999	.0999	CP	2-27-10	1045	72	46
100.0000	10.0000	1.0000	.0999	CP	2-28	1100	70	48
100.0000	10.0000	1.0000	.0999	CP	3-1	0900	66	49
100.0000	10.0002	.9998	.1002	CP	3-5	1200	70	48
100.0001	9.9999	.9999	.0998	CP	3-7	1330	68	47
100.0000	9.9999	.9999	.0999	CP	3-9	1130	70	41
100.0000	10.0001	1.0000	.0999	CP	3-10	1200	70	44
100.0000	10.0001	.9999	.0999	CP	3-11	0900	66	49
99.9999	9.9999	.9999	.0999	AV	3-15	1000	70	48
100.0000	10.0000	1.0000	.0998	CP	3-17	0900	72	46
100.0000	9.9998	1.0001	.1000	CP	4-8	1930	76	49
99.9999	10.0001	1.0000	.0999	CP	4-10	1630	73	47
99.9999	10.0001	1.0001	.1000	CP	4-11	1430	74	47
100.0000	10.0002	1.0000	.1000	CP	4-21	1830	77	49
100.0000	10.0000	1.0000	.0999	CP	4-22	1130	74	47
100.0000	10.0001	1.0000	.0999	CP	4-23	1015	74	44
100.0002	9.9999	1.0000	.1000	CP	4-24	0930	68	47
100.0000	9.9999	.9999	.1000	CP	4-25	0930	73	47
100.0000	9.9999	1.0001	.0999	CP	4-26	0900	76	42
100.0000	10.0002	1.0000	.0999	CP	4-30	1320	78	43
99.9998	10.0000	1.0002	.0999	CP	8-26	0845	78	49
100.0000	9.9998	1.0001	.0999	CP	8-27	0955	78	43
100.0000	10.0000	1.0000	.1000	CP	8-28	1600	73	47
99.9998	10.0000	.9999	.1000	CP	8-29	1400	70	48
100.0000	10.0000	1.0000	.0999	CP	8-31	0720	72	46
100.0001	10.0000	1.0000	.1000	CP	9-1	1330	76	49
100.0000	10.0001	1.0000	.0999	CP	9-2	1300	68	47
100.0000	10.0000	1.0000	.1000	CP	9-3	1130	72	46
100.0000	10.0001	1.0000	.0999	CP	10-26	0750	70	48
100.0000	10.0000	.9998	.0997	CP	10-27	1250	74	47
100.0000	9.9999	1.0000	.0999	CP	10-29	1400	71	49
100.0000	9.9999	1.0000	.0999	CP	11-1	1000	78	49
100.0000	10.0000	.9999	.0999	CP	11-2	0715	70	48
100.0000	10.0000	1.0000	.0999	CP	11-3	0900	70	48
100.0000	10.0001	.9999	.1000	CP	11-5	1320	76	42
100.0000	10.0001	.9999	.1000	CP	11-8	1230	70	48
100.0000	10.0001	1.0000	.0998	CP	11-9	1015	71	41
100.0000	10.0000	.9999	.0999	CP	11-10	0900	70	44

BLANK PROCESSING DATA SHEET # 5

UNIT : F55 RUN : 1 DATE : 9-21-11

BLANKS DONE : 8-31-2010

BEAKER	A	B	C
	200 ml ACETONE	75 ml DICHLOR	200 ml WATER
	FISHER OPTIMA LOT # 023283	FISHER OPTIMA LOT # 063910	DWNA, Inc Sparkletts Distilled
FINAL WEIGHT	108.9019	106.3074	106.9680
TARE WEIGHT	108.9001	106.3058	106.9640
NET WEIGHT	.0018	.0016	.0040

TARE BEAKERS INTO DESC : TIME : 1410 DATE : 8-7-2010

DATE 8-26 BY : CP DATE 8-27 BY : CP DATE : BY :

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.8999	0435	108.9001	1050		
B	106.3061	0436	106.3058	1051		
C	106.9641	0437	106.9640	1052		

FINAL BEAKERS INTO DESC : TIME : 8-28 DATE : 0820

DATE 8-29 BY : CP DATE 8-31 BY : CP DATE : BY :

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9019	1501	108.9019	0742		
B	106.3076	1502	106.3074	0743		
C	106.9676	1503	106.9680	0744		

TARE QC

DATE	TIME	BY	WB	DB	%
8-26-11	0845	CP		78	49
8-27-11	0955	CP		78	43

FINAL QC

DATE	TIME	BY	WB	DB	%
8-29	1400	CP		70	48
8-31	0720	CP		72	46

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT : F55 RUN : 1 DATE : 9-21-11

BLANK CALCULATIONS

Acetone :	.0018	g ÷	200	ml =	.000009	g/ml
Dicholoromethane :	.0016	g ÷	75	ml =	.000021	g/ml
Distilled Water :	.0040	g ÷	200	ml =	.000020	g/ml

FRONT HALF CATCH

FILTERS : .2982 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .2982 g

BEAKERS : .1098 (Total Catch) g - 75 (ml Acetone) (.0007 .000009 g) (Blank Value / ml Acetone) = .1091 g

TOTAL FRONT HALF CATCH : .4073 g

BACK HALF CATCH

FILTERS : .0023 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0023 g

BEAKERS :

Acetone : .1717 (Total Catch) g - 125 (ml Acetone) (.0011 .000009 g) (Blank Value / ml Acetone) = .1706 g

Extract : .0879 (Total Catch) g - 75 (ml Dichloromethane) (.0016 .000021 g) (Blank Value / Dichloromethane) = .0863 g

Water : .3015 (Total Catch) g - 300 (ml Water) (.0010 .000020 g) (Blank Value / Water) = .2955 g

TOTAL BACK HALF CATCH : .5547 g

TOTAL CATCH : .9620 g

% FRONT HALF : 42.3 %

CALCULATIONS DATA SHEET # 7

UNIT: Jotul F55 RUN: 1 DATE: 9-21-2011

1) $Vm(std) = \dfrac{(118.426\ Vm)(17.64)(.927\ mcf)\left(30.04\ "Hg + \frac{1.132\ "H_2O}{13.6}\right)}{(543\ TmA)} = \dfrac{107.1682}{000.0000}$ dscf

2) $Vw(std) = (.04707)(136.4\ ml\ H_2O) = \dfrac{6.4203}{00.0000}$ scf

3) $Asw = \dfrac{(6.4203\ scf)}{(6.4203\ scf + 107.1682\ dscf)} = \dfrac{.0565}{.0000}$ Bws × 100 = $\dfrac{5.6522}{00.0000}$ % H_2O

4) $Cs = \dfrac{(.9620\ g.)}{(107.1682\ dscf)}(15.43) = \dfrac{.1385}{0.0000}$ gr / dscf

5) Estimated g / hr = $\dfrac{(.9620\ g.)}{(107.1682\ dscf)}\left(\dfrac{7.063}{00.0000}\ dscfm\right)(60) = \dfrac{3.8041}{00.0000}$ 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: Total FSS RUN: 1 DATE: 9-21-2011

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

Wet Bulb / Dry Bulb

Pre : WB: 64 DB: 75 = 50.0 % RH 1.6 % H_2O

Post : WB: 70 DB: 84 = 48.0 % RH 1.9 % H_2O

Average: 49.0 % RH 1.75 % H_2O

Empty Stove Weight (lbs): N/A w/ stack & oil seal : Wet: N/A Dry: 496.7

Kindling Weight (lbs): Paper: .1 Wood: 1.1

Preburn Fuel Weight: 25.9 + 20.0 + 2.6 Total: 48.5

Kindling & Preburn Fuel Weight (wood only) (lbs): **Total**: 49.6

Coal Bed Wt Range (lbs): 4.3 - 3.5 **Scale**: 501.0 - 500.2

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

Lower : .20 x fuel weight : Always round UP to nearest tenth **Actual Coal Bed Weight**: 4.3

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

Test Fuel (.75" x 1.5" x 5" spacers) = 24 pcs

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" x 4"	16	5	10.2	59.0
4" x 4"	16	2	7.1	41.0

Test Fuel Weight: 17.3 lbs

Estimated Dry Burn Rate:

$$\frac{173 - (17.3 \times 1.16378)}{2.2046} \times \frac{60}{\frac{410}{\text{TIME}}} = .960 \text{ kg / hr}$$

Estimated BTU's/hr: 19,140 x $\frac{63}{100}$ x $\frac{.960}{\text{DBR}}$ = 11575.9 BTU's/hr

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

WOOD STOVE OPERATING DATA PAGE #9

Unit : Total F55 Run : 1 Date : 9-21-2011

FIRE STARTED: 0610

WARM UP AND PREBURN:

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

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

CHARCOAL BED PREPARATION :

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

TEST:

DOOR wide open during loading 0 min. 45 sec.

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

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 12 or 16 inches.

1st warm up / pre-burn fuel charge (25.9 lbs.) added at 0615

2nd warm up / pre-burn fuel charge (20.0 lbs.) added at 0748

3rd warm up / pre-burn fuel charge (2.6 lbs.) added at 0905

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 F55 Run : 1 Date : 9-21-2011

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

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

Time Test Fuel moisture reading taken : 0830

pc #	Dimen.	Use	TOP	BOTTOM	SIDE	Avg Corrected
1	2"×4"×8'	K	15.1	15.0	15.0	15.033
2						
3						
4	2"×4"×8'	P	18.6	19.1	19.1	18.9
5	2"×4"×8'	P	20.9	22.2	22.6	21.9
6	2"×4"×8'	P	17.7	18.5	18.1	18.1
7	2"×4"×8'	P				58.9
8	2"×4"×8'	P				
9						
10						
11						
12	2x4x16"	T	17.9	17.9	18.0	17.9
13	"	T	18.1	18.2	18.2	18.2
14	"	T	17.9	18.0	18.2	18.0
med 15	"	T	21.3	21.3	22.0	21.5
wet 16	"	T	23.4	23.4	24.1	23.6
DRY 17	4x4x16"	T	19.3	19.5	19.8	19.5
DRY 18	"	T	18.1	18.3	19.0	18.4
19						137.1
20	Spacers	T	17.9	18.1	18.2	18.0

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	15.033 %	19.633 %	19.586 %
Wet Moisture % :	13.068 %	16.411 %	16.378 %

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

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

GAS DATA SHEET #12

WEIGHT: 501.0 DATE: 9-21-2011

UNIT: Jotol F55 RUN: 1 PAGE: 1 OF 3

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
0 1010	518.3	17.3	—	.162	4.1	.639	16.0	.067	.69	.038	450
5 15	517.6	16.6	.7	.440	11.0	.368	9.2	.056	.58	.052	250
10 20	517.4	16.4	.2	.106	2.7	.703	17.6	.040	.42	.042	550
15 25	517.1	16.1	.3	.112	2.8	.699	17.5	.046	.48	.040	500
20 30	516.7	15.7	.4	.106	2.7	.691	17.3	.075	.77	.038	575
25 35	516.3	15.3	.4	.173	4.4	.619	15.5	.080	.82	.040	575
Fan? 30 40	515.9	14.9	.4	.163	4.1	.627	15.7	.097	.99	.040	625
35 45	515.3	14.3	.6	.170	4.3	.599	15.0	.140	1.42	.038	750
40 50	514.7	13.7	.6	.257	6.4	.540	13.5	.080	.82	.048	725
45 55	513.9	12.9	.8	.498	12.4	.329	8.2	.018	.20	.054	475
50 1100	513.1	12.1	.8	.445	11.1	.380	9.5	.010	.12	.055	350
55 05	512.3	11.3	.8	.514	12.8	.309	7.7	.019	.21	.058	350
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.543"	*****
60 10	511.4	10.4	.9	.495	12.4	.329	8.2	.011	.13	.060	350
65 15	510.7	9.7	.7	.512	12.8	.313	7.8	.017	.19	.062	.375
70 20	509.9	8.9	.8	.542	13.5	.281	7.0	.024	.26	.061	.375
75 25	509.2	8.2	.7	.502	12.5	.325	8.1	.016	.18	.060	.350
80 30	508.6	7.6	.6	.424	10.6	.404	10.1	.008	.10	.056	.375
85 35	508.0	7.0	.6	.410	10.2	.408	10.2	.030	.32	.055	.375
90 40	507.5	6.5	.5	.400	10.0	.424	10.6	.016	.18	.055	.375
95 45	507.1	6.1	.4	.312	7.8	.488	12.2	.074	.76	.051	.500
100 50	506.8	5.8	.3	.270	6.8	.532	13.3	.063	.65	.050	.500
105 55	506.5	5.5	.3	.191	4.8	.583	14.6	.135	1.37	.048	.500
110 1200	506.2	5.2	.3	.234	5.9	.540	13.5	.134	1.36	.045	.625
115 05	506.0	5.0	.2	.215	5.4	.528	13.2	.212	2.14	.044	.650
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.647"	*****
120 10	505.9	4.9	.1	.223	5.6	.528	13.2	191	1.93	0.43	575
125 15	505.7	4.7	.2	.222	5.6	.536	13.4	.170	1.72	.043	550
130 20	505.5	4.5	.2	.220	5.5	.548	13.7	.156	1.58	.042	525
135 25	505.4	4.4	.1	.222	5.6	.544	13.6	.153	1.55	.040	525
140 30	505.3	4.3	.1	.225	5.7	.540	13.5	.152	1.54	.038	500
145 35	505.2	4.2	.1	.224	5.6	.544	13.6	.152	1.54	.038	500
150 40	505.0	4.0	.2	.218	5.5	.552	13.8	.148	1.50	.038	500
155 45	504.8	3.8	.2	.227	5.7	.540	13.5	.157	1.59	.037	550
160 50	504.6	3.6	.2	2.14	5.4	.552	13.8	.153	1.55	.038	600
165 55	504.4	3.4	.2	.213	5.4	.560	14.0	.136	1.38	.038	550
170 1300	504.3	3.3	.1	.211	5.3	.567	14.2	.128	1.30	.037	525
175 05	504.2	3.2	.1	.212	5.3	.567	14.2	.124	1.26	.036	500
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.468"	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	1.658"	*****

GAS DATA SHEET #12

WEIGHT: 501.0 DATE: 9-21-2011

UNIT: Total F55 RUN: 1 PAGE: 2 OF 3

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
180 10	504.1	3.1	.1	.212	5.3	.567	14.2	.121	1.23	.036	.500
185 15	504.0	3.0	.1	.211	5.3	.563	14.1	.134	1.36	.035	.500
190 20	503.9	2.9	.1	.213	5.4	.560	14.0	.129	1.31	.035	.500
195 25	503.8	2.8	.1	.214	5.4	.563	14.1	.122	1.24	.035	.475
200 30	503.7	2.7	.1	.214	5.4	.567	14.2	.117	1.19	.035	.500
205 35	503.6	2.6	.1	.214	5.4	.567	14.2	.115	1.17	.035	.500
210 40	503.5	2.5	.1	.209	5.3	.571	14.3	.116	1.18	.035	.475
215 45	503.4	2.4	.1	.206	5.2	.575	14.4	.112	1.14	.035	475
220 50	503.3	2.3	.1	.204	5.1	.579	14.5	.113	1.15	.035	.475
225 55	503.3	2.3	.0	.195	4.9	.587	14.7	.112	1.14	.035	.475
230 1400	503.2	2.2	.1	.184	4.6	.603	15.1	.101	1.03	.035	.475
235 05	503.1	2.1	.1	.180	4.5	.611	15.3	.095	.97	.035	.475
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.4217	*****
240 10	503.0	2.0	.1	.180	4.5	.611	15.3	.096	.98	.035	.475
245 15	502.9	1.9	.1	.179	4.5	.611	15.3	.092	.94	.035	.475
250 20	502.9	1.9	.0	.177	4.5	.611	15.3	.090	.92	.034	.475
255 25	502.8	1.8	.1	.172	4.3	.619	15.5	.090	.92	.034	.475
260 30	502.8	1.8	.0	.171	4.3	.619	15.5	.089	.91	.033	.475
265 35	502.7	1.7	.1	.170	4.3	.623	15.6	.087	.89	.033	.475
270 40	502.6	1.6	.1	.168	4.2	.627	15.7	.085	.87	.032	.475
275 45	502.6	1.6	.0	.169	4.3	.623	15.6	.088	.90	.032	.475
280 50	502.5	1.5	.1	.171	4.3	.623	15.6	.087	.89	.032	.475
285 55	502.4	1.4	.1	.169	4.3	.623	15.6	.085	.87	.031	.475
290 1500	502.4	1.4	.0	.166	4.2	.627	15.7	.084	.86	.030	.475
295 05	502.3	1.3	.1	.166	4.2	.627	15.7	.086	.88	.030	.475
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.3917	*****
300 10	502.2	1.2	.1	.165	4.2	.627	15.7	.087	.89	.030	.475
305 15	502.2	1.2	.0	.160	4.0	.635	15.9	.083	.85	.030	.475
310 20	502.1	1.1	.1	.158	4.0	.635	15.9	.082	.84	.030	.475
315 25	502.1	1.1	.0	.151	3.8	.643	16.1	.080	.82	.030	.475
320 30	502.0	1.0	.1	.152	3.8	.643	16.1	.080	.82	.030	.500
325 35	502.0	1.0	.0	.154	3.9	.639	16.0	.080	.82	.030	.500
330 40	501.9	.9	.1	.154	3.9	.639	16.0	.081	.83	.030	.500
335 45	501.9	.9	.0	.153	3.9	.639	16.0	.081	.83	.030	.500
340 50	501.8	.8	.1	.153	3.9	.639	16.0	.082	.84	.030	.500
345 55	501.8	.8	.0	.146	3.7	.647	16.2	.085	.87	.030	.525
350 1600	501.7	.7	.1	.144	3.6	.651	16.3	.080	.82	.030	.525
355 05	501.6	.6	.1	.141	3.6	.655	16.4	.076	.78	.030	.525
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.3607	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	1.1727	*****

GAS DATA SHEET #12

WEIGHT: 501.0 DATE: 9-21-2011

UNIT: Total F 55 RUN: 1 PAGE: 3 OF 3

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
3 10	501.6	.6	.0	.138	3.5	.659	16.5	.073	.75	.030	5.25
3 15	501.5	.5	.1	.140	3.6	.655	16.4	.078	.86	-.027	550
3 20	501.4	.4	.1	.139	3.6	.654	16.4	.077	.79	-.025	550
3 25	501.4	.4	0	.139	3.6	.654	16.4	.077	.79	-.023	550
3 30	501.3	.3	.1	.135	3.5	.657	16.5	.073	.75	-.023	550
3 35	501.3	.3	0	.134	3.5	.656	16.5	.073	.75	-.023	550
3 40	501.2	.2	.1	.136	3.5	.653	16.3	.094	.96	-.024	550
3 45	501.2	.2	0	.136	3.5	.654	16.3	.093	.95	-.024	550
3 50	501.1	.1	.1	.136	3.5	.654	16.3	.093	.95	-.024	550
3 55	501.1	.1	0	.130	3.3	.644	16.6	.085	.87	-.024	550
4 1700	501.0	0	.1	.131	3.3	.644	16.6	.085	.87	-.024	550
4 05											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.271	*****
420											
425											
430											
435											
440											
445											
450											
455											
460											
465											
470											
475											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****		*****
480											
485											
490											
495											
500											
505											
510											
515											
520											
525											
530										-3,101	
535											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****		*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.037	*****

1/183

PREBURN DATA SHEET #13

UNIT: Jotul F55 RUN: 1 DATE: 9-21-2011 PAGE: 1 of 1

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	~~Inlet FIREBOX~~	~~baffle CEC/OAT~~	AMBIENT	STATIC	COMMENTS
0 0905	503.4	—	307	459	477	531	586	452	604	789	74	:055	PREBURN START: # 2 1/4 UP
5 10	503.2	.2	247	436	458	493	569	452	558	740	73	:054	COAL BED SCALE RANGE:
10 15	503.0	.2	217	414	435	463	546	454	517	676	73	:050	501.0 → 500.2
15 20	502.8	.2	199	389	413	444	524	447	487	630	73	:048	PRIMARY AIR: MIN
20 25	502.5	.3	197	368	392	427	502	438	462	602	72	:048	SECONDARY AIR: N/A
25 30	502.2	.3	190	354	365	398	470	422	436	587	72	:047	FAN: LOW
30 35	502.0	.2	189	350	358	393	464	417	432	602	73	:046	PUMPS ON AT: 0935
35 40	501.6	.4	192	350	347	383	455	407	427	632	73	:048	CHECK WB/DB: N/A
40 45	501.4	.2	189	349	344	378	449	398	425	615	72	:046	
45 50	501.2	.2	180	334	336	373	441	388	419	589	73	:044	
50 55	501.1	.1	170	318	325	369	427	380	407	550	73	:042	
55 1000	501.1	.0	164	304	321	363	416	369	397	529	72	:040	
*****	****	***	****	*****	*****	****	*****	*****	*****	*****	*****	****	
60 05	501.0	.1	159	290	311	357	404	366	388	511	72	:038	
65 10	501.0	.0	163	276	306	358	395	359	383	500	72	:038	338
20 15													
/													
/													
/													
/													
/													
/													
/													
/													
/													
/													

at 500.8 add 3 blocks (2.6 lbs)

Jotul F55

Temperature Data Sheet 14

Run 1
9/21/11

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	163	276	306	358	395	359	383	500	74	1401	230	61	233	37	34
5	225	287	294	341	380	357	347	543	73	1383	231	46	234	37	34
10	181	270	281	338	362	353	334	450	72	1366	232	44	235	37	34
15	165	257	269	328	345	347	320	418	72	1351	233	42	236	38	35
20	156	245	259	320	328	339	309	396	72	1336	235	42	237	38	35
25	157	238	248	313	315	331	300	406	72	1322	236	43	239	38	35
30	153	230	241	307	305	324	294	397	72	1308	237	44	240	38	35
35	154	228	235	299	297	318	295	418	72	1297	238	45	241	38	36
40	162	232	230	290	291	311	290	449	72	1288	239	46	242	38	36
45	203	283	230	279	295	303	285	501	72	1277	243	46	243	38	36
50	218	324	237	273	308	292	286	547	73	1272	246	47	244	37	37
55	234	361	242	268	320	284	289	598	72	1269	248	47	245	38	37
60	242	388	251	262	335	277	295	643	73	1269	245	47	246	38	37
65	245	408	261	257	348	273	300	689	73	1269	244	48	246	38	36
70	247	423	271	253	363	268	306	738	73	1271	245	48	247	38	37
75	246	442	282	249	378	263	311	759	74	1273	246	48	246	39	37
80	239	439	290	247	390	261	316	749	74	1276	246	49	245	39	38
85	236	421	296	247	398	255	321	686	76	1280	247	49	243	39	38
90	229	425	299	247	404	252	325	717	75	1282	248	49	241	39	38
95	217	413	303	249	409	248	332	675	75	1283	247	50	241	39	38
100	210	396	306	250	409	247	337	670	75	1286	248	50	239	39	38
105	194	375	305	253	408	250	337	597	77	1289	247	50	239	39	38
110	192	357	301	259	406	252	337	594	79	1291	247	50	239	38	37
115	185	341	299	263	407	255	335	568	79	1293	247	51	239	38	37
120	182	327	297	267	409	257	334	559	80	1294	248	51	237	38	37
125	177	316	296	272	411	261	336	550	81	1295	248	51	237	38	37
130	172	305	297	274	412	264	335	536	82	1296	247	51	238	38	37
135	168	296	296	276	412	268	336	529	82	1297	248	52	237	38	36
140	166	288	294	276	411	264	333	520	78	1299	248	52	238	38	37
145	162	280	293	275	409	266	330	517	77	1299	247	52	234	38	37
150	159	273	291	276	407	266	327	509	77	1300	247	56	232	38	37
155	159	268	289	277	404	271	324	511	77	1300	246	53	233	38	37
160	156	263	288	277	401	272	322	505	77	1301	247	54	232	38	37
165	154	260	287	278	399	273	321	500	77	1301	246	54	233	38	36
170	153	255	286	278	396	274	320	495	77	1301	245	55	233	38	36

175	151	251	284	279	393	277	321	494	77	1301	246	55	235	37	36
180	151	248	282	280	390	280	320	491	77	1302	247	55	235	38	36
185	151	245	282	282	388	281	320	490	77	1302	247	56	235	37	36
190	150	243	280	283	385	282	320	489	77	1302	247	57	235	37	36
195	150	239	279	285	382	282	320	488	77	1302	247	58	235	37	36
200	149	237	277	286	378	284	321	487	77	1302	246	45	235	37	36
205	148	236	277	287	376	287	320	486	78	1301	246	45	235	37	35
210	148	235	276	288	373	287	320	483	77	1301	246	45	235	37	35
215	147	234	275	289	371	289	319	479	78	1300	247	45	235	37	35
220	147	231	275	289	369	289	319	477	78	1299	247	45	234	37	35
225	146	230	273	288	366	291	319	473	78	1298	247	45	234	37	35
230	145	228	272	288	362	292	318	467	78	1298	246	45	234	37	35
235	144	225	269	287	360	289	316	460	78	1298	246	46	234	36	35
240	143	223	267	287	355	292	315	456	78	1299	246	46	234	36	34
245	143	221	265	286	351	291	314	453	78	1299	247	47	235	36	34
250	142	219	261	287	348	289	313	449	78	1301	247	49	234	36	34
255	141	218	259	286	344	288	312	444	78	1303	247	49	234	36	34
260	140	216	257	285	341	287	310	439	78	1304	246	50	234	36	34
265	140	214	255	284	337	285	309	434	78	1305	247	50	234	36	34
270	139	212	252	283	334	284	308	429	78	1305	247	50	234	36	34
275	139	210	250	282	330	282	306	427	78	1305	247	50	234	36	34
280	138	209	249	282	327	282	306	426	78	1306	247	51	234	36	33
285	138	206	248	282	324	279	305	423	78	1305	247	51	232	36	33
290	137	205	245	281	322	277	304	421	78	1306	247	51	233	36	33
295	136	204	244	281	319	275	304	419	78	1306	247	51	232	35	33
300	136	202	243	280	316	274	303	416	78	1306	247	51	232	35	33
305	136	201	242	279	314	273	302	413	78	1307	247	51	231	35	33
310	135	200	239	278	311	271	301	411	78	1308	247	51	232	35	33
315	135	200	237	278	309	268	300	407	78	1308	246	52	232	35	33
320	134	198	235	278	305	268	300	404	78	1308	246	52	232	35	32
325	134	196	233	278	303	266	299	401	78	1308	246	52	233	35	32
330	134	195	232	276	300	265	299	399	78	1309	247	52	233	35	32
335	134	194	230	277	297	263	299	397	78	1309	247	52	234	35	32
340	134	192	228	277	295	260	299	394	78	1310	247	53	233	35	32
345	133	191	226	278	292	259	299	390	78	1309	247	53	234	35	32
350	132	190	224	279	289	257	299	387	79	1309	248	54	234	35	32
355	132	188	223	278	285	256	297	385	78	1311	248	53	233	34	32

360	131	188	221	276	283	252	295	381	78	1311	248	53	233	34	32
365	131	186	221	275	279	253	295	378	80	1312	248	52	234	34	31
370	131	185	219	275	276	252	293	374	80	1312	248	52	236	34	31
375	132	184	218	272	273	251	291	370	80	1312	248	53	236	34	31
380	132	183	216	271	271	249	290	367	81	1313	248	53	237	34	31
385	132	182	215	269	268	248	287	364	81	1313	248	53	236	34	31
390	131	180	217	263	265	239	283	359	80	1313	248	53	237	34	31
395	130	179	217	262	262	238	280	357	80	1313	248	54	234	34	31
400	129	178	215	260	260	236	278	354	80	1314	248	53	234	33	31
405	128	177	212	257	258	235	276	351	80	1314	248	58	234	33	31
410	127	176	213	254	254	231	273	348	80	1313	248	70	234	33	31

TEMPERATURE DATA SHEET #14A

		TEST TIME	410		
STACK AVG	**160**	TOP AVG	**255**	LT SIDE AVG	**260**
BACK AVG	**279**	RT SIDE AVG	**344**	BOTTOM AVG	**276**
FIREBOX AVG	**311**	SEC/CAT AVG	**479**	AMBIENT AVG	**77**

END	**225.6**	
START	**338.8**	
	-113.2	DELTA T

CIRCLE: **LOSS / GAIN**

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 9-21-2011 Analyte : CO_2 (15-1)

Unit : Total FGS Run # : 1

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

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

Span Cyl. # : 487905 Conc. : 12.20 % CO_2 Cyl. Press. : 1400 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 : C. Walters Time : 0845 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	.109	.109	.437
SPAN	48.8	.488	12.20	48.8	.488	12.234	.034	.137

POST RUN Audit : by : C. Walters Time : 1730 Temp : 78 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	000	-.002	.060	.060	.238
SPAN	48.8	.488	12.20	48.5	.485	12.110	-.040	-.162

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

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

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

ZERO / SPAN CHECK DATA SHEET #15-2

Date : 9-21-2011 Analyte : O_2 (15-2)

Unit : Jotul F55 Run # : 1

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

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

Span Cyl. # : 487905 Conc. : 12.60 % O_2 Cyl. Press. : 1400 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % O_2

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

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

PRE RUN Audit : by : C. Watkins Time : 0845 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	-.025	-.025	-.100
SPAN	12.60	.504	12.6	12.6	.504	12.575	-.025	-.100

POST RUN Audit : by : C. Watkins Time : 1730 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	-.025	-.025	-.100
SPAN	12.60	.504	12.6	12.6	.505	12.600	ϕ	ϕ

± 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 : 9-21-2011 Analyte : CO (15-3)

Unit : Jotul FS5 Run # : 1

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

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

Span Cyl. # : 1487905 Conc. : 4.90 % CO Cyl. Press. : 1400 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 10.0 % CO

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

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

PRE RUN Audit : by : C. Watmough Time : 0845 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	.013	.013	.128
SPAN	49.0	.490	4.90	49.0	.490	4.906	.006	.061

POST RUN Audit : by : C. Watmough Time : 1730 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	.013	.013	.128
SPAN	49.0	.490	4.90	49.1	.491	4.916	.016	.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 #15-4

Date : 9-21-2011 Analyte : SO_2 (15-4)

Unit : Jotul F55 Run # : 1

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

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

Span Cyl. # : CC82089 Conc. : 1250 ppm SO_2 Cyl. Press. : 1670 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 2500 ppm SO_2

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

PRE RUN Audit : by : C. Walters Time : 0845 Temp : 75 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-1.900	-1.900	-.076
SPAN	50.0	.500	1250	50.0	.500	1246.7	-3.300	-.132

POST RUN Audit : by : C. Walters Time : 1130 Temp : 78 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.2	.002	3.094	3.094	.124
SPAN	50.0	.500	1250	50.1	.501	1249.2	-.800	-.032

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

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

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

QUALITY CHECKS DATA SHEET # 16

UNIT : Total FS5 RUN : 1 DATE : 9-21-2011

Thermocouple Check:

T/C # 1	— °F	T/C # 13	58.7 °F
T/C # 2	— °F	T/C # 14	59.1 °F
T/C # 3	59.1 °F	T/C # 15	59.0 °F
T/C # 4	58.9 °F	T/C # 16	56.5 °F
T/C # 5	58.6 °F	T/C # 17	53.7 °F
T/C # 6	58.6 °F	T/C # 18	59.6 °F
T/C # 7	58.5 °F	T/C # 19	— °F
T/C # 8	58.6 °F	T/C # 20	— °F
T/C # 9	58.6 °F	T/C # 21	— °F
T/C # 10	59.0 °F	T/C # 22	— °F
T/C # 11	58.0 °F	T/C # 23	— °F
T/C # 12	59.0 °F	T/C # 24	— °F

Thermocouple Readout:

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

ZERO .5 °F Adj. to 0.0 °F ZERO -.1 °F Difference .005 %

SPAN 1998.8 °F Adj. to 2000.0 °F SPAN 2000.5 °F Difference .025 %

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 200.2 °F	400	= 399.8 °F
600	= 599.7 °F	800	= 799.6 °F	1000	= 999.7 °F
1200	= 1199.6 °F	1400	= 1399.4 °F	1600	= 1599.4 °F
1800	= 1799.7 °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 : 511.1 − 501.1 = 10.0

Post : 511.0 − 501.0 = 10.0

Stack Cleaned Prior to Test Run : YES X NO —

TABLE 1 ----- RAW DATA

CLIENT : Jotul TEST No. : 2

MODEL: F55 DATE: 23-Sep-11

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	495.000	0.150	78	0.88	4.80	475
5	496.500	0.190	78	0.96	9.00	425
10	498.198	0.100	80	0.46	2.20	575
15	499.463	0.100	80	0.53	2.00	600
20	500.675	0.090	80	0.60	2.30	625
25	501.839	0.080	80	0.72	2.50	650
30	502.958	0.090	81	0.63	5.80	625
35	504.126	0.110	81	0.51	7.30	550
40	505.454	0.080	81	0.82	5.30	650
45	506.577	0.140	81	0.31	10.70	500
50	508.037	0.140	82	0.33	8.70	500
55	509.502	0.140	83	0.30	10.70	450
60	511.130	0.170	83	0.53	12.20	500
65	512.601	0.170	84	0.12	11.50	450
70	514.234	0.170	84	0.13	10.70	450
75	515.874	0.190	84	0.11	10.20	425
80	517.610	0.150	85	0.30	8.60	475
85	519.170	0.160	86	0.25	9.10	450
90	520.822	0.130	86	0.62	8.60	500
95	522.309	0.160	86	0.45	8.90	450
100	523.961	0.180	87	0.23	9.40	425
105	525.716	0.180	87	0.26	10.40	425
110	527.472	0.180	87	0.16	10.00	425
115	529.227	0.150	87	0.57	8.30	475
120	530.798	0.120	88	0.79	7.60	525
125	532.225	0.120	88	0.92	6.90	525
130	533.651	0.100	88	1.62	6.00	575
135	534.954	0.070	88	2.42	5.30	675
140	536.064	0.070	88	2.28	5.40	675
145	537.174	0.080	88	2.21	5.30	650
150	*538.326*	*0.080*	*88*	*2.20*	*5.20*	*650*
155	539.479	0.080	88	2.21	5.40	650
160	540.632	0.080	88	2.17	5.20	650
165	541.784	0.080	88	2.08	5.10	625
170	542.983	0.080	88	2.23	5.20	625
175	544.181	0.090	88	2.14	5.20	600

180	545.430	0.100	88	2.13	5.20	575
185	546.733	0.100	88	2.08	5.10	575
190	548.035	0.110	88	1.99	4.80	550
195	549.397	0.110	88	2.00	4.90	550
200	550.759	0.120	88	1.99	4.80	525
205	552.186	0.120	88	1.94	4.80	525
210	553.613	0.120	88	1.89	4.70	525
215	555.039	0.120	88	1.90	4.60	525
220	556.466	0.120	88	1.72	4.50	525
225	557.893	0.120	88	1.73	4.50	525
230	559.319	0.120	88	1.64	4.40	525
235	560.746	0.120	88	1.66	4.40	525
240	562.173	0.120	90	1.60	4.30	525
245	563.610	0.120	90	1.44	4.40	525
250	565.047	0.120	90	1.56	4.40	525
255	566.484	0.120	90	1.64	4.20	525
260	567.921	0.130	90	1.62	4.10	500
265	569.430	0.120	90	1.50	3.90	525
270	570.867	0.120	90	1.49	3.90	525
275	572.304	0.130	90	1.49	3.70	500
280	573.813	0.130	90	1.47	3.80	500
285	575.322	0.140	90	1.48	3.80	475
290	576.910	0.140	90	1.49	3.80	475
295	578.498	0.140	90	1.44	3.80	475
300	580.087	0.130	90	1.62	3.70	500
305	581.595	0.130	90	0.95	4.40	500
310	583.104	0.130	90	0.91	4.40	500
315	584.613	0.130	90	1.09	4.10	500
320	586.122	0.130	90	1.11	3.90	500
325	587.631	0.130	90	1.09	3.90	500
330	589.140	0.130	90	1.39	3.70	500
335	590.649	0.130	90	1.45	3.70	500
340	592.158	0.130	90	1.36	3.80	500
345	593.667	0.130	90	1.35	3.80	500
350	595.176	0.130	90	1.13	3.70	500
355	596.684	0.130	90	1.08	3.60	500
360	598.193	0.140	90	1.03	3.60	475
365	599.782	0.140	90	1.14	3.50	475
370	601.370	0.130	90	1.16	3.60	500
375	602.879	0.140	90	1.13	3.50	475
380	604.467	0.140	90	1.14	3.50	475
385	606.055	0.140	90	1.14	3.50	475
390	607.643	0.140	90	1.20	3.50	475

TABLE 2---RAW DATA

CLIENT : Jotul TEST No. 2

MODEL: F55 DATE: 23-Sep-11

METER CAL. FACTOR (Y) -------	0.927		Wt. WOOD BURNED(LB) -------	17.8	Lbs
BAROMETRIC PRESS.(Pb) -------	30.1	in Hg	WET,FUEL MOISTURE % -------	15.926	%
LEAK RATE POST (Lp) -------	0.000	cfm	Wt. PART. COLLECTED -------	0.6605	g
WATER VOL. (V1c) -------	136.1	Ml	METER VOLUME Vm -------	112.643	mcf
TEST TIME (MIN) -------	390	min	HC MOLE FRACTION -------	0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT : Jotul TEST No. 2

MODEL: F55 DATE: 23-Sep-11

AVG DELTA H	-------	0.13	in H2O	AVG PRCNT CO	-------	1.23	%
AVG METER TEMP. Tm	-------	87	deg F	AVG PRCNT CO2	-------	5.48	%
AVG PPM SO2	-------	524	PPM	AVG BAL CO2/CO	-------	4.45	%

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul TEST No. 2

MODEL: F55 DATE: 23-Sep-11

****

STD SAMPLE VOL. Vm(std) d) ------	101.40	dscf	STACK GAS FLOW Qsd -------	467.935	dscf/Hr
				&	
				7.80	dscf/min
VOL. WATER VAPOR Vw(s td) -----	6.406	scf	PARTICULATE CONCTRT. C s ------	0.0065	g/dscf
PRCNT MSTR Bws -------	5.94	%	PARTC.EMISS. RATE E -------	3.05	g/Hr
BURN RATE BR -------	1.04	Kg/Hr	MOLES OF GAS PER Lb WOOD Nt ----	0.53	Lb-mole/Lb
CO EMISSION RATE -------	193.22	g/Hr	PART.EMISS. RATE ------	2.92	g/Kgdry fuel
	&				
	185.08	g/Kgdry fuel			

TABLE 5 ---- PROPORTIONAL RATE VARIATION

CLIENT : Jotul TEST No. : 2

MODEL: F55 DATE: 23-Sep-11

TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR	PROPRTN RATE VAR. AVERAGE
5	652.5	97	100
10	659.7	98	
15	663.5	99	
20	663.4	99	
25	663.6	99	
30	662.9	99	
35	664.7	99	
40	665.1	99	
45	664.6	99	
50	664.1	99	
55	665.2	99	
60	664.7	99	
65	666.7	99	
70	665.5	99	
75	668.4	99	
80	667.6	99	
85	669.2	100	
90	670.8	100	
95	670.8	100	
100	670.2	100	
105	671.8	100	
110	672.2	100	
115	671.8	100	
120	671.5	100	
125	673.5	100	
130	673.0	100	
135	673.5	100	
140	673.5	100	
145	673.5	100	
150	673.1	100	
155	673.7	100	
160	673.7	100	
165	673.1	100	
170	673.6	100	
175	673.0	100	
180	673.6	100	

185	673.5	100
190	673.0	100
195	673.4	100
200	673.4	100
205	673.5	100
210	673.5	100
215	673.0	100
220	673.5	100
225	673.5	100
230	673.0	100
235	673.5	100
240	672.2	100
245	675.7	101
250	675.7	101
255	675.7	101
260	675.7	101
265	675.8	101
270	675.7	101
275	675.7	101
280	675.8	101
285	675.8	101
290	675.6	101
295	675.6	101
300	676.1	101
305	675.4	100
310	675.8	101
315	675.8	101
320	675.8	101
325	675.8	101
330	675.8	101
335	675.8	101
340	675.8	101
345	675.8	101
350	675.8	101
355	675.4	100
360	675.8	101
365	676.1	101
370	675.6	101
375	675.8	101
380	675.6	101
385	675.6	101
390	675.6	101

COMPUTER INPUT DATA SHEET #1

3.05

Client: Jotul North America

Address: 55 Hutcherson
Gorham, ME. 04038

Phone: 1-800-797-5912 Fax:

Run No.: 2 Date of Test: 9-23-2011 Burn Rate: 1.044

Model No.: F55 ☐ min ☒ min-1.25 ☐ fan

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

Dry Gas Meter Y Factor: .927 (0.000) (Data Sheet #2) Post Leak Rate: .000 (.000) (Data Sheet #2) cfm Time: 390 (000) (Data Sheet #2) min.

Dry Gas Meter Volume: 112.643 (00.000) (Data Sheet #2) cf

Stack Flow: 6.641 (00.000) (Data Sheet #2) dscfm Δ H: .125 (.000) (Data Sheet #2) in. H_2O

Maximum Vac.: 3.0 (0.0) (Data Sheet #2) Barometric Pressure: 30.10 (00.00) (Data Sheet #2) in. Hg

H_2O Captured: 136.1 (00.0) (Data Sheet #3) g

Front Half Catch % Of Total: 42.6 (00.0) (Data Sheet #6) % Total Particulate Catch: .6605 (0.0000) (Data Sheet #6) g

Flue Gas Moisture: 5.9429 (00.000) (Data Sheet #7) %

Particulate Emission: .1005 (0.0000) (Data Sheet #7) gr/dscf

Relative Humidity: 56.0 (00.0) (Data Sheet #8) % RH Ambient Moisture: 1.95 (0.00) (Data Sheet #8) % H_2O

Preburn Fuel Wt.: 44.8 (00.0) (Data Sheet #8) lbs. Coal Bed Wt.: 43 (00.0) (Data sheet #8) lbs. Test Fuel Wt.: 17.8 (00.0) (Data sheet #8) lbs.

Heat Output (EPA Default): 12588.8 (00,000.0) (Data Sheet #8) BTU/hr

Kindling Fuel % Moisture (wet): 12.943 (00.000) (Data Sheet #10) % Pretest Fuel % Moisture (wet): 17.219 (00.000) (Data Sheet #10) %

Test Fuel % Moisture (dry): 18.943 (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove]) % Test Fuel % Moisture (wet): 15.926 %

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

Stack Static Pressure: -.041 (+/- .000) (Data Sheet #12) in. H_2O

Average Ambient Temperature: 84 (00) (Data Sheet #14) °F Stove Temperature Change: -124.7 (+/- 000.0) (Data Sheet #14) °F

Start = 0940

End = 1610

meter temp = 547

METER BOX DATA SHEET PAGE # 2

Page: 1 of 4

UNIT: Jotul FSS RUN: 2 DATE: 9-23-2011

Meter Box: SH Y Factor: .927

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: 1500

ROTO: PRESS: .18			SAMPLING RATIO: 24 : 1				BP: 30.16		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	0940	495.000	—	7.345	.15	78	475	78	2.0
5	45	496.500	—	8.209	.19	78	425	78	3.0
10	50	498.198	498.198	6.045	.10	80	575	80	2.0
15	55	499.463	499.463	5.793	.10	80	600	80	2.0
20	1000	500.675	500.675	5.561	.09	80	625	80	2.0
25	05	501.839	501.839	5.348	.08	80	650	80	2.0
30	10	502.958	502.958	5.551	.09	81	625	81	2.0
35	15	504.126	504.126	6.308	.11	81	550	81	2.0
40	20	505.454	505.454	6.338	.08	81	650	81	2.0
45	25	506.577	506.577	6.939	.14	81	500	81	2.0
50	30	508.037	508.037	6.926	.14	82	500	82	2.0
55	35	509.502	509.502	7.696	.17	82	450	82	2.0
ROTO PRESS: .18			TOTALS:	77.054	1.44	964	BP.: 30.10		
60	1040	511.130	511.130	6.913	.14	83	500	83	2.0
65	45	512.601	512.601	7.681	.17	83	450	83	2.0
70	50	514.234	514.234	7.647	.17	84	450	84	2.0
75	55	515.874	515.874	8.118	.19	84	425	84	2.0
80	1100	517.610	517.610	7.250	.15	85	475	85	2.0
85	05	519.170	519.170	7.639	.16	86	450	86	2.0
90	10	520.822	520.822	6.875	.13	86	500	86	2.0
95	15	522.309	522.309	7.638	.16	86	450	86	2.0
100	20	523.961	523.961	8.074	.18	87	425	87	2.0
105	25	525.716	525.716	8.074	.18	87	425	87	2.0
110	30	527.472	527.472	8.074	.18	87	425	87	2.0
115	35	529.227	529.227	7.224	.15	87	475	87	2.0
			TOTALS:	91.227	1.960	1025	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	168.286	3.40	1989	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 2 of 4

UNIT: Total FGS RUN: 2 DATE: 9-23-2011

Meter Box: 514 Y Factor: 1.927

Leak checks: 15 " Hg @ 1002 cfm _____ " Hg @ _____ cfm

15 " Hg @ 1000 cfm _____ " Hg @ _____ cfm

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

ROTO: PRESS: .18 SAMPLING RATIO: 24 : 1 BP: 30.10

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1146	530.798	530.798	6.524	.12	88	525	88	2.0
125	45	532.225	532.225	6.524	.12	88	525	88	2.0
130	50	533.651	533.651	5.957	.10	88	575	88	2.0
135	55	534.954	534.954	5.074	.07	88	625	88	2.0
140	1200	536.064	536.064	5.074	.07	88	625	88	2.0
145	05	537.174	537.174	5.269	.08	88	650	88	2.0
150	10	538.326	538.326	5.269	.08	88	650	88	2.0
155	15	539.479	539.479	5.269	.08	88	650	88	2.0
160	20	540.632	540.632	5.269	.08	88	650	88	2.0
165	25	541.784	541.784	5.480	.08	88	625	88	2.0
170	30	542.983	542.983	5.480	.08	88	625	88	2.0
175	35	544.181	544.181	5.709	.09	88	600	88	2.0
ROTO PRESS:		.18	TOTALS:	66.898*	1.05*	1056*	BP.:	30.10	
180	1240	545.430	545.430	5.957	.10	88	575	88	2.0
185	45	546.733	546.733	5.957	.10	88	575	88	2.0
190	50	548.035	548.035	6.228	.11	88	550	88	2.0
195	55	549.397	549.397	6.228	.11	88	550	88	2.0
200	1300	550.759	550.759	6.524	.12	88	525	88	2.0
205	05	552.186	552.186	6.524	.12	88	525	88	2.0
210	10	553.613	553.613	6.524	.12	88	525	88	2.0
215	15	555.039	555.039	6.524	.12	88	525	88	2.0
220	20	556.466	556.466	6.524	.12	88	525	88	2.0
225	25	557.893	557.893	6.524	.12	88	525	88	2.0
230	30	559.319	559.319	6.524	.12	88	525	88	2.0
235	35	560.746	560.746	6.524	.12	88	525	88	2.0
			TOTALS:	76.562*	1.38*	1056*	MAX VACC =		
TOTAL Cu Ft			TOTALS:	143.460*	2.43*	2112*	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 3 of 4

UNIT: F-55 RUN: 2 DATE: 9-23-11

Meter Box: 5H Y Factor: .927

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: .18			SAMPLING RATIO: 24 : 1				BP: 30.10		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
240	1340	562.173	562.173	6.500	.12	90	525	90	2.0
245	45	563.610	563.610	6.500	.12	90	525	90	2.0
250	50	565.047	565.047	6.500	.12	90	525	90	2.0
255	55	566.484	566.484	6.500	.12	90	525	90	2.0
260	1400	567.921	567.921	6.825	.13	90	500	90	2.0
265	05	569.430	569.430	6.500	.12	90	525	90	2.0
270	10	570.867	570.867	6.500	.12	90	525	90	2.0
275	15	572.304	572.304	6.825	.13	90	500	90	2.0
280	20	573.813	573.813	6.825	.13	90	500	90	2.0
285	25	575.322	575.322	7.185	.14	90	475	90	2.0
290	30	576.910	576.910	7.185	.14	90	475	90	2.0
295	35	578.498	578.498	7.185	.14	90	475	90	2.0
ROTO PRESS: .18			TOTALS:	81.030°	1.53°	1080	BP.: 30.10		
300	1440	580.087	580.087	6.825	.13	90	500	90	2.0
305	45	581.595	581.595	6.825	.13	90	500	90	2.0
310	50	583.104	583.104	6.825	.13	90	500	90	2.0
315	55	584.613	584.613	6.825	.13	90	500	90	2.0
320	1500	586.122	586.122	6.825	.13	90	500	90	2.0
325	05	587.631	587.631	6.825	.13	90	500	90	2.0
330	10	589.140	589.140	6.825	.13	90	500	90	2.0
335	15	590.649	590.649	6.825	.13	90	500	90	2.0
340	20	592.158	592.158	6.825	.13	90	500	90	2.0
345	25	593.667	593.667	6.825	.13	90	500	90	2.0
350	30	595.176	595.176	6.825	.13	90	500	90	2.0
355	35	596.684	596.684	6.825	.13	90	500	90	2.0
			TOTALS:	81.900°	1.56°	1080°	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	162.930°	3.09°	2160°	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 4 of 4

UNIT: F55 RUN: 2 DATE: 4-23-11

Meter Box: 5H Y Factor: .927

Leak checks: 15 " Hg @.007 cfm _____ " Hg @_____ cfm

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

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

ROTO: PRESS: .18 SAMPLING RATIO: 24 : 1 BP: 30.10

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
360	1540	598.193	598.193	7.185	.14	90	475	90	2.0
365	45	599.782	599.782	7.185	.14	90	475	90	2.0
370	50	601.370	601.370	6.825	.13	90	500	90	2.0
375	55	602.879	602.879	7.185	.14	90	475	90	2.0
380	1600	604.467	604.467	7.185	.14	90	475	90	2.0
385	05	606.055	606.055	7.185	.14	90	475	90	2.0
390	10	607.643	607.643	7.185	.14	90	475	90	2.0
395									
400									
405									
410									
415									
ROTO PRESS:			TOTALS:	49.935'	.97'	630'	BP.:		
420									
425									
430									
435									
440									
445									
450									
455									
460									
465									
470									
475						689'			
			TOTALS:	524.611'	9.89'	87'	MAX VACC =		3.0
TOTAL Cu Ft.		112.643'	TOTALS:	6.641'	.125'	547'	AVG. BP:		30.10

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PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : F55 RUN : 2 DATE : 9-23-11

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	715.0	577.4	488.8	893.8
INITIAL WT	609.4	573.8	485.3	870.4
NET WT GRAMS	105.6	3.6	3.5	23.4

TOTAL CATCH : 136.1 GRAMS H_2O

FRONT HALF

FILTER #	30F	
FINAL WT g	.7885	
INITIAL WT g	.6241	
NET WT g	.1644	

BEAKER #	96
DESC.	ACETONE
FINAL WT g	104.0987
INITIAL WT g	103.9807
NET WT g	.1180
VOL. DESC. ml	100

BACK HALF

FILTER #	30B	
FINAL WT g	.4006	
INITIAL WT g	.3488	
NET WT g	.0518	

BEAKER #	97	98	99	100	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	100.1450	105.0445	105.0080	106.8153	
INITIAL WT g	99.9820	105.0224	104.9323	106.7398	
NET WT g	.1630	.0221	.0757	.0755	.1512
VOL. DESC ml	140	75	150	150	310

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 11-4-2010 Time : 1600 By : CP

Manufacturer S & S Grade : # 25 Glass Front Size : 11 cm Lot No. : 393588

Back Size: 8.2 cm Lot No. : JI1441535

	DATE: 10-12-2010	BY: AV	DATE: 11-15-10	BY: AV	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
21F	0.6199	9:45	0.6199	10:30		
22F	0.6268	9:46	0.6267	10:31		
23F	.0.6260	9:47	0.6256	10:32		
24F	0.6229	9:48	0.6228	10:33		
25F	0.6255	9:49	0.6255	10:34		
26F	0.6260	9:50	0.6262	10:35		
27F	0.6230	9:51	0.6230	10:36		
28F	0.6273	9:52	0.6274	10:37		
29F	0.6246	9:53	0.6245	10:38		
30F	0.6241	9:54	0.6241	10:39	R-2	
21B	0.3495	9:55	0.3494	10:40		
22B	0.3499	9:56	0.3499	10:41		
23B	0.3469	9:57	0.3467	10:42		
24B	0.3447	9:58	0.3447	10:43		
25B	0.3524	9:59	0.3522	10:44		
26B	0.3503	10:00	0.3500	10:45		
27B	0.3538	10:01	0.3537	10:46		
28B	0.3501	10:02	0.3502	10:47		
29B	0.3508	10:03	0.3508	10:48		
30B	0.3487	10:04	0.3488	10:49	R-2	

Checked by: CP Walmsley Date: 11-15-10 Time: 1510

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
11-11-10	0840	CP		67	42
11-15-10	0930	CP		70	48

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 11-15-20 0 Time : 1000 By : CP

	DATE: 11-19-10	BY: AV	DATE: 11-23-10	BY: CP	DATE: 11-24	BY: CP
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
76	103,8023	11:20	03.7990	1415	103,7992	1420
77	107,3857	11:21	07.3828	1416	107,3833	1421
78	94,4935	11:22	94.4900	1417	94,4904	1422
79	97,6174	11:23	97.6115	1418	97,6120	1423
80	109,1245	11:24	09.1200	1419	109,1205	1424
81	101,4640	11:25	01.4600	1420	101.4605	1425
82	97,4742	11:26	97.4706	1421	97.4710	1426
83	98,3270	11:27	98.3231	1422	98.3235	1427
84	105,5520	11:28	05.5478	1423	105.5482	1428
85	97,9928	11:29	97.9880	1424	97.9885	1429
86	104,7445	11:30	04.7406	1425	104,7410	1430
87	105,9180	11:31	05.9158	1426	105,9163	1431
88	100,0025	11:32	00.0001	1427	100.0005	1432
89	120,6722	11:33	120.6683	1428	120.6688	1433
90	106,4045	11:34	06.4017	1429	106,4021	1434
91	95,0515	11:35	95.0485	1430	95.0490	1435
92	96,6781	11:36	96.6763	1431	96,6767	1436
93	107,8838	11:37	107.8818	1432	107.8823	1437
94	106,3634	11:38	06.3605	1433	106.3610	1438
95	107,4089	11:39	07.4065	1434	107.4070	1439
					103.9807	
96	103,9833	11:40	03.9802	1435	[illegible]	1440
97	99,9850	11:41	99.9816	1436	99,9820	1441
98	105,0246	11:42	05.0219	1437	105,0224	1442
99	104,9354	11:43	04.9319	1438	104,9323	1443
100	106,7415	11:44	06,7393	1439	06,7398	1444

R:

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	%RH	
11-19	0930	CW	-	65	[illegible]	Checked by :
11-23	1400	CW	-	66	[illegible]	Date :
11-24	1400	CW	-	65	[illegible]	Time :

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : T-55 RUN : 2 DATE : 9-23-11 Page : 1 of 1

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
96	9-24	1600	CJ	104,0985	9-27	1010	CJ	104.0987	9-29	0846	CJ				
97	9-24	1600	CJ	100.1445	9-27	1011	CJ	100,1450	9-29	0847	CJ				
98	9-24	1600	CJ	105.0448	9-27	1012	CJ	105,0445	9-29	0848	CJ				
99	9-24	1600	CJ	105.0076	9-27	1013	CJ	105,0080	9-29	0849	CJ				
100	9-24	1600	CJ	106,8154	9-27	1014	CJ	106,8153	9-29	0850	CJ				

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	~~Weight~~	Date	Time	By
30F	9-23	1800	CJ	.7967	9-24	1213	CJ	.7890	9-25	1315	CJ	(7885)	9-27	1005	CJ
30B	9-23	1800	CJ	.4059	9-24	1214	CJ	.4033	9-25	1316	CJ	.4010	9-27	1006	CJ
				(.4006)	9-29	0845	CJ								

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	9-24-11	1200	CJ	77	44
2	9-25-11	1300	CJ	76	43
3	9-27-11	1000	CJ	77	49
4	9-29-11	0840	CJ	72	42
5					

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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 4-13-2011 Through	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0000	10.0001	1.0000	.0998	CP	4-13-11	1030	66	49
100.0001	10.0002	1.0000	.0999	CP	4-15-11	1330	75	48
100.0004	10.0000	.9999	.0998	CP	4-19-11	1600	74	44
100.0003	10.0000	1.0000	.0999	CP	4-20-11	1815	72	46
100.0000	10.0001	.9999	.1000	CP	6-16-11	0900	76	39
99.9997	9.9999	.9998	.0999	CP	6-19-11	1530	74	44
99.9996	10.0002	1.0000	.0999	CP	6-20-11	1600	73	47
100.0000	10.0000	.9998	.0999	CP	6-21-11	1400	73	47
100.0000	10.0000	1.0001	.0999	CP	6-22-11	1200	72	46
99.9999	9.9998	1.0000	.1000	CP	6-23-11	1700	76	49
100.0000	10.0002	1.0000	.0999	CP	6-24-11	1400	75	48
100.0000	10.0000	1.0000	.0999	CP	6-27-11	1230	78	46
100.0001	10.0002	.9999	.0998	CP	6-30-11	1030	78	46
99.9995	10.0000	.9999	.0999	CP	7-1-11	1030	70	48
99.9999	9.9999	1.0000	.1000	CP	7-2-11	1145	75	45
100.0000	9.9999	.9999	.0999	CP	7-5-11	1000	73	47
99.9999	10.0001	1.0000	.0999	CP	7-6-11	0930	76	49
100.0000	9.9997	1.0000	.0997	CP	9-22-11	1700	77	46
100.0000	10.0001	1.0000	.0999	CP	9-24-11	1200	77	49
100.0000	9.9998	1.0001	.1000	CP	9-25-11	1300	76	49
100.0000	9.9999	1.0001	.0998	CP	9-27-11	1000	77	49
99.9996	9.9999	1.0000	.0998	CP	9-29-11	0840	72	42
99.9997	9.9998	.9999	.1000	CP	9-30-11	1000	70	48
99.9996	9.9998	1.0000	.0999	CP	10-1-11	1520	70	48
99.9998	10.0002	1.0000	.0997	CP	10-2-11	1430	74	47

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 11-11-10 Through 4-7-11	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0000	10.0002	1.0000	.0998	CP	11-11	0840	67	42
100.0000	10.0000	1.0001	.1000	CP	11-15	0930	70	48
100.0000	10.0001	1.0000	.0999	CP	11-19	0930	65	48
100.0000	10.0000	1.0000	.1000	CP	11-23	1400	66	45
100.0000	9.9997	1.0000	.0998	CP	11-24	1400	65	48
100.0000	10.0000	.9999	.0998	CP	11-26	1100	67	46
100.0000	10.0001	1.0001	.0997	CP	12-14	1000	75	41
100.0001	10.0003	1.0000	.0999	CP	12-16	1100	75	48
100.0000	10.0002	1.0000	.0999	CP	12-18	1000	77	46
100.0000	10.0000	1.0000	.0999	CP	12-21	1100	66	49
100.0000	10.0004	1.0000	.0997	CP	12-22	1400	72	48
100.0000	10.0001	1.0000	.1001	CP	12-23	1100	76	38
100.0000	10.0000	.9999	.0999	CP	12-24	1000	67	46
100.0000	10.0001	1.0001	.0999	CP	12-25	1100	75	48
100.0000	10.0000	1.0000	.0999	CP	11-19-11	0930	66	49
100.0000	9.9999	1.0000	.0999	CP	1-21-11	1400	77	44
99.9996	10.0000	1.0000	.0998	CP	1-25-11	0900	75	48
100.0000	10.0002	1.0001	.1000	CP	1-26-11	1400	74	44
100.0000	10.0001	.9998	.0998	CP	1-27-11	1200	65	48
100.0000	10.0002	1.0000	.0999	CP	1-28-11	1630	70	46
100.0000	10.0001	1.0001	.0999	CP	1-29-11	1200	68	48
100.0000	10.0002	1.0000	.0999	CP	1-30-11	1500	66	49
100.0000	9.9999	1.0000	.0999	CP	2-15-11	0930	75	41
100.0000	10.0000	1.0001	.1000	CP	2-16-11	0930	66	49
100.0000	10.0002	1.0000	.0999	CP	2-22-11	1000	70	48
100.0000	10.0001	1.0002	.0999	CP	3-4-11	1200	69	47
100.0000	10.0004	.9999	.1000	CP	3-5-11	1000	70	48
100.0000	10.0001	1.0000	.0999	CP	3-8-11	1000	74	47
100.0000	10.0000	1.0000	.1000	CP	3-9-11	1600	67	46
100.0000	10.0002	0.9999	.0999	CP	3-10-11	1600	66	49
100.0000	10.0000	1.0000	.0999	CP	3-12-11	1530	73	47
100.0000	10.0001	.9999	.0998	CP	3-13-11	1200	65	48
100.0000	10.0001	1.0000	.0999	CP	3-29-11	1120	76	49
100.0000	10.0000	.9999	.0998	CP	3-30-11	0800	74	47
100.0000	10.0001	1.0000	.0999	CP	3-31-11	1000	70	48
100.0000	10.0002	.9998	.0999	CP	4-4-11	0830	74	47
100.0000	10.0003	1.0000	.1000	CP	4-5-11	1130	73	47
100.0000	9.9999	1.0001	.0999	CP	4-6-11	1030	77	49
100.0000	10.0000	9.9999	.1001	CP	4-7-11	1000	78	40

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 2-26-2010 Through 11-10-2010	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0001	10.0004	.9999	.0999	CP	2-26-10	0840	72	46
100.0001	9.9999	.9999	.0999	CP	2-27-10	1045	72	46
100.0000	10.0000	1.0000	.0999	CP	2-28	1100	70	48
100.0000	10.0000	1.0000	.0999	CP	3-1	0900	66	49
100.0000	10.0002	.9998	.1002	CP	3-5	1200	70	48
100.0001	9.9999	.9999	.0998	CP	3-7	1330	68	47
100.0000	9.9999	.9999	.0999	CP	3-9	1130	70	41
100.0000	10.0001	1.0000	.0999	CP	3-10	1200	70	44
100.0000	10.0001	.9999	.0999	CP	3-11	0900	66	49
99.9999	9.9999	.9999	.0999	AM	3-15	1000	70	48
100.0000	10.0000	1.0000	.0998	CP	3-17	0900	72	46
100.0000	9.9998	1.0001	.1000	CP	4-8	1430	76	49
99.9999	10.0001	1.0000	.0999	CP	4-10	1430	73	47
99.9999	10.0001	1.0001	.1000	CP	4-11	1430	74	47
100.0000	10.0002	1.0000	.1000	CP	4-21	1830	77	49
100.0000	10.0000	1.0000	.0999	CP	4-22	1130	74	47
100.0000	10.0001	1.0000	.0999	CP	4-23	1015	74	44
100.0002	9.9999	1.0000	.1000	CP	4-24	0930	68	47
100.0000	9.9999	.9999	.1000	CP	4-25	0930	73	47
100.0000	9.9999	1.0001	.0999	CP	4-26	0900	76	42
100.0000	10.0002	1.0000	.0999	CP	4-30	1320	78	43
99.9998	10.0000	1.0002	.0999	CP	8-26	0845	78	49
100.0000	9.9998	1.0001	.0999	CP	8-27	0955	78	43
100.0000	10.0000	1.0000	.1000	CP	8-28	1600	73	47
99.9998	10.0000	.9999	.1000	CP	8-29	1400	70	48
100.0000	10.0000	1.0000	.0999	CP	8-31	0720	72	46
100.0001	10.0000	1.0000	.1000	CP	9-1	1330	76	49
100.0000	10.0001	1.0000	.0999	CP	9-2	1300	68	47
100.0000	10.0000	1.0000	.1000	CP	9-3	1130	72	46
100.0000	10.0001	1.0000	.0999	CP	10-26	0750	70	48
100.0000	10.0000	.9998	.0997	CP	10-27	1250	74	47
100.0000	9.9999	1.0000	.0999	CP	10-29	1400	71	49
100.0000	9.9999	1.0000	.0999	CP	11-1	1000	78	49
100.0000	10.0000	.9999	.0999	CP	11-2	0715	70	48
100.0000	10.0000	1.0000	.0999	CP	11-3	0900	70	48
100.0000	10.0001	.9999	.1000	CP	11-5	1320	76	42
100.0000	10.0001	.9999	.1000	CP	11-8	1230	70	48
100.0000	10.0001	1.0000	.0998	CP	11-9	1015	71	41
100.0000	10.0000	.9999	.0999	CP	11-10	0900	70	44

BLANK PROCESSING DATA SHEET # 5

UNIT : F55 RUN : 2 DATE : 9-23-11

BLANKS DONE : 8-31-2010

BEAKER	A	B	C
	200 ml ACETONE	75 ml DICHLOR	200 ml WATER
	FISHER OPTIMA LOT # 023283	FISHER OPTIMA LOT # 066390	DWNA, Inc Sparkletts Distilled
FINAL WEIGHT	108.9019	106.3074	106.9680
TARE WEIGHT	108.9001	106.3058	106.9640
NET WEIGHT	.0018	.0016	.0040

TARE BEAKERS INTO DESC : TIME : 1410 DATE : 8-7-2010

DATE : 8-26 BY : CP DATE : 8-27 BY : CP DATE : BY :

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.8999	0435	108.9001	1050		
B	106.3061	0436	106.3058	1051		
C	106.9641	0437	106.9640	1052		

FINAL BEAKERS INTO DESC : TIME : 8-28 DATE : 0820

DATE : 8-29 BY : CP DATE : 8-31 BY : CP DATE : BY :

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9019	1501	108.9019	0742		
B	106.3076	1502	106.3074	0743		
C	106.9676	1503	106.9680	0744		

TARE QC

DATE	TIME	BY	WB	DB	%
8-26-10	0845	CP		78	49
8-27-10	0955	CP		78	43

FINAL QC

DATE	TIME	BY	WB	DB	%
8-29	1400	CP		70	48
8-31	0720	CP		72	46

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT : F55 RUN : 2 DATE : 9-23-11

BLANK CALCULATIONS

Acetone : .0018 g ÷ 200 ml = .000009 g/ml

Dicholoromethane : .0016 g ÷ 75 ml = .000021 g/ml

Distilled Water : .0040 g ÷ 200 ml = .000020 g/ml

FRONT HALF CATCH

FILTERS : .1644 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .1644 g

BEAKERS : .1180 (Total Catch) g - 200 (ml Acetone) (.000009 g) (Blank Value / ml Acetone) = .1171 g

TOTAL FRONT HALF CATCH : .2815 g

BACK HALF CATCH

FILTERS : .0518 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0518 g

BEAKERS :

Acetone : .1630 (Total Catch) g - 140 (ml Acetone) (.000009 g) (Blank Value / ml Acetone) = .1617 g

Extract : .0221 (Total Catch) g - 75 (ml Dichloromethane) (.000021 g) (Blank Value / Dichloromethane) = .0205 g

Water : .1512 (Total Catch) g - 310 (ml Water) (.000020 g) (Blank Value / Water) = .1450 g

TOTAL BACK HALF CATCH : .3790 g

TOTAL CATCH : .6605 g

% FRONT HALF : 42.6 %

CALCULATIONS DATA SHEET # 7

UNIT: Jotul F55 RUN: 2 DATE: 9-23-2011

1) $Vm(std) = \dfrac{(112.43\ Vm)(17.64)(.927\ mcf)\left(30.10" Hg + \frac{.125" H_2O}{13.6}\right)}{(547\ TmA)} = \dfrac{101.3898}{000.0000}$ dscf

2) $Vw(std) = (.04707)(134.1\ ml\ H_2O) = \dfrac{6.4062}{00.0000}$ scf

3) $Asw = \dfrac{(6.4062\ scf)}{(6.4062\ scf + 101.3898\ dscf)} = \dfrac{.0594}{.0000}$ Bws × 100 = $\dfrac{5.9429}{00.0000}$ % H_2O

4) $Cs = \dfrac{(.1005\ g.)}{(101.3898\ dscf)}(15.43) = \dfrac{.1005}{0.0000}$ gr / dscf

5) Estimated g / hr = $\dfrac{(.1005\ g.)}{(101.3898\ dscf)}\left(\dfrac{6.641}{00.0000}\ dscfm\right)(60) = \dfrac{2.5958}{00.0000}$ 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: Total FSS RUN: 2 DATE: 9-23-2011

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

Wet Bulb / Dry Bulb

Pre : WB: 67 DB: 77 = 58.0 % RH 1.8 % H_2O

Post : WB: 72 DB: 85 = 54.0 % RH 2.1 % H_2O

Average: 56.0 % RH 1.95 % H_2O

Empty Stove Weight (lbs): N/A w/ stack & oil seal : Wet: N/A Dry: 496.8

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

Preburn Fuel Weight: 20.7 + 20.0 + 2.5 Total: 43.2

Kindling & Preburn Fuel Weight (wood only) (lbs): **Total**: 44.8

Coal Bed Wt Range (lbs): 4.4 - 3.6 **Scale**: 501.2 - 500.4

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

Lower : .20 × fuel weight : Always round UP to nearest tenth **Actual Coal Bed Weight**: 4.3

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

Test Fuel (.75" × 1.5" × 5" spacers) = 24 pcs

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" × 4"	16	5	9.3	52.2
4" × 4"	16	2	8.1	47.8

Test Fuel Weight: 17.8 lbs

Estimated Dry Burn Rate:

$$\frac{17.8 - (17.8 \times .15926)}{2.2046} \times \frac{60}{\frac{390}{\text{TIME}}} = 1.044 \text{ kg / hr}$$

Estimated BTU's/hr: 19,140 × $\frac{63}{100}$ × $\frac{1.044}{\text{DBR}}$ = 12588.8 BTU's/hr

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

330 = 1.24

WOOD STOVE OPERATING DATA PAGE #9

Unit : Totul F55 Run : 2 Date : 9-23-2011

FIRE STARTED: 0605

WARM UP AND PREBURN:

PRIMARY AIR : Set wide open for all warm-up / preburn fuel charges. Then set to 1/8" at start of preburn.

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

CHARCOAL BED PREPARATION :

Raked and leveled prior to each warm-up / preburn charge. At 1 1/2 min. prior to loading last fuel, raked and leveled. In stove 30 sec.

TEST:

DOOR wide open during loading 0 min. 45 sec.

PRIMARY AIR : Opened full for first 5 min., then set to run setting of 1/8".

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 12 or 16 inches.

1st warm up / pre-burn fuel charge (20.7 lbs.) added at 0610

2nd warm up / pre-burn fuel charge (20.0 lbs.) added at 0728

3rd warm up / pre-burn fuel charge (2.5 lbs.) added at 0840

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 : Total FSS Run : 2 Date : 9-23-2011

Room Temperature : 68 °F Temperature Correction Set? : (Yes) No

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

Time Test Fuel moisture reading taken : 0715

pc #	Dimen.	Use	TOP	BOTTOM	SIDE	Avg Corrected
1	2"×4"×8'	K	15.1	14.8	14.7	14.867
2						
3						
4	2"×4"×8'	P	21.7	22.3	22.4	22.1
5	2"×4"×8'	P	19.9	19.2	18.5	19.2
6	2"×4"×8'	P	20.0	19.1	19.6	19.5
7	2"×4"×8'	P	22.2	22.5	22.6	22.4
8	2"×4"×8'	P				(83.2)
9						
10						
11						
12	2×4×16"	T	18.0	17.9	17.9	17.9
13	"	T	18.9	18.9	18.9	18.9
14	"	T	18.7	18.7	19.0	18.8
15	"	T	19.2	19.8	20.0	19.6
16	"	T	20.2	20.2	20.8	20.4
17	4×4×16"	T	19.0	19.0	19.6	19.2
18	"	T	17.6	17.9	17.9	17.8
19						(132.6)
20	Spacers	T	18.6	18.9	17.7	18.40

DRY

MED

DRY

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	14.867 %	20.800 %	18.943 %
Wet Moisture % :	12.943 %	17.209 %	15.926 %

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

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

GAS DATA SHEET #12

WEIGHT: 501.1 DATE: 9-23-2011

UNIT: Total FSS RUN: 2 PAGE: 1 OF 3

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
0 0940	518.9	17.8	—	.191	4.8	.603	15.1	.086	.88	.044	475
5 45	518.2	17.1	.7	.360	9.0	.432	10.8	.094	.96	.052	425
10 50	517.9	16.8	.3	.085	2.2	.723	18.1	.044	.46	.050	575
15 55	517.6	16.5	.3	.080	2.0	.727	18.2	.051	.53	.044	.600
20 1000	517.2	16.3	.2	.089	2.3	.715	17.9	.058	.60	.040	.625
25 05	517.1	16.0	.3	.097	2.5	.699	17.5	.070	.72	.040	.650
30 10	516.7	15.6	.4	.230	5.8	.571	14.3	.061	.63	.045	.625
35 15	516.1	15.0	.6	.290	7.3	.516	12.9	.049	.51	.049	.550
40 20	515.6	14.5	.5	.210	5.3	.583	14.6	.080	.82	.048	.650
45 25	515.0	13.9	.6	.427	10.7	.388	9.7	.029	.31	.053	.500
50 30	514.4	13.3	.6	.348	8.7	.468	11.7	.031	.33	.054	.500
55 35	513.7	12.6	.7	.435	10.9	.384	9.6	.028	.30	.058	.450
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.577	*****
60 40	512.9	11.8	.8	.490	12.2	.321	8.0	.051	.53	.060	.500
65 45	512.2	11.1	.7	.459	11.5	.364	9.1	.010	.12	.060	.450
70 50	511.6	10.5	.6	.430	10.7	.396	9.9	.011	.13	.058	.450
75 55	510.9	9.8	.7	.410	10.2	.416	10.4	.009	.11	.058	.425
80 1100	510.3	9.2	.6	.345	8.6	.476	11.9	.028	.30	.056	.475
85 05	509.8	8.7	.5	.362	9.1	.456	11.4	.023	.25	.056	.450
90 10	509.4	8.3	.4	.345	8.6	.460	11.5	.060	.62	.055	.500
95 15	509.0	7.9	.4	.354	8.9	.456	11.4	.043	.45	.055	450
100 20	508.5	7.4	.5	.377	9.4	.444	11.1	.021	.23	.055	.425
105 25	507.9	6.8	.6	.427	10.7	.392	9.8	.024	.26	.057	.425
110 30	507.4	6.3	.5	.401	10.0	.424	10.6	.014	.16	.056	.425
115 35	507.0	5.9	.4	.331	8.3	.476	11.9	.055	.57	.055	.475
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.681	*****
120 40	506.6	5.5	.4	.302	7.6	.496	12.4	.077	.79	.053	.525
125 45	506.3	5.2	.3	.277	6.9	.516	12.9	.090	.92	.050	.525
130 50	506.0	4.9	.3	.238	6.0	.524	13.1	.160	1.62	.048	.575
135 55	505.8	4.7	.2	.211	5.3	.647	16.2	.240	2.42	.045	.675
140 1200	505.6	4.5	.2	.216	5.4	.524	13.1	.226	2.28	.044	.675
145 05	505.4	4.3	.2	.212	5.3	.528	13.2	.210	2.21	.044	.650
150 10	505.2	4.1	.2	.208	5.2	.536	13.4	.218	2.20	.042	.650
155 15	505.0	3.9	.2	.215	5.4	.524	13.1	.219	2.21	.040	.650
160 20	504.8	3.7	.2	.206	5.2	.536	13.4	.215	2.17	.040	.650
165 25	504.6	3.5	.2	.203	5.1	.544	13.6	.206	2.08	.038	.625
170 30	504.5	3.4	.1	.206	5.2	.532	13.3	.221	2.23	.040	.625
175 35	504.4	3.3	.1	.207	5.2	.536	13.4	.212	2.14	.040	.600
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.524	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	1.782	*****

GAS DATA SHEET #12

WEIGHT: 501.1 DATE: 9-23-2011

UNIT: Jotul F-55 RUN: 2 PAGE: 2 OF 3

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
180 40	504.3	3.2	.1	207	5.2	.536	13.4	.211	2.13	:038	.575
185 45	504.2	3.1	.1	.204	5.1	.544	13.6	.206	2.08	:037	.575
190 50	504.1	3.0	.1	.192	4.8	.560	14.0	.197	1.99	:036	.550
195 55	504.0	2.9	.1	.193	4.9	.556	13.9	.198	2.00	:036	.550
200 1300	503.9	2.8	.1	.191	4.8	.560	14.0	.197	1.99	:035	.525
205 05	503.8	2.7	.1	.190	4.8	.560	14.0	.192	1.94	:035	.525
210 10	503.7	2.6	.1	.187	4.7	.567	14.2	.187	1.89	:035	.525
215 15	503.6	2.5	.1	.181	4.6	.571	14.3	.188	1.90	:035	.525
220 20	503.5	2.4	.1	.177	4.5	.579	14.5	.170	1.72	:034	.525
225 25	503.4	2.3	.1	.177	4.5	.579	14.5	.171	1.73	:034	.525
230 30	503.4	2.3	.0	.174	4.4	.587	14.7	.162	1.64	:034	.525
235 35	503.3	2.2	.1	.176	4.4	.587	14.7	.164	1.66	:033	.525
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.422	*****
240 40	503.2	2.1	.1	.170	4.3	.595	14.9	.158	1.60	:033	.525
245 45	503.2	2.1	.0	.176	4.4	.595	14.9	.142	1.44	:033	.525
250 50	503.1	2.0	.1	.173	4.4	.591	14.8	.154	1.56	:034	.525
255 55	503.0	1.9	.1	.166	4.2	.595	14.9	.162	1.64	:034	.525
260 1400	502.9	1.8	.1	.164	4.1	.599	15.0	.160	1.62	:034	.500
265 05	502.9	1.8	.0	.155	3.9	.615	15.4	.148	1.50	:033	.525
270 10	502.8	1.7	.1	.154	3.9	.615	15.4	.147	1.49	:033	.525
275 15	502.8	1.7	.0	.147	3.7	.623	15.6	.147	1.49	:033	.500
280 20	502.7	1.6	.1	.149	3.8	.619	15.5	.145	1.47	:033	.500
285 25	502.6	1.5	.1	.150	3.8	.619	15.5	.146	1.48	:033	.475
290 30	502.5	1.4	.1	.150	3.8	.619	15.5	.147	1.49	:033	.475
295 35	502.5	1.4	.0	.149	3.8	.619	15.5	.142	1.44	:033	.475
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.399	*****
300 40	502.4	1.3	.1	.148	3.7	.615	15.4	.160	1.62	:033	.500
305 45	502.3	1.2	.1	.175	4.4	.615	15.4	.093	.95	:035	.500
310 50	502.2	1.1	.1	.175	4.4	.615	15.4	.089	.91	:035	.500
315 55	502.1	1.0	.1	.161	4.1	.623	15.6	.107	1.09	:033	.500
320 1500	502.1	1.0	.0	.156	3.9	.627	15.7	.109	1.11	:033	.500
325 05	502.0	.9	.1	.156	3.9	.631	15.8	.107	1.09	:033	.500
330 10	502.0	.9	.0	.147	3.7	.627	15.7	.137	1.39	:033	.500
335 15	501.9	.8	.1	.147	3.7	.623	15.6	.143	1.45	:033	.500
340 20	501.8	.7	.1	.149	3.8	.623	15.6	.134	1.36	:033	.500
345 25	501.7	.6	.1	.150	3.8	.623	15.6	.133	1.35	:033	.500
350 30	501.7	.6	.0	.148	3.7	.635	15.9	.111	1.13	:033	.500
355 35	501.6	.5	.1	.141	3.6	.643	16.1	.106	1.08	:033	.500
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.400	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	1.221	*****

GAS DATA SHEET #12

WEIGHT: 501.1 DATE: 9-23-2011

UNIT: Jotul F-55 RUN: 2 PAGE: 3 OF 3

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
340	501.5	.4	.1	.142	3.6	.643	16.1	.101	1.03	-.033	.475
345	501.5	.4	.0	.140	3.5	.643	16.1	.112	1.14	-.033	.475
350	501.4	.3	.1	.142	3.6	.639	16.0	.114	1.16	-.033	.500
355	501.4	.3	.0	.137	3.5	.643	16.1	.111	1.13	-.033	.475
360	501.3	.2	.1	.140	3.5	.643	16.1	.112	1.14	-.033	.475
365	501.2	.1	.1	.138	3.5	.644	16.1	.112	1.14	-.031	475
370	501.1	0	.1	.140	3.5	.644	16.1	.118	1.20	-.030	475
375											
380											
385											
390											
395											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.226	*****
400											
405											
410											
415											
420											
425											
430											
435											
440											
445											
450											
455											
460											
465											
470											
475											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****		*****
480											
485											
490											
495											
500											
505											
510											
515											
520											
525											
530											
535											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-3.229	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.041	*****

PREBURN DATA SHEET #13

UNIT: Jotul F55 RUN: 2 DATE: 9-23-2011 PAGE: 1 of 1

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	~~Inlet FIREBOX~~	~~baffle SECONDAT~~	AMBIENT	STATIC	COMMENTS
0 0840	503.7	—	269	472	435	563	590	447	595	805	73	-.055	PREBURN START: # 2-5 UP
5 45	503.4	.3	260	463	424	541	585	452	580	827	75	-.055	COAL BED SCALE RANGE:
10 50	503.0	.4	232	447	409	509	572	468	551	776	78	-.053	501.2 → 500.4
15 55	502.6	.4	219	428	396	483	544	470	524	756	79	-.051	PRIMARY AIR: 1/8"
20 0900	502.3	.3	215	423	384	464	537	458	507	762	80	-.051	SECONDARY AIR: N/A
25 05	501.9	.4	213	416	374	445	527	438	486	759	79	-.051	FAN: Low
30 10	501.7	.2	205	407	364	433	516	423	473	744	78	-.051	PUMPS ON AT:
35 15	501.6	.1	188	379	354	425	499	403	455	646	78	-.049	CHECK WB/DB: N/A
40 20	501.5	.1	178	357	345	421	481	383	450	618	78	-.047	
45 25	501.4	.1	173	341	337	416	471	368	442	605	77	-.047	
50 30	501.3	.1	168	325	329	411	460	367	435	590	78	-.046	
55 35	501.2	.1	164	314	321	407	451	357	425	572	76	-.045	
*****	****	***	****	*****	*****	****	*****	*****	*****	*****	*****	****	
60 0940	501.1	.1	176	300	320	415	443	359	430	566	76	-.044	367
65													
70													

360 OK.

at 501.2 add 3 blocks (7.5 lbs)

Jotul F55

Temperature Data Sheet 14

Run 2
9/23/11

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	176	300	320	415	443	359	430	566	78	1338	230	60	228	37	34
5	228	342	313	386	428	363	382	543	79	1325	231	42	228	37	34
10	183	286	297	380	409	359	365	474	77	1314	231	41	229	37	34
15	161	270	285	366	389	348	347	433	77	1304	232	42	229	37	34
20	150	258	271	355	370	343	333	409	77	1292	232	43	230	38	35
25	143	246	260	346	355	325	322	393	77	1282	233	44	230	38	35
30	150	248	250	334	342	322	310	407	76	1270	233	44	231	38	35
35	162	270	244	323	334	307	306	425	76	1257	234	45	232	38	36
40	159	264	242	315	331	298	303	460	76	1247	235	44	234	38	36
45	180	296	241	302	329	287	296	539	76	1240	238	44	235	38	36
50	192	318	243	295	337	278	295	529	77	1233	240	44	237	38	36
55	203	347	251	286	343	265	295	562	78	1230	242	45	241	37	36
60	220	386	256	280	353	259	300	630	77	1229	244	45	241	37	36
65	224	407	265	274	367	253	306	698	78	1228	245	45	242	37	37
70	225	419	272	270	380	246	311	718	79	1230	247	45	240	37	37
75	224	432	280	266	390	238	313	735	80	1231	248	46	239	37	37
80	215	417	284	265	395	239	320	714	80	1232	248	45	238	37	37
85	215	416	288	262	398	232	323	704	81	1233	245	46	236	36	38
90	212	411	294	260	400	224	323	677	81	1234	242	47	235	36	38
95	211	413	295	260	401	226	329	685	81	1235	241	47	234	36	38
100	213	420	298	261	405	217	333	700	82	1235	240	49	234	36	38
105	223	435	300	262	412	217	337	727	82	1236	240	48	233	36	38
110	223	441	306	264	419	220	340	731	83	1236	240	49	231	36	39
115	212	433	310	266	424	212	346	717	83	1237	241	50	232	36	39
120	202	418	311	268	426	214	349	693	84	1237	243	50	233	35	39
125	195	396	314	271	426	214	353	664	84	1238	242	51	232	35	39
130	188	379	314	273	425	213	353	643	85	1238	243	51	232	35	39
135	181	360	314	274	421	218	348	595	85	1239	242	54	233	35	38
140	177	347	312	276	416	218	342	576	85	1241	242	55	233	35	38
145	173	332	310	277	411	224	339	565	85	1244	242	54	235	35	38
150	171	321	305	281	408	225	340	552	85	1248	243	55	236	35	38
155	170	311	307	283	404	224	338	544	87	1255	244	55	239	35	37
160	168	301	301	286	401	232	338	539	86	1260	244	55	239	34	37
165	166	295	300	288	399	228	339	534	87	1263	244	57	239	35	37
170	163	287	297	287	397	232	337	521	86	1266	245	53	239	35	37

175	160	281	295	287	394	234	337	517	86	1266	245	40	238	35	37
180	159	274	294	287	389	234	338	512	86	1267	245	40	239	34	36
185	157	270	294	286	387	237	337	509	86	1267	245	42	239	34	36
190	156	264	290	286	384	235	338	504	86	1268	244	43	238	34	36
195	155	259	289	287	382	237	337	503	87	1269	244	43	240	34	36
200	154	254	286	285	378	237	337	500	86	1269	245	43	240	34	36
205	154	251	284	284	375	238	336	496	86	1270	247	44	240	34	36
210	153	247	282	283	372	237	335	494	86	1270	248	44	240	34	36
215	152	245	280	283	370	240	334	485	86	1271	248	44	241	34	35
220	151	241	276	283	367	236	332	479	86	1271	248	45	239	34	35
225	149	238	274	281	364	239	331	475	86	1271	248	45	239	34	35
230	149	235	271	280	360	240	329	472	86	1271	248	45	240	34	35
235	148	232	269	278	357	242	326	468	86	1271	248	45	240	33	35
240	148	231	266	277	355	236	325	464	87	1271	248	46	240	33	35
245	147	229	263	274	351	236	323	461	86	1271	248	46	239	33	35
250	146	225	262	274	349	235	322	457	87	1270	248	46	239	33	35
255	147	226	265	273	347	237	321	456	88	1270	248	47	240	33	35
260	147	223	258	272	344	232	319	451	87	1271	248	47	239	33	35
265	147	223	255	270	342	238	318	447	86	1271	248	46	239	33	35
270	146	220	253	270	339	234	316	442	87	1271	248	47	238	33	35
275	145	217	251	267	336	230	312	436	86	1269	248	48	236	33	34
280	142	216	248	266	333	228	310	432	86	1267	247	48	233	33	34
285	141	214	248	265	330	224	307	429	86	1267	246	49	233	33	34
290	140	212	246	264	327	224	305	426	86	1267	246	49	232	33	34
295	139	210	244	262	325	221	302	423	86	1267	245	50	231	33	34
300	138	209	242	263	323	223	302	420	86	1266	244	50	230	33	34
305	138	208	241	263	321	222	300	426	86	1265	243	51	230	32	34
310	138	207	239	266	320	223	303	431	86	1265	243	51	230	32	34
315	138	206	239	267	320	223	304	427	86	1264	242	52	230	32	33
320	138	206	238	268	317	224	307	426	87	1263	242	52	230	32	33
325	137	205	236	267	315	223	306	424	87	1262	241	52	229	32	33
330	136	205	235	266	314	224	306	422	87	1261	240	53	228	32	33
335	135	204	234	265	312	223	304	420	86	1261	240	53	229	32	33
340	135	203	233	265	310	222	303	419	87	1262	239	54	229	32	33
345	134	203	232	265	309	223	302	418	86	1261	238	54	228	32	33
350	134	202	232	265	308	222	301	416	86	1260	238	54	228	32	32
355	133	202	231	266	307	222	299	412	86	1260	237	56	228	32	32

360	133	201	230	265	306	222	297	408	86	1259	237	55	228	32	32
365	132	200	230	265	306	221	296	405	86	1258	237	56	228	32	32
370	132	200	229	265	305	221	294	404	85	1258	238	55	228	32	32
375	132	199	228	264	304	220	292	400	86	1258	237	56	228	32	32
380	132	199	228	265	303	221	291	397	85	1258	237	56	228	32	32
385	131	198	227	265	303	221	291	394	85	1257	238	56	228	32	31
390	131	198	227	265	302	221	287	393	85	1260	240	60	228	32	31

TEMPERATURE DATA SHEET #14A

		TEST TIME	390		
STACK AVG	**164**	TOP AVG	**279**	LT SIDE AVG	**269**
BACK AVG	**283**	RT SIDE AVG	**361**	BOTTOM AVG	**242**
FIREBOX AVG	**322**	SEC/CAT AVG	**509**	AMBIENT AVG	**84**

END	**242.6**	
START	**367.3**	
	-124.7	DELTA T

CIRCLE: **LOSS / GAIN**

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 9-23-2011 Analyte : CO_2 (15-1)

Unit : Total FSS Run # : 2

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

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

Span Cyl. # : 487905 Conc. : 12.20 % CO_2 Cyl. Press. : 1400 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 : C. Walters Time : 0820 Temp : 71 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.109	.109	.437
SPAN	48.8	.488	12.20	48.8	.488	12.234	.034	.137

POST RUN Audit : by : C. Walters Time : 1700 Temp : 82 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.109	.109	.437
SPAN	48.8	.488	12.20	49.1	.491	12.309	.109	.435

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

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

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

ZERO / SPAN CHECK DATA SHEET #15-2

Date : 9-23-2011 Analyte : O_2 (15-2)

Unit : Jotul F55 Run # : 2

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

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

Span Cyl. # : 487905 Conc. : 12.60 % O_2 Cyl. Press. : 1400 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % O_2

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

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

PRE RUN Audit : by : C. Watling Time : 0820 Temp : 71 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-.025	-.025	-.100
SPAN	12.60	.504	12.6	12.6	.504	12.575	-.025	-.100

POST RUN Audit : by : C. Watling Time : 1700 Temp : 82 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.001	ϕ	ϕ	ϕ
SPAN	12.60	.504	12.6	12.5	.501	12.500	-.100	-.400

± 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 : 9-23-2011 Analyte : CO (15-3)

Unit : Total FSS Run # : 2

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

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

Span Cyl. # : 487905 Conc. : 4.90 % CO Cyl. Press. : 1400 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 10.0 % CO

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

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

PRE RUN Audit : by C. Wartman Time : 0820 Temp : 71 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.013	.013	.128
SPAN	49.0	.490	4.90	49.0	.490	4.906	.006	.061

POST RUN Audit : by : C. Wartman Time : 1700 Temp : 82 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.013	.013	.128
SPAN	49.0	.490	4.90	48.9	.489	4.896	-.004	-.039

± 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 : 9-23-2011 Analyte : SO_2 (15-4)

Unit : Jotul F55 Run # : 2

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

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

Span Cyl. # : CC82089 Conc. : 1250 ppm SO_2 Cyl. Press. : 1670 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 2500 ppm SO_2

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

PRE RUN Audit : by : C. Worley Time : 0820 Temp : 71 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-1.900	-1.900	-.076
SPAN	50.0	.500	1250	50.0	.500	1246.7	-3.300	-.132

POST RUN Audit : by : C. Worley Time : 1700 Temp : 82 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.2	.002	3.094	3.094	.124
SPAN	50.0	.500	1250	50.1	.501	1249.2	-.800	-.032

± 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 FS5 RUN : 2 DATE : 9-23-2011

Thermocouple Check:

T/C # 1	— °F	T/C # 13	66.0 °F
T/C # 2	— °F	T/C # 14	66.1 °F
T/C # 3	65.3 °F	T/C # 15	65.9 °F
T/C # 4	64.5 °F	T/C # 16	60.5 °F
T/C # 5	64.5 °F	T/C # 17	54.7 °F
T/C # 6	64.8 °F	T/C # 18	66.6 °F
T/C # 7	64.6 °F	T/C # 19	— °F
T/C # 8	64.8 °F	T/C # 20	— °F
T/C # 9	64.6 °F	T/C # 21	— °F
T/C # 10	64.8 °F	T/C # 22	— °F
T/C # 11	64.1 °F	T/C # 23	— °F
T/C # 12	67.6 °F	T/C # 24	— °F

Thermocouple Readout:

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

ZERO -.1 °F Adj. to 0.0 °F ZERO .5 °F Difference .025 %

SPAN 2000.5 °F Adj. to 2000.0 °F SPAN 1999.7 °F Difference -.015 %

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 200.3 °F	400	= 400.0 °F
600	= 600.0 °F	800	= 799.9 °F	1000	= 999.9 °F
1200	= 1199.9 °F	1400	= 1399.6 °F	1600	= 1599.6 °F
1800	= 1799.9 °F	2000	= 2000.0 °F		

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

Scale Check Pre : 513.0 − 503.2 = 10.0

Post : 511.0 − 501.0 = 10.0

Stack Cleaned Prior to Test Run : YES ____ NO X

TABLE 1 ----- RAW DATA

CLIENT : Jotul TEST No. : 4

MODEL: F55 DATE: 28-Sep-11

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	718.000	0.150	85	1.03	5.70	500
5	719.500	0.270	85	0.48	12.20	375
10	721.534	0.140	85	0.70	5.50	525
15	722.988	0.170	86	0.78	9.20	475
20	724.601	0.230	86	0.27	12.70	400
25	726.516	0.210	86	0.42	15.70	425
30	728.318	0.210	86	0.62	14.80	425
35	730.120	0.180	86	0.53	15.40	450
40	731.822	0.180	88	0.58	16.00	450
45	733.537	0.180	88	0.31	15.30	450
50	735.252	0.260	89	0.09	12.30	375
55	737.316	0.260	90	0.23	10.20	375
60	739.388	0.200	90	0.68	8.40	425
65	741.217	0.180	91	0.92	7.70	450
70	742.951	0.120	91	1.15	6.40	550
75	744.370	0.130	91	1.09	6.70	525
80	745.856	0.130	91	1.37	6.50	525
85	747.342	0.110	91	1.36	6.50	575
90	748.700	0.100	91	0.88	6.10	600
95	750.000	0.141	91	0.92	6.10	500
100	751.561	0.130	91	1.29	5.00	525
105	753.047	0.140	91	1.36	4.90	500
110	754.608	0.140	91	1.42	4.80	500
115	756.168	0.180	91	1.28	5.20	450
120	757.902	0.180	91	1.05	5.40	450
125	759.638	0.200	91	1.07	5.50	425
130	761.477	0.200	91	1.01	5.60	425
135	763.315	0.200	91	1.01	5.40	425
140	765.154	0.200	91	1.00	5.30	425
145	766.992	0.200	91	0.89	5.20	425
150	768.831	0.230	91	0.92	5.10	400
155	770.784	0.230	91	0.87	5.00	400
160	772.737	0.230	91	0.89	4.90	400
165	774.690	0.230	91	0.90	4.90	400
170	776.643	0.230	91	0.90	4.80	400
175	778.596	0.230	91	0.91	4.80	400

180	780.549	0.230	91	0.90	4.60	400
185	782.502	0.230	91	0.86	4.40	400
190	784.456	0.230	91	0.87	4.50	400
195	786.409	0.230	91	0.79	4.40	400
200	788.362	0.230	91	0.73	4.40	400
205	790.315	0.230	91	0.80	4.30	400
210	792.268	0.230	91	0.77	4.20	400
215	794.221	0.230	91	0.67	4.20	400
220	796.174	0.230	91	0.70	4.00	400
225	798.127	0.230	91	0.64	4.00	400
230	800.080	0.230	91	0.63	3.90	400
235	802.033	0.230	91	0.68	4.00	400
240	803.986	0.230	91	0.67	4.00	400
245	805.939	0.230	91	0.68	4.00	400

TABLE 2---RAW DATA

CLIENT : Jotul TEST No. 4

MODEL: F55 DATE: 28-Sep-11

METER CAL. FACTOR (Y)	0.927		Wt. WOOD BURNED(LB)	17.8	Lbs
BAROMETRIC PRESS.(Pb)	30.32	in Hg	WET,FUEL MOISTURE %	16.218	%
LEAK RATE POST (Lp)	0.000	cfm	Wt. PART. COLLECTED	0.4796	g
WATER VOL. (V1c)	99.5	Ml	METER VOLUME Vm	87.939	mcf
TEST TIME (MIN)	245	min	HC MOLE FRACTION	0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT : Jotul TEST No. 4

MODEL: F55 DATE: 28-Sep-11

AVG DELTA H	-------	0.20	in H2O	AVG PRCNT CO	-------	0.83	%
AVG METER TEMP. Tm	-------	90	deg F	AVG PRCNT CO2	-------	6.80	%
AVG PPM SO2	-------	439	PPM	AVG BAL CO2/CO	-------	8.18	%

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul TEST No. 4

MODEL: F55 DATE: 28-Sep-11

STD SAMPLE VOL. Vm(std) d) ------	79.37	dscf	STACK GAS FLOW Qsd -------	666.639	dscf/Hr
				11.11	& dscf/min
VOL. WATER VAPOR Vw(s td) -----	4.683	scf	PARTICULATE CONCTRT. C s ------	0.0060	g/dscf
PRCNT MSTR Bws -------	5.57	%	PARTC.EMISS. RATE E -------	4.03	g/Hr
BURN RATE BR -------	1.66	Kg/Hr	MOLES OF GAS PER Lb WOOD Nt ----	0.47	Lb-mole/Lb
CO EMISSION RATE -------	185.61	g/Hr	PART.EMISS. RATE ------	2.43	g/Kgdry fuel
	& 112.01	g/Kgdry fuel			

TABLE 5 ---- PROPORTIONAL RATE VARIATION

CLIENT : Jotul TEST No. : 4

MODEL: F55 DATE: 28-Sep-11

TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR	PROPRTN RATE VAR. AVERAGE
5	682.9	97	100
10	694.7	99	
15	694.4	99	
20	696.4	99	
25	696.4	99	
30	696.2	99	
35	696.2	99	
40	694.9	99	
45	698.9	100	
50	698.3	100	
55	699.2	100	
60	701.3	100	
65	700.8	100	
70	702.8	100	
75	702.9	100	
80	702.6	100	
85	702.6	100	
90	703.2	100	
95	702.4	100	
100	702.9	100	
105	702.6	100	
110	702.9	100	
115	702.5	100	
120	702.8	100	
125	703.6	100	
130	704.0	100	
135	703.6	100	
140	704.0	100	
145	703.6	100	
150	704.0	100	
155	703.7	100	
160	703.7	100	
165	703.7	100	
170	703.7	100	
175	703.7	100	
180	703.7	100	

185	703.7	100
190	704.1	100
195	703.7	100
200	703.7	100
205	703.7	100
210	703.7	100
215	703.7	100
220	703.7	100
225	703.7	100
230	703.7	100
235	703.7	100
240	703.7	100
245	703.7	100

COMPUTER INPUT DATA SHEET #1

4.03

Client: Jotul North America

Address: 55 Hutcherson
Gorham, ME. 04038

Phone: 1-800-797-5912 Fax:

Run No.: 4 Date of Test: 9-28-2011 Burn Rate: 1.657

Model No.: F55 ☐ min ☐ min-1.25 ☐ fan

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

Dry Gas Meter Y Factor: .927 (0.000) (Data Sheet #2) Post Leak Rate: 0.000 cfm (.000) (Data Sheet #2) Time: 245 min. (000) (Data Sheet #2)

Dry Gas Meter Volume: 87.939 cf (00.000) (Data Sheet #2)

Stack Flow: 7,950 dscfm (00.000) (Data Sheet #2) Δ H: .198 in. H_2O (.000) (Data Sheet #2)

Maximum Vac.: 3.0 (0.0) (Data Sheet #2) Barometric Pressure: 30.32 in. Hg (00.00) (Data Sheet #2)

H_2O Captured: 99.5 g (00.0) (Data Sheet #3)

Front Half Catch % Of Total: 31.9 % (00.0) (Data Sheet #6) Total Particulate Catch: .4796 g (0.0000) (Data Sheet #6)

Flue Gas Moisture: 5.5759 % (00.000) (Data Sheet #7)

Particulate Emission: .0933 gr/dscf (0.0000) (Data Sheet #7)

Relative Humidity: 47.0 % RH (00.0) (Data Sheet #8) Ambient Moisture: 1.55 % H_2O (0.00) (Data Sheet #8)

Preburn Fuel Wt.: 37.0 lbs. (00.0) (Data Sheet #8) Coal Bed Wt.: 3.9 lbs. (00.0) (Data sheet #8) Test Fuel Wt.: 17.8 lbs. (00.0) (Data sheet #8)

Heat Output (EPA Default): 19980.4 BTU/hr (00,000.0) (Data Sheet #8)

Kindling Fuel % Moisture (wet): 13.144 % (00.000) (Data Sheet #10) Pretest Fuel % Moisture (wet): 16.580 % (00.000) (Data Sheet #10)

Test Fuel % Moisture (dry): 19.357 % (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove]) Test Fuel % Moisture (wet): 16.218 %

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

Stack Static Pressure: -.047 in. H_2O (+/- .000) (Data Sheet #12)

Average Ambient Temperature: 85 °F (00) (Data Sheet #14) Stove Temperature Change: -111.8 °F (+/- 000.0) (Data Sheet #14)

Start = 1030

End = 1435

meter temp = 550

METER BOX DATA SHEET PAGE # 2

Page: 1 of 3

UNIT: Jotul FS5 RUN: 4 DATE: 9-28-2011

Meter Box: 5H Y Factor: .927

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

15 " Hg @ 1000 cfm _____ " Hg @ _____ cfm

Inject SO^2 @ 100 cc/min. Nozzle: Probe @ 3/8 " od Initial Volume: 1500

ROTO: PRESS: .18			SAMPLING RATIO: 23 : 1				BP: 30.35		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1030	718.000	—	6.945	.15	85	500	85	2.0
5	35	719.500	—	9.260	.27	85	375	85	3.0
10	40	721.534	721.534	6.614	.14	85	525	85	2.0
15	45	722.988	722.988	7.247	.17	86	475	86	2.0
20	50	724.601	724.601	8.166	.23	86	400	86	2.0
25	55	726.516	726.516	8.156	.21	86	425	86	2.0
30	1100	728.318	728.318	8.156	.21	86	425	86	2.0
35	05	730.120	730.120	7.703	.18	86	450	86	2.0
40	10	731.822	731.822	7.675	.18	88	450	88	2.0
45	15	733.537	733.537	7.675	.18	88	450	88	2.0
50	20	735.252	735.252	9.193	.26	89	375	89	2.0
55	25	737.316	737.316	9.176	.26	90	375	90	2.0
ROTO PRESS: .18			TOTALS:	96.516	2.44	1040	BP.: 30.35		
60	1130	739.388	739.388	8.096	.20	90	425	90	2.0
65	35	741.217	741.217	7.633	.18	91	450	91	2.0
70	40	742.951	742.951	6.245	.12	91	550	91	2.0
75	45	744.370	744.370	6.542	.13	91	525	91	2.0
80	50	745.856	745.856	6.542	.13	91	525	91	2.0
85	55	747.342	747.342	5.974	.11	91	575	91	2.0
90	1200	748.700	748.700	5.725	.10	91	600	91	2.0
95	05	750.000	750.000	6.870	.14	91	500	91	2.0
100	10	751.561	751.561	6.542	.13	91	525	91	2.0
105	15	753.047	753.047	6.870	.14	91	500	91	2.0
110	20	754.608	754.608	6.870	.14	91	500	91	2.0
115	25	756.168	756.168	7.633	.18	91	450	91	2.0
			TOTALS:	81.542	1.70	1091	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	178.058	4.14	2131	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 2 of 3

UNIT: Total FSS RUN: 4 DATE: 9-28-2011

Meter Box: 514 Y Factor: 1.927

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

15 " Hg @ 1.00 cfm _____ " Hg @ _____ cfm

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

ROTO: PRESS: .18 SAMPLING RATIO: 23 : 1 BP: 30.30

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1230	757.902	757.902	7.620	.18	91	450	91	2.0
125	35	759.638	759.638	8.068	.20	91	425	91	2.0
130	40	761.477	761.477	8.068	.20	91	425	91	2.0
135	45	763.315	763.315	8.068	.20	91	425	91	2.0
140	50	765.154	765.154	8.068	.20	91	425	91	2.0
145	55	766.992	766.992	8.068	.20	91	425	91	2.0
150	1300	768.831	768.831	8.573	.23	91	400	91	2.0
155	05	770.784	770.784	8.573	.23	91	400	91	2.0
160	10	772.737	772.737	8.573	.23	91	400	91	2.0
165	15	774.690	774.690	8.573	.23	91	400	91	2.0
170	20	776.643	776.643	8.573	.23	91	400	91	2.0
175	25	778.596	778.596	8.573	.23	91	400	91	2.0
ROTO PRESS: .18			TOTALS:	99.398	2.56	1092	BP.: 30.30		
180	1330	780.549	780.549	8.573	.23	91	400	91	2.0
185	35	782.502	782.502	8.573	.23	91	400	91	2.0
190	40	784.456	784.456	8.573	.23	91	400	91	2.0
195	45	786.409	786.409	8.573	.23	91	400	91	2.0
200	50	788.362	788.362	8.573	.23	91	400	91	2.0
205	55	790.315	790.315	8.573	.23	91	400	91	2.0
210	1400	792.268	792.268	8.573	.23	91	400	91	2.0
215	05	794.221	794.221	8.573	.23	91	400	91	2.0
220	10	796.174	796.174	8.573	.23	91	400	91	2.0
225	15	798.127	798.127	8.573	.23	91	400	91	2.0
230	20	800.080	800.080	8.573	.23	91	400	91	2.0
235	25	802.033	802.033	8.573	.23	91	400	91	2.0
			TOTALS:	102.876	2.76	1092	MAX VACC =		
TOTAL Cu Ft			TOTALS:	202.274	5.32	2184	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 3 of 3

UNIT: Jotul F55 RUN: 4 DATE: 9-28-2011

Meter Box: SH Y Factor: .927

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

15 " Hg @ 100 cfm _____ " Hg @ _____ cfm

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

ROTO: PRESS: .18 SAMPLING RATIO: 23 : 1 BP: 30.30

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
240	1430	803.486	803.486	8.573	.23	91	400	91	2.0
245	35	805.939	805.939	8.573	.23	91	400	91	2.0
250									
255				17.146	.46	182			
260									
265									
270									
275									
280									
285									
290									
295									
ROTO PRESS:			TOTALS:				BP.:		
300									
305									
310									
315									
320									
325									
330									
335									
340									
345									
350						4497			
355				397.478	9.92				
			TOTALS:			90	MAX VACC =		3.0
TOTAL Cu Ft.		87.939	TOTALS:	7.950	.198	550	AVG. BP:		30.32

1.50

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : F53 RUN : 4 DATE : 9-28-11

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	690.0	581.0	487.8	922.9
INITIAL WT	618.7	577.0	486.5	900.0
NET WT GRAMS	71.3	4.0	1.3	22.9

TOTAL CATCH : 99.5 **GRAMS H_2O**

FRONT HALF

FILTER #	32F	
FINAL WT g	.7270	
INITIAL WT g	.6257	
NET WT g	.1013	

BEAKER #	106
DESC.	ACETONE
FINAL WT g	96.7612
INITIAL WT g	96.7089
NET WT g	.0523
VOL. DESC. ml	75

BACK HALF

FILTER #	32B	
FINAL WT g	.4060	
INITIAL WT g	.3484	
NET WT g	.0576	

BEAKER #	107	108	109	110	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	107.4970	104.9614	98.9359	104.0499	
INITIAL WT g	107.3420	104.9474	98.8653	104.0149	
NET WT g	.1550	.0170	.0706	.0350	(.1056)
VOL. DESC ml	150	75	175	100	(.075)

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 11-4-2010 Time : 1600 By : _____

Manufacturer S & S Grade : # 25 Glass Front Size : 11 cm Lot No. : 393588

Back Size: 8.2 cm Lot No. : J11441535

	DATE: 10-12-10	BY: AV	DATE: 11-15-10	BY: AV	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
31F	0.6217	10:05	0.6216	10:50		
32F	0.6258	10:06	0.6257	10:51		
33F	0.6225	10:07	0.6224	10:52		
34F	0.6160	10:08	0.6160	10:53		
35F	0.6161	10:09	0.6161	10:54		
36F	0.6216	10:10	0.6216	10:55		
37F	0.6160	10:11	0.6162	10:56		
38F	0.6120	10:12	0.6120	10:57		
39F	0.6142	10:13	0.6141	10:58		
40F	0.6150	10:14	0.6146	10:59		
31B	0.3512	10:15	0.3510	11:00		
32B	0.3487	10:16	0.3484	11:01		
33B	0.3477	10:17	0.3478	11:02		
34B	0.3522	10:18	0.3525	11:03		
35B	0.3478	10:19	0.3476	11:04		
36B	0.3505	10:20	0.3505	11:05		
37B	0.3493	10:21	0.3491	11:06		
38B	0.3468	10:22	0.3469	11:07		
39B	0.3503	10:23	0.3500	11:08		
40B	0.3494	10:24	0.3490	11:09		

Checked by: CP Date: 10-2-11 Time: 1500

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
11-14-10	0840	CP		67	42
11-15-10	0930	CP		70	48

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 2-13-2011 Time : 1300 By : CP

	DATE: 2-15-2011	BY: AV	DATE: 2-16-2011	BY: AV	DATE: 2-22-2011	BY: AV
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
101	95,5922	10:00	95,5913	1030	95,5916	1035
102	96,3724	10:01	96,3704	1031	96,3700	1036
103	102,3550	10:02	102,3534	1032	102,3539	1037
104	106,2077	1003	106,2069	1033	106,2068	1038
105	107,0647	1004	107,0616	1034	107,0620	1039
106	96,7105	1005	96,7084	1035	96,7089	1040
107	107,3435	1006	107,3425	1036	107,3420	1041
108	104,9480	1007	104,9471	1037	104,9474	1042
109	98,8658	1008	98,8648	1038	98,8653	1043
110	104,0155	1009	104,0148	1039	104,0149	1044
111	97,7415	1010	97,7406	1040	97,7401	1045
112	104,8863	1011	104,8852	1041	104,8854	1046
113	106,4430	1012	106,4420	1042	106,4421	1047
114	106,1930	1013	106,1917	1043	106,1920	1048
115	106,8185	1014	106,8166	1044	106,8166	1049
116	105,9340	1015	105,9329	1045	105,9329	1050
117	103,8890	1016	103,8872	1046	103,8876	1051
118	107,1541	1017	107,1528	1047	107,1532	1052
119	105,5031	1018	105,5009	1048	105,5014	1053
120	106,0922	1019	106,0903	1049	106,0907	1054
121	106,3694	1020	106,3675	1050	106,3680	1055
122	107,0231	1021	107,0217	1051	107,0216	1056
123	108,6532	1022	108,6519	1052	108,6523	1057
124	106,2102	1023	106,2083	1053	106,2088	1058
125	107,7525	1024	107,7506	1054	107,7509	1059

R1

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH	
2-15-11	0930	CW	-	75	41	Checked by : CP
2-16-11	0930	CW	-	66	49	Date : 10-2011
2-22-11	1000	CW	-	70	48	Time : 1500

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : F55 **RUN :** 4 **DATE :** 9-28-11 **Page :** 1 **of** 1

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
106	9-29	1500	CJ	196.7609	10-1	1532	CJ	96.7612	10-2	1435	CJ				
107	9-29	1500	CJ	107.4966	10-1	1533	CJ	107.4970	10-2	1436	CJ				
108	9-29	1500	CJ	104.9645	10-1	1534	CJ	104.9644	10-2	1437	CJ				
109	9-29	1500	CJ	98.9358	10-1	1535	CJ	98.9359	10-2	1438	CJ				
110	9-29	1500	CJ	104.0495	10-1	1536	CJ	104.0499	10-2	1439	CJ				

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
32F	9-28	1630	CJ	.7375	9-29	0855	CJ	.7275	9-30	1012	CJ	.7270	10-1	1530	CJ
32F	9-28	1630	CJ	.4097	9-29	0856	CJ	.4064	9-30	1013	CJ	.4060	10-1	1531	CJ

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	9-29-11	0840	CJ	72	42
2	9-30-11	1000	CJ	70	48
3	10-1-11	1520	CJ	70	48
4	10-2-11	1430	CJ	74	47
5					

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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 4-13-2011 Through	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0000	10.0001	1.0000	.0998	CP	4-13-11	1030	66	49
100.0001	10.0002	1.0000	.0999	CP	4-15-11	1330	75	48
100.0004	10.0000	.9999	.0998	CP	4-19-11	1600	74	44
100.0003	10.0000	1.0000	.0999	CP	4-20-11	1815	72	46
100.0000	10.0001	.9999	.1000	CP	6-16-11	0900	76	39
99.9997	9.9999	.9998	.0999	CP	6-19-11	1530	74	44
99.9996	10.0002	1.0000	.0999	CP	6-20-11	1600	73	47
100.0000	10.0000	.9998	.0999	CP	6-21-11	1400	73	47
100.0000	10.0000	1.0001	.0999	CP	6-22-11	1200	72	46
99.9999	9.9998	1.0000	.1000	CP	6-23-11	1700	76	49
100.0000	10.0002	1.0000	.0999	CP	6-24-11	1400	75	48
100.0000	10.0000	1.0000	.0999	CP	6-27-11	1230	78	46
100.0001	10.0002	.9999	.0998	CP	6-30-11	1030	78	46
99.9995	10.0000	.9999	.0999	CP	7-1-11	1030	70	48
99.9999	9.9999	1.0000	.1000	CP	7-2-11	1145	75	45
100.0000	9.9999	.9999	.0999	CP	7-5-11	1000	73	47
99.9999	10.0001	1.0000	.0999	CP	7-6-11	0930	76	49
100.0000	9.9997	1.0000	.0997	CP	9-22-11	1700	77	46
100.0000	10.0001	1.0000	.0999	CP	9-24-11	1700	77	49
100.0000	9.9998	1.0001	.1000	CP	9-25-11	1300	76	49
100.0000	9.9999	1.0001	.0998	CP	9-27-11	1000	77	49
99.9996	9.9999	1.0000	.0998	CP	9-29-11	0840	72	42
99.9997	9.9998	.9999	.1000	CP	9-30-11	1000	70	48
99.9996	9.9998	1.0000	.0999	CP	10-1-11	1520	70	45
99.9998	10.0002	1.0000	.0997	CP	10-2-11	1430	74	47

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 11-11-10 Through 4-7-11	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0000	10.0002	1.0000	.0998	CP	11-11	0840	67	42
100.0000	10.0000	1.0001	.1000	CP	11-15	0930	70	48
100.0000	10.0001	1.0000	.0999	CP	11-19	0930	65	48
100.0000	10.0000	1.0000	.1000	CP	11-23	1400	66	45
100.0000	9.9997	1.0000	.0998	CP	11-24	1400	65	48
100.0000	10.0000	.9999	.0998	CP	11-26	1100	67	46
100.0000	10.0001	1.0001	.0997	CP	12-14	1000	75	41
100.0001	10.0003	1.0000	.0999	CP	12-16	1100	75	48
100.0000	10.0002	1.0000	.0999	CP	12-18	1000	77	46
100.0000	10.0000	1.0000	.0999	CP	12-21	1100	66	49
100.0000	10.0004	1.0000	.0997	CP	12-22	1400	72	48
100.0000	10.0001	1.0000	.1001	CP	12-23	1100	76	38
100.0000	10.0000	.9999	.0999	CP	12-24	1000	67	46
100.0000	10.0001	1.0001	.0999	CP	12-25	1100	70	49
100.0000	10.0000	1.0000	.0999	CP	1-19-11	0930	66	49
100.0000	9.9999	1.0000	.0999	CP	1-21-11	1400	77	44
99.9996	10.0000	1.0000	.0998	CP	1-25-11	0900	75	48
100.0000	10.0002	1.0001	.1000	CP	1-26-11	1400	74	44
100.0000	10.0001	.9998	.0998	CP	1-27-11	1200	65	48
100.0000	10.0002	1.0000	.0999	CP	1-28-11	1630	70	48
100.0000	10.0001	1.0001	.0999	CP	1-29-11	1200	68	48
100.0000	10.0002	1.0000	.0999	CP	1-30-11	1500	66	49
100.0000	9.9999	1.0000	.0999	CP	2-15-11	0930	75	41
100.0000	10.0000	1.0001	.1000	CP	2-16-11	0930	66	49
100.0000	10.0002	1.0000	.0999	CP	2-22-11	1000	70	48
100.0000	10.0001	1.0002	.0999	CP	3-4-11	1200	69	47
100.0000	10.0004	.9999	.1000	CP	3-5-11	1000	70	48
100.0000	10.0001	1.0000	.0999	CP	3-8-11	1000	74	47
100.0000	10.0000	1.0000	.1000	CP	3-9-11	1600	67	46
100.0000	10.0002	0.9999	.0999	CP	3-10-11	1600	66	49
100.0000	10.0000	1.0000	.0999	CP	3-12-11	1530	73	47
100.0000	10.0001	.9999	.0998	CP	3-13-11	1200	65	48
100.0000	10.0001	1.0000	.0999	CP	3-29-11	1120	76	49
100.0000	10.0000	.9999	.0998	CP	3-30-11	0800	74	47
100.0000	10.0001	1.0000	.0999	CP	3-31-11	1000	70	48
100.0000	10.0002	.9998	.0999	CP	4-4-11	0830	74	47
100.0000	10.0003	1.0000	.1000	CP	4-5-11	1130	73	47
100.0000	9.9999	1.0001	.0999	CP	4-6-11	1030	77	49
100.0000	10.0000	9.9999	.1001	CP	4-7-11	1000	78	40

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 2-26-2010 Through 11-10-2010	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0001	10.0004	.9999	.0999	CP	2-26	0840	72	46
100.0001	9.9999	.9999	.0999	CP	2-27-10	1045	72	46
100.0000	10.0000	1.0000	.0999	CP	2-28	1100	70	48
100.0000	10.0000	1.0000	.0999	CP	3-1	0900	66	49
100.0000	10.0002	.9998	.1002	CP	3-5	1200	70	48
100.0001	9.9999	.9999	.0998	CP	3-7	1330	68	47
100.0000	9.9999	.9999	.0999	CP	3-9	1130	70	41
100.0000	10.0001	1.0000	.0999	CP	3-10	1200	70	44
100.0000	10.0001	.9999	.0999	CP	3-11	0900	66	49
99.9999	9.9999	.9999	.0999	AM	3-15	1000	70	48
100.0000	10.0000	1.0000	.0998	CP	3-17	0900	72	46
100.0000	9.9998	1.0001	.1000	CP	4-8	1930	76	49
99.9999	10.0001	1.0000	.0999	CP	4-10	1130	73	42
99.9999	10.0001	1.0001	.1000	CP	4-11	1430	74	47
100.0000	10.0002	1.0000	.1000	CP	4-21	1830	77	49
100.0000	10.0000	1.0000	.0999	CP	4-22	1130	74	47
100.0000	10.0001	1.0000	.0999	CP	4-23	1015	74	44
100.0002	9.9999	1.0000	.1000	CP	4-24	0930	68	47
100.0000	9.9999	.9999	.1000	CP	4-25	0930	73	47
100.0000	9.9999	1.0001	.0999	CP	4-26	0900	76	42
100.0000	10.0002	1.0000	.0999	CP	4-30	1320	78	43
99.9998	10.0000	1.0002	.0999	CP	8-26	0845	78	49
100.0000	9.9998	1.0001	.0999	CP	8-27	0955	78	43
100.0000	10.0000	1.0000	.1000	CP	8-28	1600	73	47
99.9998	10.0000	.9999	.1000	CP	8-29	1400	70	48
100.0000	10.0000	1.0000	.0999	CP	8-31	0720	72	46
100.0001	10.0000	1.0000	.1000	CP	9-1	1330	76	49
100.0000	10.0001	1.0000	.0999	CP	9-2	1300	68	47
100.0000	10.0000	1.0000	.1000	CP	9-3	1130	72	46
100.0000	10.0001	1.0000	.0999	CP	10-26	0750	70	48
100.0000	10.0000	.9998	.0997	CP	10-27	1250	74	47
100.0000	9.9999	1.0000	.0999	CP	10-29	1400	71	49
100.0000	9.9999	1.0000	.0999	CP	11-1	1000	78	49
100.0000	10.0000	.9999	.0999	CP	11-2	0715	70	48
100.0000	10.0000	1.0000	.0999	CP	11-3	0900	70	48
100.0000	10.0001	.9999	.1000	CP	11-5	1320	76	42
100.0000	10.0001	.9999	.1000	CP	11-8	1230	70	48
100.0000	10.0001	1.0000	.0998	CP	11-9	1015	71	41
100.0000	10.0000	.9999	.0999	CP	11-10	0905	70	44

BLANK PROCESSING DATA SHEET # 5

UNIT : F55 RUN : 4 DATE : 9-28-11

BLANKS DONE : 8-31-2010

BEAKER	A	B	C
	200 ml ACETONE	75 ml DICHLOR	200 ml WATER
	FISHER OPTIMA LOT # 073283	FISHER OPTIMA LOT # 066390	DWNA, Inc Sparkletts Distilled
FINAL WEIGHT	108.9019	106.3074	106.9680
TARE WEIGHT	108.9001	106.3058	106.9640
NET WEIGHT	.0018	.0016	.0040

TARE BEAKERS INTO DESC : TIME : 1410 DATE : 8-7-2010

DATE 8-26 BY : CP DATE 8-27 BY : CP DATE : BY :

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.8999	0435	108.9001	1050		
B	106.3061	0436	106.3058	1051		
C	106.9641	0437	106.9640	1052		

FINAL BEAKERS INTO DESC : TIME : 8-28 DATE : 0820

DATE 8-29 BY : CP DATE 8-31 BY : CP DATE : BY :

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9019	1501	108.9019	0742		
B	106.3076	1502	106.3074	0743		
C	106.9676	1503	106.9680	0744		

TARE QC

DATE	TIME	BY	WB	DB	%
8-26-10	0845	CP		78	49
8-27-10	0955	CP		78	43

FINAL QC

DATE	TIME	BY	WB	DB	%
8-29	1400	CP		70	48
8-31	0720	CP		72	46

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT : FSS RUN : 4 DATE : 9-28-11

BLANK CALCULATIONS

Acetone : .0018 g ÷ 200 ml = .000009 g/ml

Dicholoromethane : .0016 g ÷ 75 ml = .000021 g/ml

Distilled Water : .0040 g ÷ 200 ml = .000020 g/ml

FRONT HALF CATCH

FILTERS : .1013 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .1013 g

BEAKERS : .0523 (Total Catch) g - 75 (ml Acetone) (.0007 .000009 g) (Blank Value / ml Acetone) = .0516 g

TOTAL FRONT HALF CATCH : .1529 g

BACK HALF CATCH

FILTERS : .0576 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0576 g

BEAKERS :

Acetone : .1550 (Total Catch) g - 150 (ml Acetone) (.0014 .000009 g) (Blank Value / ml Acetone) = .1536 g

Extract : .0170 (Total Catch) g - 75 (ml Dichloromethane) (.0016 .000021 g) (Blank Value / Dichloromethane) = .0154 g

Water : .1056 (Total Catch) g - 275 (ml Water) (.0055 .000020 g) (Blank Value / Water) = .1001 g

TOTAL BACK HALF CATCH : .3267 g

TOTAL CATCH : .4796 g

% FRONT HALF : 31.9 %

CALCULATIONS DATA SHEET # 7

UNIT: Jotul F-55 RUN: 4 DATE: 9-28-2011

1) $Vm(std) = \dfrac{(87.939\ Vm)(17.64)(.927\ mcf)\left(30.32\text{" Hg} + \frac{.198\text{" } H_2O}{13.6}\right)}{(550\ TmA)} = \underset{000.0000}{79.3113}$ dscf

2) $Vw(std) = (.04707)(99.5\ ml\ H_2O) = \underset{00.0000}{4.6835}$ scf

3) $Asw = \dfrac{(4.6835\ scf)}{(4.6835\ scf + 79.3113\ dscf)} = \underset{.0000}{.0558}$ Bws × 100 = $\underset{00.0000}{5.5759}$ % H_2O

4) $Cs = \dfrac{(.4796\ g.)}{(79.3113\ dscf)}(15.43) = \underset{0.0000}{.0933}$ gr / dscf

5) Estimated g / hr = $\dfrac{(.4796\ g.)}{(79.3113\ dscf)}\left(\underset{00.0000}{7.950}\ dscfm\right)(60) = \underset{00.0000}{2.8844}$ 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 : Total F55 RUN : 4 DATE : 9-28-2011

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

Wet Bulb / Dry Bulb

Pre : WB : 60 DB : 78 = 43.0 % RH 1.1 % H_2O

Post : WB : 70 DB : 83 = 51.0 % RH 2.0 % H_2O

Average : 47.0 % 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 : 1.0 -

Preburn Fuel Weight : 18.4 + 15.5 + 2.1 Total : 36.0 -

Kindling & Preburn Fuel Weight (wood only) (lbs) : **Total :** 37.0 -

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

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

Lower : .20 × fuel weight : Always round UP to nearest tenth **Actual Coal Bed Weight :** 3.9

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

Test Fuel (.75" × 1.5" × 5" spacers) = 24 pcs

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" × 4"	16	5	10.9	61.2
4" × 4"	16	2	6.9	38.8

Test Fuel Weight : 17.8 - lbs

Estimated Dry Burn Rate :

$$\frac{17.8 - (17.8 \times .16218)}{2.2046} \times \frac{60}{\frac{245}{\text{TIME}}} = 1.157 \text{ kg / hr}$$

Estimated BTU's/hr : 19,140 × $\frac{63}{100}$ × $\frac{1.157}{\text{DBR}}$ = 19980.4 BTU's/hr

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

220

WOOD STOVE OPERATING DATA PAGE #9

Unit : Totul F55 Run : 4 Date : 9-28-2011

FIRE STARTED: 0728

WARM UP AND PREBURN:

PRIMARY AIR : Set wide open for all warm-up / preburn fuel charges. Then set to 5/8" at start of preburn.

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

CHARCOAL BED PREPARATION :

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

TEST:

DOOR wide open during loading 0 min. 35 sec.

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

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 12 or 16 inches.

1st warm up / pre-burn fuel charge (18.4 lbs.) added at 0740

2nd warm up / pre-burn fuel charge (15.5 lbs.) added at 0850

3rd warm up / pre-burn fuel charge (2.1 lbs.) added at 0925

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 : Total FSS Run : 4 Date : 9-28-2011

Room Temperature : 75 °F Temperature Correction Set? : (Yes) No

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

Time Test Fuel moisture reading taken : 0830

pc #	Dimen.	Use	TOP	BOTTOM	SIDE	Avg Corrected
1	2"×4"×8'	K	15.1	15.2	15.1	15.133
2						
3						
4	2"×4"×8'	P	20.6	20.2	18.9	19.9
5	2"×4"×8'	P	17.9	21.3	18.2	19.1
6	2"×4"×8'	P	19.7	22.6	18.5	20.3
7	2"×4"×8'	P	20.2	20.4	20.0	20.2
8	2"×4"×8'	P				(79.5)
9						
10						
11						
12	2×4×16"	T	18.0	18.0	18.0	18.0
13	"	T	18.6	18.6	18.9	18.7
14	"	T	19.9	19.9	19.9	19.9
15	"	T	17.8	17.6	18.1	17.9
16	"	T	24.1	24.7	24.7	24.5
17	4×4×16"	T	18.4	18.6	18.6	18.5
18	"	T	18.0	18.0	18.1	18.0
19						(135.5)
20	Spacers	T	22.8	24.1	19.9	22.3

DRY

WET

DRY

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	15.133 %	19.875 %	19.357 %
Wet Moisture % :	13.144 %	16.580 %	16.218 %

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

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

GAS DATA SHEET #12

WEIGHT: 3.9 DATE: 9-28-2011

UNIT: Total FSS RUN: 4 PAGE: 1 OF 2

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
0 1030	21.7	17.8	—	.225	5.7	.560	14.0	.101	1.03	:038	.500
5 35	20.6	16.7	1.1	.487	12.2	.325	8.1	.046	.48	:056	.375
10 40	20.0	16.1	.6	.217	5.5	.583	14.6	.068	.70	:050	.525
15 45	19.2	15.3	.8	.369	9.2	.432	10.8	.076	.78	:054	.475
20 50	18.2	14.3	1.0	.509	12.7	.313	7.8	.025	.27	:059	.400
25 55	16.8	12.9	1.4	.629	15.7	.185	4.6	.040	.42	:061	.425
30 1100	15.5	11.6	1.3	.595	14.8	.213	5.3	.060	.62	:069	.425
35 05	14.0	10.1	1.5	.617	15.4	.193	4.8	.051	.53	:067	.450
40 10	12.7	8.8	1.3	.642	16.0	.169	4.2	.056	.58	:072	.450
45 15	11.7	7.8	1.0	.615	15.3	.205	5.1	.029	.31	:071	.450
50 20	10.7	6.8	1.0	.492	12.3	.337	8.4	.007	.09	:071	.375
55 25	10.1	6.2	.6	.403	10.2	.412	10.3	.020	.23	:068	.375
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.739'	*****
60 30	9.7	5.8	.4	.334	8.4	.468	11.7	.066	.68	:055	.425
65 35	9.3	5.4	.4	.309	7.7	.484	12.1	.090	.92	:054	.450
70 40	8.9	5.0	.4	.255	6.4	.524	13.1	.113	1.15	:050	.550
75 45	8.6	4.7	.3	.268	6.7	.520	13.0	.107	1.09	:049	.525
80 50	8.2	4.3	.4	.258	6.5	.516	12.9	.135	1.37	:049	.525
85 55	8.0	4.1	.2	.258	6.5	.516	12.9	.134	1.36	:049	.575
90 1200	7.6	3.7	.4	.243	6.1	.552	13.8	.086	.88	:048	.600
95 05	7.3	3.4	.3	.244	6.1	.548	13.7	.090	.92	:048	.500
100 10	7.1	3.2	.2	.198	5.0	.579	14.5	.127	1.29	:046	.525
105 15	7.0	3.1	.1	.196	4.9	.579	14.5	.134	1.36	:045	.500
110 20	6.8	2.9	.2	.192	4.8	.579	14.5	.140	1.42	:044	.500
115 25	6.7	2.8	.1	.206	5.2	.571	14.3	.126	1.28	:044	.450
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.581'	*****
120 30	6.5	2.6	.2	.214	5.4	.571	14.3	.103	1.05	:044	.450
125 35	6.4	2.5	.1	.220	5.5	.567	14.2	.105	1.07	:044	.425
130 40	6.3	2.4	.1	.223	5.6	.563	14.1	.099	1.01	:043	.425
135 45	6.1	2.2	.2	.215	5.4	.571	14.3	.099	1.01	:043	.425
140 50	6.0	2.1	.1	.210	5.3	.579	14.5	.098	1.00	:043	.425
145 55	5.9	2.0	.1	.207	5.2	.587	14.7	.087	.89	:043	.425
150 1300	5.8	1.9	.1	.204	5.1	.587	14.7	.090	.92	:042	.400
155 05	5.7	1.8	.1	.200	5.0	.595	14.9	.085	.87	:042	.400
160 10	5.5	1.6	.2	.195	4.9	.599	15.0	.087	.89	:042	.400
165 15	5.4	1.5	.1	.195	4.9	.599	15.0	.088	.90	:041	.400
170 20	5.3	1.4	.1	.191	4.8	.603	15.1	.088	.90	:041	.400
175 25	5.2	1.3	.1	.190	4.8	.603	15.1	.089	.91	:041	.400
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.509'	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	1.829'	*****

GAS DATA SHEET #12

WEIGHT: 3.9 DATE: 9-28-2011

UNIT: Jotol F 55 RUN: 4 PAGE: 1 OF 2

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
180 T330	5.1	1.2	.1	.184	4.6	.611	15.3	.088	.90	.040	.400
185 35	5.0	1.1	.1	.176	4.4	.655	16.4	.084	.86	.040	.400
190 40	4.9	1.0	.1	.177	4.5	.615	15.4	.085	.87	.040	.400
195 45	4.8	.9	.1	.173	4.4	.623	15.6	.077	.79	.040	.400
200 50	4.7	.8	.1	.175	4.4	.623	15.6	.071	.73	.040	.400
205 55	4.6	.7	.1	.169	4.3	.627	15.7	.078	.80	.040	.400
210 1400	4.5	.6	.1	.167	4.2	.631	15.8	.075	.77	.040	.400
215 05	4.4	.5	.1	.166	4.2	.635	15.9	.065	.67	.040	.400
220 10	4.3	.4	.1	.158	4.0	.643	16.1	.068	.70	.040	.400
225 15	4.3	.4	.0	.157	4.0	.643	16.1	.062	.64	.039	.400
230 20	4.2	.3	.1	.154	3.9	.647	16.2	.061	.63	.039	.400
235 25	4.1	.2	.1	.157	4.0	643	16.1	.066	.68	.038	.400
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.476'	*****
240 1430	4.0	.1	.1	.157	4.0	.643	16.1	.065	.67	.038	.400
245 35	3.9	.0	.1	.160	4.0	.643	16.1	.066	.68	.038	.400
250 10											
255 45											
260 50											
265 55											
270 1500											
275											
280											
285											
290											
295											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.76'	*****
300											
305											
310											
315											
320											
325											
330											
335											
340											
345											
350											
355											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.552'	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	2.381'	*****

- .047'

PREBURN DATA SHEET #13

UNIT: Jotul F55 RUN: 4 DATE: 9-28-2011 PAGE: 1 of 1

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	~~Inlet FIREBOX~~	~~baffle SECONDAT~~	AMBIENT	STATIC	COMMENTS
0 0925	6.7	—	459	607	461	614	627	484	715	1004	81	:060	PREBURN START: # 2.3 UP
5 30	6.2	.5	363	591	465	558	624	495	674	961	87	:058	COAL BED SCALE RANGE:
10 35	5.7	.5	305	570	458	519	610	495	628	877	88	:056	4.4 → 3.6
15 40	5.3	.4	263	535	447	481	583	481	579	805	89	:054	PRIMARY AIR: 5/8"
20 45	5.0	.3	241	501	430	457	557	466	538	750	87	:051	SECONDARY AIR: N/A
25 50	4.9	.1	227	470	414	437	533	452	508	708	88	:050	FAN: Low
30 55	4.6	.3	219	452	400	424	518	440	491	689	82	:049	PUMPS ON AT: 0955
35 1000	4.4	.2	215	439	391	415	505	432	480	669	82	:048	CHECK WB/DB: N/A
40 05	4.3	.1	203	416	381	408	491	424	467	641	81	:044	
45 10	4.2	.1	190	388	369	405	477	420	456	614	80	:042	411
50 15	4.1	.1	181	363	356	400	464	414	445	591	80	:040	
55 20	4.0	.1	182	348	349	400	454	411	439	584	80	:040	
*****	****	***	****	*****	*****	****	*****	*****	*****	*****	*****	****	
60 25	4.0	.0	180	329	343	399	445	407	433	574	79	:038	384
65 30	3.9	.1	196	318	343	416	440	409	443	574	79	:038	
70 35													

at 4.6 add 3 blocks (7.1 lbs)

Jotul F55

Temperature Data Sheet 14

Run 4
9/28/11

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	196	318	343	416	440	409	443	574	81	1298	239	58	240	33	30
5	279	354	335	384	426	406	385	626	83	1292	240	45	241	33	30
10	236	341	323	371	410	400	367	558	83	1289	242	45	243	34	33
15	246	343	310	354	394	384	351	580	81	1287	242	46	242	34	34
20	266	362	302	339	384	371	341	608	81	1287	243	45	243	34	36
25	340	434	303	323	385	358	340	733	81	1286	240	46	244	34	37
30	371	476	311	311	395	344	344	793	81	1289	240	46	243	34	38
35	398	522	325	302	410	334	362	854	82	1293	241	47	245	34	39
40	410	553	340	296	427	329	375	889	84	1298	242	47	248	35	39
45	410	576	353	294	447	324	388	909	87	1306	241	48	248	35	39
50	378	567	365	293	465	317	396	904	86	1309	242	49	248	35	39
55	341	548	373	297	481	317	403	854	88	1313	240	49	248	35	39
60	306	516	375	299	484	315	401	796	88	1317	238	50	248	35	39
65	281	486	375	300	483	313	398	759	90	1321	237	50	246	35	39
70	262	457	372	300	479	312	391	715	89	1324	235	52	244	35	39
75	250	436	369	299	474	311	384	702	89	1326	233	53	242	36	38
80	241	418	364	299	471	309	381	684	90	1328	231	54	239	36	38
85	234	401	358	298	466	306	375	660	87	1329	230	54	236	36	38
90	229	386	353	298	460	305	372	651	87	1330	229	54	235	36	38
95	224	372	350	295	455	303	372	638	88	1331	230	55	233	36	37
100	216	357	345	293	448	302	369	615	88	1332	231	55	231	37	37
105	210	344	339	292	440	298	366	598	87	1332	231	56	231	37	37
110	206	333	332	293	432	295	366	588	87	1333	231	56	231	37	36
115	202	323	327	291	427	292	363	581	87	1333	231	52	230	37	36
120	200	316	321	291	423	291	364	577	85	1332	231	52	230	37	36
125	199	310	318	290	420	290	367	575	83	1331	232	52	230	36	36
130	198	303	317	291	417	289	370	575	86	1331	232	53	231	36	35
135	196	297	314	291	415	287	372	576	86	1331	233	53	231	36	35
140	195	293	312	290	414	287	373	572	87	1331	232	53	232	35	35
145	194	290	309	288	413	285	370	567	85	1330	232	53	234	35	34
150	192	286	306	289	413	285	369	562	85	1330	232	54	234	35	34
155	191	282	304	288	412	284	367	557	84	1329	233	54	235	35	34
160	189	278	300	287	411	283	366	551	86	1328	233	54	235	35	34
165	188	274	297	286	409	282	365	547	85	1327	233	54	236	35	34
170	187	272	294	286	407	279	366	541	85	1325	233	54	236	34	33

175	185	268	291	286	404	278	366	536	85	1321	233	55	236	34	33
180	184	265	289	284	401	276	365	530	84	1318	233	55	236	34	33
185	182	261	286	282	397	274	361	523	84	1317	233	55	236	34	33
190	181	258	283	280	393	273	360	518	83	1315	233	55	236	34	32
195	179	255	280	277	390	271	355	515	84	1313	233	56	236	34	32
200	178	252	277	274	387	270	353	512	84	1313	233	56	236	33	32
205	177	250	274	274	385	268	350	507	84	1314	232	56	236	33	32
210	176	247	273	271	382	267	346	500	84	1314	233	56	235	33	32
215	175	245	269	270	379	266	343	495	83	1315	232	56	236	33	32
220	174	242	267	268	375	266	339	490	83	1315	232	56	236	33	31
225	172	240	265	269	371	265	339	485	84	1315	232	56	235	33	31
230	171	238	262	268	366	264	336	479	83	1315	232	57	235	33	31
235	170	235	258	268	362	262	337	476	84	1315	232	57	235	33	31
240	169	232	256	270	356	261	337	474	83	1315	231	57	235	32	31
245	168	230	254	272	351	260	340	471	83	1314	231	58	234	32	30

TEMPERATURE DATA SHEET #14A

		TEST TIME	245		
STACK AVG	**230**	TOP AVG	**343**	LT SIDE AVG	**314**
BACK AVG	**297**	RT SIDE AVG	**417**	BOTTOM AVG	**302**
FIREBOX AVG	**366**	SEC/CAT AVG	**612**	AMBIENT AVG	**85**

END	**273.4**	
START	**385.2**	
	-111.8	DELTA T

CIRCLE: **LOSS** / **GAIN**

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 9-28-2011 Analyte : CO_2 (15-1)

Unit : Total FSS Run # : 4

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

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

Span Cyl. # : 487905 Conc. : 12.20 % CO_2 Cyl. Press. : 1400 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 : C. Watts Time : 0810 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	.109	.109	.437
SPAN	48.8	.488	12.20	48.4	.488	12.234	.034	.137

POST RUN Audit : by : C. Watts Time : 1500 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	.001	.134	.134	.537
SPAN	48.8	.488	12.20	48.4	.484	12.135	-.065	-.261

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

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

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

ZERO / SPAN CHECK DATA SHEET #15-2

Date : 9-28-2011 Analyte : O_2 (15-2)

Unit : Jotul F55 Run # : 4

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

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

Span Cyl. # : 487905 Conc. : 12.60 % O_2 Cyl. Press. : 1400 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % O_2

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

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

PRE RUN Audit : by : C. Watlington Time : 0810 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	-.025	-.025	-.100
SPAN	12.60	.504	12.6	12.6	.504	12.575	-.025	-.100

POST RUN Audit : by : C. Watlington Time : 1500 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	.002	.025	.025	.100
SPAN	12.60	.504	12.6	12.6	.503	12.550	-.050	-.200

± 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 : 9-28-2011 Analyte : CO (15-3)

Unit : Total FS5 Run # : 4

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

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

Span Cyl. # : 487905 Conc. : 4.90 % CO Cyl. Press. : 1400 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 10.0 % CO

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

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

PRE RUN Audit : by : C. Watson Time : 0810 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	.013	.013	.128
SPAN	49.0	.490	4.90	49.0	.490	4.906	.006	.061

POST RUN Audit : by : C. Watson Time : 1500 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	.013	.013	.128
SPAN	49.0	.490	4.90	4.90	.490	4.906	.006	.061

± 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 : 9-28-2011 Analyte : SO_2 (15-4)

Unit : Jotul F55 Run # : 4

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

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

Span Cyl. # : CC82089 Conc. : 1250 ppm SO_2 Cyl. Press. : 1670 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 2500 ppm SO_2

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

PRE RUN Audit : by : C. Worley Time : 0810 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	-1.900	-1.900	-.076
SPAN	50.0	.500	1250	50.0	.500	1246.7	-3.300	-.132

POST RUN Audit : by : C. Worley Time : 1500 Temp : 75 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.2	.002	3.094	3.094	.124
SPAN	50.0	.500	1250	50.3	.503	1254.2	4.214	.169

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

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

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

QUALITY CHECKS DATA SHEET # 16

UNIT : Total FSS RUN : 4 DATE : 9-28-2011

Thermocouple Check:

T/C # 1	— °F	T/C # 13	70.3 °F
T/C # 2	— °F	T/C # 14	68.2 °F
T/C # 3	69.8 °F	T/C # 15	70.5 °F
T/C # 4	67.2 °F	T/C # 16	64.0 °F
T/C # 5	66.2 °F	T/C # 17	58.2 °F
T/C # 6	66.4 °F	T/C # 18	72.3 °F
T/C # 7	66.3 °F	T/C # 19	— °F
T/C # 8	66.0 °F	T/C # 20	— °F
T/C # 9	66.2 °F	T/C # 21	— °F
T/C # 10	66.6 °F	T/C # 22	— °F
T/C # 11	64.8 °F	T/C # 23	— °F
T/C # 12	74.2 °F	T/C # 24	— °F

Thermocouple Readout:

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

ZERO 1.4 °F Adj. to 0.0 °F ZERO 1.1 °F Difference .055 %

SPAN 1998.6 °F Adj. to 2000.0 °F SPAN 2000.7 °F Difference .035 %

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 200.1 °F	400	= 400.0 °F
600	= 599.8 °F	800	= 799.7 °F	1000	= 999.8 °F
1200	= 1199.7 °F	1400	= 1399.4 °F	1600	= 1599.5 °F
1800	= 1799.8 °F	2000	= 2000.0 °F		

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

Scale Check Pre : 14.4 − 4.4 = 10.0

Post : 13.8 − 3.8 = 10.0

Stack Cleaned Prior to Test Run : YES ____ NO X

TABLE 1 ----- RAW DATA

CLIENT : Jotul TEST No. : 5

MODEL: F55 DATE: 29-Sep-11

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	804.439	0.150	80	0.19	8.40	200
5	805.939	0.120	83	0.18	13.00	225
10	807.315	0.100	83	0.50	17.50	250
15	808.553	0.100	83	0.36	17.60	250
20	809.792	0.050	84	0.99	17.90	350
25	810.679	0.020	84	2.03	17.50	625
30	811.177	0.050	84	0.62	17.50	350
35	812.065	0.080	85	0.31	16.50	275
40	813.199	0.120	86	0.04	15.40	225
45	814.590	0.120	86	0.03	12.80	225
50	815.981	0.120	87	0.02	12.40	225
55	817.377	0.120	87	0.03	11.20	225
60	818.773	0.140	88	0.05	10.00	200
65	820.349	0.110	88	0.32	8.10	225
70	821.750	0.110	88	0.28	8.00	225
75	823.151	0.090	88	0.61	7.10	250
80	824.412	0.090	88	0.50	7.30	250
85	825.673	0.090	88	0.53	6.50	250
90	826.935	0.110	88	0.51	6.20	225
95	828.336	0.110	88	0.52	6.20	225
100	829.737	0.140	88	0.48	6.10	200
105	831.313	0.140	88	0.52	5.70	200
110	832.889	0.140	88	0.62	5.40	200
115	834.465	0.190	88	0.66	5.20	175
120	836.266	0.190	88	0.67	5.00	175
125	838.067	0.190	88	0.65	4.80	175
130	839.868	0.190	88	0.63	4.70	175
135	841.668	0.190	88	0.61	4.60	175
140	843.469	0.190	88	0.57	4.20	175
145	845.270	0.190	88	0.55	4.20	175
150	847.071	0.190	88	0.56	4.20	175
155	848.872	0.190	88	0.60	4.20	175
160	850.673	0.190	88	0.58	4.20	175
165	852.475	0.190	88	0.59	4.00	175
170	854.274	0.190	88	0.59	3.80	175
175	856.075	0.190	88	0.56	3.80	175

TABLE 2---RAW DATA

CLIENT : Jotul TEST No. 5

MODEL: F55 DATE: 29-Sep-11

METER CAL. FACTOR (Y) -------	0.927		Wt. WOOD BURNED(LB) -------	19.4	Lbs
BAROMETRIC PRESS.(Pb) -------	30	in Hg	WET,FUEL MOISTURE % -------	16.448	%
LEAK RATE POST (Lp) -------	0.000	cfm	Wt. PART. COLLECTED -------	0.0958	g
WATER VOL. (V1c) -------	53.3	Ml	METER VOLUME Vm -------	51.636	mcf
TEST TIME (MIN) -------	175	min	HC MOLE FRACTION -------	0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT : Jotul TEST No. 5

MODEL: F55 DATE: 29-Sep-11

AVG DELTA H	-------	0.14	in H2O	AVG PRCNT CO	-------	0.50	%
AVG METER TEMP. Tm	-------	87	deg F	AVG PRCNT CO2	-------	8.64	%
AVG PPM SO2	-------	226	PPM	AVG BAL CO2/CO	-------	17.23	%

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul TEST No. 5

MODEL: F55 DATE: 29-Sep-11

STD SAMPLE VOL. Vm(std) d) ------	46.37	dscf	STACK GAS FLOW Qsd -------	867.648 14.46	dscf/Hr & dscf/min
VOL. WATER VAPOR Vw(s td) -----	2.509	scf	PARTICULATE CONCTRT. C s ------	0.0021	g/dscf
PRCNT MSTR Bws -------	5.13	%	PARTC.EMISS. RATE E -------	1.79	g/Hr
BURN RATE BR -------	2.52	Kg/Hr	MOLES OF GAS PER Lb WOOD Nt ----	0.41	Lb-mole/Lb
CO EMISSION RATE -------	145.76 & 57.82	g/Hr g/Kgdry fuel	PART.EMISS. RATE ------	0.71	g/Kgdry fuel

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Jotul TEST No. : 5

MODEL: F55 DATE: 29-Sep-11

TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR	PROPRTN RATE VAR. AVERAGE
5	272.0	97	100
10	279.9	99	
15	279.8	99	
20	279.8	99	
25	280.2	99	
30	280.9	100	
35	280.2	100	
40	280.7	100	
45	281.4	100	
50	281.2	100	
55	281.9	100	
60	281.7	100	
65	282.4	100	
70	282.4	100	
75	282.4	100	
80	282.4	100	
85	282.4	100	
90	282.7	100	
95	282.4	100	
100	282.4	100	
105	282.4	100	
110	282.4	100	
115	282.4	100	
120	282.4	100	
125	282.4	100	
130	282.4	100	
135	282.3	100	
140	282.4	100	
145	282.4	100	
150	282.4	100	
155	282.4	100	
160	282.4	100	
165	282.6	100	
170	282.1	100	
175	282.4	100	

COMPUTER INPUT DATA SHEET #1

Client: Jotul North America

Address: 55 Hutcherson
Gorham, ME. 04038

Phone: 1-800-797-5912 Fax:

Run No.: 5 Date of Test: 9-29-2011 Burn Rate: 2,521

Model No.: F55 ☐ min ☐ min-1.25 ☐ fan

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

1.78

Dry Gas Meter Y Factor: .927 (0.000) (Data Sheet #2) Post Leak Rate: 0.000 cfm (.000) (Data Sheet #2) Time: 175 min. (000) (Data Sheet #2)

Dry Gas Meter Volume: 51.636 cf (00.000) (Data Sheet #2)

Stack Flow: 16,172 dscfm (00.000) (Data Sheet #2) Δ H: .136 in. H_2O (.000) (Data Sheet #2)

Maximum Vac.: 2.0 (0.0) (Data Sheet #2) Barometric Pressure: 30.00 in. Hg (00.00) (Data Sheet #2)

H_2O Captured: 53.3 g (00.0) (Data Sheet #3)

Front Half Catch % Of Total: 59.8 % (00.0) (Data Sheet #6) Total Particulate Catch: .0958 g (0.0000) (Data Sheet #6)

Flue Gas Moisture: 5.1375 % (00.000) (Data Sheet #7)

Particulate Emission: .0319 gr/dscf (0.0000) (Data Sheet #7)

Relative Humidity: 43.0 % RH (00.0) (Data Sheet #8) Ambient Moisture: 1.45 % H_2O (0.00) (Data Sheet #8)

Preburn Fuel Wt.: 41.5 lbs. (00.0) (Data Sheet #8) Coal Bed Wt.: 4.8 lbs. (00.0) (Data sheet #8) Test Fuel Wt.: 19.4 lbs. (00.0) (Data sheet #8)

Heat Output (EPA Default): 30398.7 BTU/hr (00,000.0) (Data Sheet #8)

Kindling Fuel % Moisture (wet): 12.816 % (00.000) (Data Sheet #10) Pretest Fuel % Moisture (wet): 11.921 % (00.000) (Data Sheet #10)

Test Fuel % Moisture (dry): 19.686 % (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove]) Test Fuel % Moisture (wet): 16.448 %

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

Stack Static Pressure: -.055 in. H_2O (+/- .000) (Data Sheet #12)

Average Ambient Temperature: 86 °F (00) (Data Sheet #14) Stove Temperature Change: -124.0 °F (+/- 000.0) (Data Sheet #14)

Start = 1140

End = 1435

meter temp = 547

METER BOX DATA SHEET PAGE # 2

Page: 1 of 2

UNIT: Jotul F55 RUN: 5 DATE: 9-29-2011

Meter Box: 5H Y Factor: .1927

Leak checks: 15 " Hg @ 1000 cfm _____ " Hg @ _____ cfm

15 " Hg @ 1000 cfm _____ " Hg @ _____ cfm

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

ROTO: PRESS: .18			SAMPLING RATIO: 57 : 1				BP: 30.00		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1140	804.439	—	17.322	.15	80	200	80	2.0
5	45	805.939	—	15.312	.12	83	225	83	2.0
10	50	807.315	807.315	13.781	.10	83	250	83	2.0
15	55	808.553	808.553	13.781	.10	83	250	83	2.0
20	1200	809.792	809.792	9.825	.05	84	350	84	2.0
25	05	810.679	810.679	5.502	.02	84	625	84	2.0
30	10	811.177	811.177	9.825	.05	84	350	84	2.0
35	15	812.065	812.065	12.482	.08	85	275	85	2.0
40	20	813.199	813.199	15.228	.12	86	225	86	2.0
45	25	814.590	814.590	15.228	.12	86	225	86	2.0
50	30	815.981	815.981	15.200	.12	87	225	87	2.0
55	35	817.377	817.377	15.200	.12	87	225	87	2.0
ROTO PRESS: .18			TOTALS:	158.686	1.15	1012	BP.: 30.00		
60	1240	818.773	818.773	17.069	.14	88	200	88	2.0
65	45	820.349	820.349	15.172	.11	88	225	88	2.0
70	50	821.750	821.750	15.172	.11	88	225	88	2.0
75	55	823.151	823.151	13.655	.09	88	250	88	2.0
80	1300	824.412	824.412	13.655	.09	88	250	88	2.0
85	05	825.673	825.673	13.655	.09	88	250	88	2.0
90	10	826.935	826.935	15.172	.11	88	225	88	2.0
95	15	828.336	828.336	15.172	.11	88	225	88	2.0
100	20	829.737	829.737	17.069	.14	88	200	88	2.0
105	25	831.313	831.313	17.069	.14	88	200	88	2.0
110	30	832.889	832.889	17.069	.14	88	200	88	2.0
115	35	834.465	834.465	19.507	.19	88	175	88	2.0
			TOTALS:	189.436	1.46	1056	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	348.122	2.61	2068	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 2 of 2

UNIT: Total FSS RUN: 5 DATE: 9-29-2011

Meter Box: 514 Y Factor: 1.927

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

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

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

ROTO: PRESS: .18 SAMPLING RATIO: 57 : 1 BP: 30.00

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1340	836.266	836.266	19.507	.19	88	175	88	2.0
125	45	838.067	838.067	19.507	.19	88	175	88	2.0
130	50	839.868	839.868	19.507	.19	88	175	88	2.0
135	55	841.668	841.668	19.507	.19	88	175	88	2.0
140	1400	843.469	843.469	19.507	.19	88	175	88	2.0
145	05	845.270	845.270	19.507	.19	88	175	88	2.0
150	10	847.071	847.071	19.507	.19	88	175	88	2.0
155	15	848.872	848.872	19.507	.19	88	175	88	2.0
160	20	850.673	850.673	19.507	.19	88	175	88	2.0
165	25	852.475	852.475	19.507	.19	88	175	88	2.0
170	30	854.274	854.274	19.507	.19	88	175	88	2.0
175	35	856.075	856.075	19.507	.19	88	175	88	2.0
ROTO PRESS:			TOTALS:	234.084	2.28	1056	BP.:		
180									
185									
190									
195									
200									
205									
210									
215									
220									
225									
230						3124			
235				582.206	4.89				
			TOTALS:			87	MAX VACC =		2.0
TOTAL Cu Ft.		51.636	TOTALS:	16.172	.136	(547)	AVG. BP:		30.00

436

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : F55 RUN : 5 DATE : 9-29-11

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	659.2	588.3	4868	926.7
INITIAL WT	613.2	586.5	485.5	922.5
NET WT GRAMS	46.0	1.8	1.3	4.2

TOTAL CATCH : 53.3 **GRAMS H_2O**

FRONT HALF

FILTER #	33F	
FINAL WT g	.6610	
INITIAL WT g	.6224	
NET WT g	.0386	

BEAKER #	111
DESC.	ACETONE
FINAL WT g	97.7595
INITIAL WT g	97.7401
NET WT g	.0194
VOL. DESC. ml	75

BACK HALF

FILTER #	33B	
FINAL WT g	.3505	
INITIAL WT g	.3478	
NET WT g	.0027	

BEAKER #	112	113	114	115	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	104.9171	106.4430	106.2025	106.8261	
INITIAL WT g	104.8854	106.4421	106.1920	106.8166	
NET WT g	.0317	.0009	.0105	.0095	(.0200)
VOL. DESC ml	150	75	150	125	(275)

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 11-4-2010 Time : 1600 By : _____

Manufacturer S & S Grade : # 25 Glass Front Size : 11 cm Lot No. : 3935588

Back Size: 8.2 cm Lot No. : J11441535

	DATE: 10-12-10	BY: AV	DATE: 11-15-10	BY: AV	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
31F	0.6217	10:05	0.6216	10:50		
32F	0.6258	10:06	0.6257	10:51		
33F	0.6225	10:07	0.6224	10:52		
34F	0.6160	10:08	0.6160	10:53		
35F	0.6161	10:09	0.6161	10:54		
36F	0.6216	10:10	0.6216	10:55		
37F	0.6160	10:11	0.6162	10:56		
38F	0.6120	10:12	0.6120	10:57		
39F	0.6142	10:13	0.6141	10:58		
40F	0.6150	10:14	0.6146	10:59		
31B	0.3512	10:15	0.3510	11:00		
32B	0.3487	10:16	0.3484	11:01		
33B	0.3477	10:17	0.3478	11:02		
34B	0.3522	10:18	0.3525	11:03		
35B	0.3478	10:19	0.3476	11:04		
36B	0.3505	10:20	0.3505	11:05		
37B	0.3493	10:21	0.3491	11:06		
38B	0.3468	10:22	0.3469	11:07		
39B	0.3503	10:23	0.3500	11:08		
40B	0.3494	10:24	0.3490	11:09		

Checked by: CP Date: 10-2-11 Time: 1500

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
11-14-10	0840	CP		67	42
11-15-10	0930	CP		70	48

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 2-13-2011 Time : 1300 By : CP

	DATE: 2-15-2011	BY: AV	DATE: 2-16-2011	BY: AV	DATE: 2-22-2011	BY: AV
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
101	95,5922	10:00	95,5913	1030	95,5916	1035
102	96,3724	10:01	96,3704	1031	96,3700	1036
103	102,3550	10:02	102,3534	1032	102,3539	1037
104	106,2077	1003	106,2069	1033	106,2068	1038
105	107,0647	1004	107,0616	1034	107,0620	1039
106	96,7105	1005	96,7084	1035	96,7089	1040
107	107,3435	1006	107,3425	1036	107,3420	1041
108	104,9480	1007	104,9471	1037	104,9474	1042
109	98,8658	1008	98,8648	1038	98,8653	1043
110	104,0155	1009	104,0148	1039	104,0149	1044
111	97,7415	1010	97,7406	1040	97,7401	1045
112	104,8863	1011	104,8852	1041	104,8854	1046
113	106,4430	1012	106,4420	1042	106,4421	1047
114	106,1930	1013	106,1917	1043	106,1920	1048
115	106,8185	1014	106,8166	1044	106,8166	1049
116	105,9340	1015	105,9329	1045	105,9329	1050
117	103,8890	1016	103,8872	1046	103,8876	1051
118	107,1541	1017	107,1528	1047	107,1532	1052
119	105,5031	1018	105,5009	1048	105,5014	1053
120	106,0922	1019	106,0903	1049	106,0907	1054
121	106,3694	1020	106,3675	1050	106,3680	1055
122	107,0231	1021	107,0217	1051	107,0216	1056
123	108,6532	1022	108,6519	1052	108,6523	1057
124	106,2102	1023	106,2083	1053	106,2088	1058
125	107,7525	1024	107,7506	1054	107,7509	1059

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
2-15-11	0930	CW	-	75	41
2-16-11	0930	CW	-	66	49
2-22-11	1000	CW	-	70	48

Checked by : CP
Date : 10-2-11
Time : 1500

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : F53 **RUN :** 5 **DATE :** 9-29-11 **Page :** 1 **of** 1

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
111	9-30	1600	CP	97.7594	10-1	1540	CP	97.7595	10-2	1440	CP				
112	9-30	1600	CP	104.9168	10-1	1541	CP	104.9171	10-2	1441	CP				
113	9-30	1600	CP	106.4427	10-1	1542	CP	106.4430	10-2	1442	CP				
114	9-30	1600	CP	106.2023	10-1	1543	CP	106.2025	10-2	1443	CP				
115	9-30	1600	CP	106.8258	10-1	1544	CP	106.8261	10-2	1445	CP				

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
33F	9-29	1800	CP	.6614	9-30	1015	CP	.6610	10-1	1545	CP				
33B	9-29	1800	CP	.3506	9-30	1016	CP	.3505	10-1	1546	CP				

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	9-30-11	1000	CP	70	48
2	10-1-11	1530	CP	70	46
3	10-2-11	1430	CP	74	47
4					
5					

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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 4-13-2011 Through	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0000	10.0001	1.0000	.0998	CP	4-13-11	1030	66	49
100.0001	10.0002	1.0000	.0999	CP	4-15-11	1330	75	48
100.0004	10.0000	.9999	.0998	CP	4-19-11	1600	74	44
100.0003	10.0000	1.0000	.0999	CP	4-20-11	1815	72	46
100.0000	10.0001	.9999	.1000	CP	6-16-11	0900	76	39
99.9997	9.9999	.9998	.0999	CP	6-19-11	1530	74	44
99.9996	10.0002	1.0000	.0999	CP	6-20-11	1600	73	47
100.0000	10.0000	.9998	.0999	CP	6-21-11	1400	73	47
100.0000	10.0000	1.0001	.0999	CP	6-22-11	1200	72	46
99.9999	9.9998	1.0000	.1000	CP	6-23-11	1700	76	49
100.0000	10.0002	1.0000	.0999	CP	6-24-11	1400	75	48
100.0000	10.0000	1.0000	.0999	CP	6-27-11	1230	78	46
100.0001	10.0002	.9999	.0998	CP	6-30-11	1030	78	46
99.9995	10.0000	.9999	.0999	CP	7-1-11	1030	70	48
99.9999	9.9999	1.0000	.1000	CP	7-2-11	1145	75	45
100.0000	9.9999	.9999	.0999	CP	7-5-11	1000	73	47
99.9999	10.0001	1.0000	.0999	CP	7-6-11	0930	76	49
100.0000	9.9997	1.0000	.0997	CP	9-22-11	1700	77	46
100.0000	10.0001	1.0000	.0999	CP	9-24-11	1700	77	49
100.0000	9.9998	1.0001	.1000	CP	9-25-11	1300	76	49
100.0000	9.9999	1.0001	.0998	CP	9-27-11	1000	77	49
99.9996	9.9999	1.0000	.0998	CP	9-29-11	0840	72	42
99.9997	9.9998	.9999	.1000	CP	9-30-11	1000	70	48
99.9996	9.9998	1.0000	.0999	CP	10-1-11	1520	70	45
99.9998	10.0002	1.0000	.0997	CP	10-2-11	1430	74	47

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 11-11-10 Through 4-7-11	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0000	10.0002	1.0000	.0998	CP	11-11	0840	67	42
100.0000	10.0000	1.0001	.1000	CP	11-15	0930	70	48
100.0000	10.0001	1.0000	.0999	CP	11-19	0930	65	48
100.0000	10.0000	1.0000	.1000	CP	11-23	1400	66	45
100.0000	9.9997	1.0000	.0998	CP	11-24	1400	65	48
100.0000	10.0000	.9999	.0998	CP	11-26	1100	67	46
100.0000	10.0001	1.0001	.0997	CP	12-14	1000	75	41
100.0001	10.0003	1.0000	.0999	CP	12-16	1100	75	48
100.0000	10.0002	1.0000	.0999	CP	12-18	1000	77	46
100.0000	10.0000	1.0000	.0999	CP	12-21	1100	66	49
100.0000	10.0004	1.0000	.0997	CP	12-22	1400	72	48
100.0000	10.0001	1.0000	.1001	CP	12-23	1100	76	38
100.0000	10.0000	.9999	.0999	CP	12-24	1000	67	46
100.0000	10.0001	1.0001	.0999	CP	12-25	1100	75	49
100.0000	10.0000	1.0000	.0999	CP	1-19-11	0930	66	49
100.0000	9.9999	1.0000	.0999	CP	1-21-11	1400	77	49
99.9996	10.0000	1.0000	.0998	CP	1-25-11	0900	75	48
100.0000	10.0002	1.0001	.1000	CP	1-26-11	1400	74	44
100.0000	10.0001	.9998	.0998	CP	1-27-11	1200	65	48
100.0000	10.0002	1.0000	.0999	CP	1-28-11	1630	70	48
100.0000	10.0001	1.0001	.0999	CP	1-29-11	1200	68	48
100.0000	10.0002	1.0000	.0999	CP	1-30-11	1500	66	49
100.0000	9.9999	1.0000	.0999	CP	2-15-11	0930	75	41
100.0000	10.0000	1.0001	.1000	CP	2-16-11	0930	66	49
100.0000	10.0002	1.0000	.0999	CP	2-22-11	1000	70	48
100.0000	10.0001	1.0002	.0999	CP	3-4-11	1200	69	47
100.0000	10.0004	.9999	.1000	CP	3-5-11	1000	70	48
100.0000	10.0001	1.0000	.0999	CP	3-8-11	1000	74	47
100.0000	10.0000	1.0000	.1000	CP	3-9-11	1600	67	46
100.0000	10.0002	0.9999	.0999	CP	3-10-11	1600	66	49
100.0000	10.0000	1.0000	.0999	CP	3-12-11	1530	73	47
100.0000	10.0001	.9999	.0998	CP	3-13-11	1200	65	48
100.0000	10.0001	1.0000	.0999	CP	3-29-11	1120	76	49
100.0000	10.0000	.9999	.0998	CP	3-30-11	0800	74	47
100.0000	10.0001	1.0000	.0999	CP	3-31-11	1000	70	48
100.0000	10.0002	.9998	.0999	CP	4-4-11	0830	74	47
100.0000	10.0003	1.0000	.1000	CP	4-5-11	1130	73	47
100.0000	9.9999	1.0001	.0999	CP	4-6-11	1030	77	49
100.0000	10.0000	9.9999	.1001	CP	4-7-11	1000	78	40

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 2-26-2010 Through 11-10-2010	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0001	10.0004	.9999	.0999	CP	2-26-10	0840	72	46
100.0001	9.9999	.9999	.0999	CP	2-27-10	1045	72	46
100.0000	10.0000	1.0000	.0999	CP	2-28	1100	70	48
100.0000	10.0000	1.0000	.0999	CP	3-1	0900	66	49
100.0000	10.0002	.9998	.1002	CP	3-5	1200	70	48
100.0001	9.9999	.9999	.0998	CP	3-7	1330	68	47
100.0000	9.9999	.9999	.0999	CP	3-9	1130	70	41
100.0000	10.0001	1.0000	.0999	CP	3-10	1200	70	44
100.0000	10.0001	.9999	.0999	CP	3-11	0900	66	49
99.9999	9.9999	.9999	.0999	AV	3-15	1000	70	48
100.0000	10.0000	1.0000	.0998	CP	3-17	0900	72	46
100.0000	9.9998	1.0001	.1000	CP	4-8	1930	76	49
99.9999	10.0001	1.0000	.0999	CP	4-10	1630	73	47
99.9999	10.0001	1.0001	.1000	CP	4-11	1430	74	47
100.0000	10.0002	1.0000	.1000	CP	4-21	1830	77	49
100.0000	10.0000	1.0000	.0999	CP	4-22	1130	74	47
100.0000	10.0001	1.0000	.0999	CP	4-23	1015	74	44
100.0002	9.9999	1.0000	.1000	CP	4-24	0930	68	47
100.0000	9.9999	.9999	.1000	CP	4-25	0930	73	47
100.0000	9.9999	1.0001	.0999	CP	4-26	0900	76	42
100.0000	10.0002	1.0000	.0999	CP	4-30	1320	78	43
99.9998	10.0000	1.0002	.0999	CP	8-26	0845	78	49
100.0000	9.9998	1.0001	.0999	CP	8-27	0955	78	43
100.0000	10.0000	1.0000	.1000	CP	8-28	1600	73	47
99.9998	10.0000	.9999	.1000	CP	8-29	1400	70	48
100.0000	10.0000	1.0000	.0999	CP	8-31	0720	72	46
100.0001	10.0000	1.0000	.1000	CP	9-1	1330	76	49
100.0000	10.0001	1.0000	.0999	CP	9-2	1300	68	47
100.0000	10.0000	1.0000	.1000	CP	9-3	1130	72	46
100.0000	10.0001	1.0000	.0999	CP	10-26	0750	70	48
100.0000	10.0000	.9998	.0997	CP	10-27	1250	74	47
100.0000	9.9999	1.0000	.0999	CP	10-29	1400	71	49
100.0000	9.9999	1.0000	.0999	CP	11-1	1000	78	49
100.0000	10.0000	.9999	.0999	CP	11-2	0715	70	48
100.0000	10.0000	1.0000	.0999	CP	11-3	0900	70	48
100.0000	10.0001	.9999	.1000	CP	11-5	1320	76	42
100.0000	10.0001	.9999	.1000	CP	11-8	1230	70	48
100.0000	10.0001	1.0000	.0998	CP	11-9	1015	71	41
100.0000	10.0000	.9999	.0999	CP	11-10	0900	70	44

BLANK PROCESSING DATA SHEET # 5

UNIT : F55 RUN : 5 DATE : 9-29-11

BLANKS DONE : 8-31-2010

BEAKER	A	B	C
	200 ml ACETONE	75 ml DICHLOR	200 ml WATER
	FISHER OPTIMA LOT # 023283	FISHER OPTIMA LOT # 063910	DWNA, Inc Sparkletts Distilled
FINAL WEIGHT	108.9019	106.3074	106.9680
TARE WEIGHT	108.9001	106.3058	106.9640
NET WEIGHT	.0018	.0016	.0040

TARE BEAKERS INTO DESC : TIME : 1410 DATE : 8-7-2010

DATE 8-26 BY : CP DATE 8-27 BY : CP DATE : BY :

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.8999	0435	108.9001	1050		
B	106.3061	0936	106.3058	1051		
C	106.9641	0937	106.9640	1052		

FINAL BEAKERS INTO DESC : TIME : 8-28 DATE : 0820

DATE 8-29 BY : CP DATE 8-31 BY CP DATE : BY :

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9019	1501	108.9019	0742		
B	106.3076	1502	106.3074	0743		
C	106.9676	1503	106.9680	0744		

TARE QC

DATE	TIME	BY	WB	DB	%
8-26-10	0845	CP		78	49
8-27-10	0955	CP		78	43

FINAL QC

DATE	TIME	BY	WB	DB	%
8-29	1400	CP		70	48
8-31	0720	CP		72	46

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT : F55 RUN : 5 DATE : 9-29-11

BLANK CALCULATIONS

Acetone : .0018 g ÷ 200 ml = .000009 g/ml

Dicholoromethane : .0016 g ÷ 75 ml = .000021 g/ml

Distilled Water : .0040 g ÷ 200 ml = .000020 g/ml

FRONT HALF CATCH

FILTERS : .0386 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0386 g

BEAKERS : .0194 (Total Catch) g - 75 (ml Acetone) (.000009 g) (Blank Value / ml Acetone) = .0187 g

TOTAL FRONT HALF CATCH : .0573 g

BACK HALF CATCH

FILTERS : .0027 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0027 g

BEAKERS :

Acetone : .0317 (Total Catch) g - 150 (ml Acetone) (.000009 g) (Blank Value / ml Acetone) = .0303 g

Extract : .0009 (Total Catch) g - 75 (ml Dichloromethane) (.000021 g) (Blank Value / Dichloromethane) = 0 g

Water : .0200 (Total Catch) g - 275 (ml Water) (.000020 g) (Blank Value / Water) = .0055 g

TOTAL BACK HALF CATCH : .0385 g

TOTAL CATCH : .0958 g

% FRONT HALF : 59.8 %

CALCULATIONS DATA SHEET # 7

UNIT : Jotul F55 RUN : 5 DATE : 9-29-2011

1) $Vm(std) = \dfrac{(51.636\ Vm)(17.64)(.927\ mcf)\left(30.00\ "Hg + \frac{.136\ "H_2O}{13.6}\right)}{(547\ TmA)} = \dfrac{46.3244}{000.0000}$ dscf

2) $Vw(std) = (.04707)(53.3\ ml\ H_2O) = \dfrac{2.5088}{00.0000}$ scf

3) $Asw = \dfrac{(2.5088\ scf)}{(2.5088\ scf + 46.3244\ dscf)} = \dfrac{.0514}{.0000}$ Bws × 100 = $\dfrac{5.1375}{00.0000}$ % H_2O

4) $Cs = \dfrac{(.0958\ g.)}{(46.3244\ dscf)}(15.43) = \dfrac{.0319}{0.0000}$ gr / dscf

5) Estimated g / hr = $\dfrac{(.0958\ g.)}{(46.3244\ dscf)}\left(\dfrac{16.172}{00.0000}\ dscfm\right)(60) = \dfrac{2.0066}{00.0000}$ 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: Total FSS RUN: 5 DATE: 9-29-2011

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

Wet Bulb / Dry Bulb

Pre : WB: 61 DB: 75 = 44.0 % RH 1.3 % H_2O

Post : WB: 66 DB: 82 = 42.0 % RH 1.6 % H_2O

Average: 43.0 % RH 1.45 % H_2O

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

Kindling Weight (lbs): Paper: .1 Wood: 19 -

Preburn Fuel Weight: 18.5 + 22.1 Total: 40.6 -

Kindling & Preburn Fuel Weight (wood only) (lbs): **Total**: 41.5 -

Coal Bed Wt Range (lbs): 4.8 - 3.9 **Scale**: 4.8 - 3.9 -

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

Lower : .20 × fuel weight : Always round UP to nearest tenth **Actual Coal Bed Weight**: 4.8 -

Maximum Coal Bed Removal (lbs): ((4.8 (Upper) + 3.9 (Lower)) ÷ 2) .25 = 1.0 - (round down to nearest tenth)

Test Fuel (.75" × 1.5" × 5" spacers) = 24 pcs

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" × 4"	16	5	10.8	55.7
4" × 4"	16	2	8.6	44.3

Test Fuel Weight: 19.4 lbs

Estimated Dry Burn Rate:

$$\frac{19.4 - (19.4 \times .16448)}{2.2046} \times \frac{60}{\frac{175}{\text{TIME}}} = 2.521 \text{ kg / hr}$$

Estimated BTU's/hr: 19,140 × $\frac{63}{100}$ × $\frac{2.521}{\text{DBR}}$ = 30398.7 - BTU's/hr

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

WOOD STOVE OPERATING DATA PAGE #9

Unit : Total F55 Run : 5 Date : 9-29-2011

FIRE STARTED: 0905

WARM UP AND PREBURN:

PRIMARY AIR : Set wide open for all warm-up / preburn fuel charges. Then set to MAXIMUM 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 0 min. 45 sec.

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

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

FAN:

ON / (OFF) during warm-up

(ON) / OFF first ALL minutes of test

Fan speed set at HIGH

(ON) / OFF during preburn

(ON) / OFF balance of test run

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

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

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

All Grades WCLB rules:

WARM UP INFORMATION:

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

1st warm up / pre-burn fuel charge (18.5 lbs.) added at 0915

2nd warm up / pre-burn fuel charge (22.1 lbs.) added at 1025

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 F55 Run : 5 Date : 9-29-2011

Room Temperature : 60 °F Temperature Correction Set? : (Yes) No

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

Time Test Fuel moisture reading taken : 0930

pc #	Dimen.	Use	TOP	BOTTOM	SIDE	Avg Corrected
1	2"×4"×8'	K	14.6	14.9	14.6	14.7
2						
3						
4	2"×4"×8'	P	19.5	21.3	20.0	20.2
5	2"×4"×8'	P	18.1	18.3	18.2	18.2
6	2"×4"×8'	P	22.5	23.0	22.6	22.7
7	2"×4"×8'	P				61.1
8	2"×4"×8'	P				
9						
10						
11						
12	2×4×16"	T	18.7	18.7	18.9	18.7
13	"	T	17.8	17.8	17.9	17.8
14	"	T	18.0	18.0	18.0	18.0
15	"	T	23.0	23.0	23.7	23.2
16	"	T	24.4	24.3	24.3	24.3
17	4×4×16"	T	18.0	18.0	18.0	18.0
18	"	T	17.7	17.8	17.8	17.8
19						(137.8)
20	Spacers	T	19.9	22.0	23.1	21.6

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	14.700 %	20.367 %	19.686 %
Wet Moisture % :	12.816 %	16.921 %	16.448 %

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

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

GAS DATA SHEET #12

WEIGHT: 4.8 DATE: 9-24-2011

UNIT: Total FSS RUN: 5 PAGE: 1 OF

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
0 1140	24.2	19.4	—	.337	8.4	.488	12.2	.017	.19	-.057	.200
5 45	23.1	18.3	1.1	.520	13.0	.305	7.6	.016	.18	-.068	.225
10 50	21.1	16.3	2.0	.703	17.5	.114	2.8	.048	.50	-.070	.250
15 55	19.5	14.7	1.6	.705	17.6	.114	2.8	.034	.36	-.070	.250
20 1200	17.8	13.0	1.7	.718	17.9	.078	1.9	.097	.99	-.072	.350
25 05	15.8	11.0	2.0	.700	17.5	.050	1.2	.201	2.03	-.070	.625
Fan? 30 10	14.2	9.4	1.6	.703	17.5	.106	2.6	.060	.62	-.070	.350
35 15	12.7	7.9	1.5	.662	16.5	.157	3.9	.029	.31	-.068	.275
40 20	11.6	6.8	1.1	.618	15.4	.213	5.3	.002	.04	-.068	.225
45 25	10.7	5.9	.9	.512	12.8	.317	7.9	.001	.03	-.066	.225
50 30	10.0	5.2	.7	.495	12.4	.333	8.3	.000	.02	-.064	.225
55 35	9.4	4.6	.6	.450	11.2	.380	9.5	.001	.03	-.064	.225
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.807'	*****
60 40	8.8	4.0	.6	.401	10.0	.428	10.7	.003	.05	-.060	.200
65 45	8.4	3.6	.4	.323	8.1	.492	12.3	.030	.32	-.058	.225
70 50	8.1	3.3	.3	.319	8.0	.500	12.5	.026	.28	-.056	.225
75 55	7.8	3.0	.3	.285	7.1	.520	13.0	.059	.61	-.055	.250
80 1300	7.5	2.7	.3	.293	7.3	.520	13.0	.048	.50	-.055	.250
85 05	7.3	2.5	.2	.260	6.5	.548	13.7	.051	.53	-.053	.250
90 10	7.1	2.3	.2	.246	6.2	.560	14.0	.049	.51	-.052	.225
95 15	6.9	2.1	.2	.246	6.2	.560	14.0	.050	.52	-.051	.225
100 20	6.7	1.9	.2	.242	6.1	.567	14.2	.046	.48	-.051	.200
105 25	6.5	1.7	.2	.229	5.7	.579	14.5	.050	.52	-.050	.200
110 30	6.4	1.6	.1	.216	5.4	.587	14.7	.060	.62	-.050	.200
115 35	6.2	1.4	.2	.205	5.2	.595	14.9	.064	.66	-.050	.175
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.641'	*****
120 40	6.1	1.3	.1	.197	5.0	.603	15.1	.065	.67	-.048	.175
125 45	5.9	1.1	.2	.190	4.8	.611	15.3	.063	.65	-.048	.175
130 50	5.8	1.0	.1	.186	4.7	.615	15.4	.061	.63	-.048	.175
135 55	5.6	.8	.2	.184	4.6	.619	15.5	.059	.61	-.048	.175
140 1400	5.5	.7	.1	.166	4.2	.639	16.0	.055	.57	-.046	.175
145 05	5.4	.6	.1	.166	4.2	.639	16.0	.053	.55	-.046	.175
150 10	5.3	.5	.1	.165	4.2	.639	15.9	.054	.56	-.045	.175
155 15	5.2	.4	.1	.166	4.2	.639	16.0	.058	.60	-.045	.175
160 20	5.1	.3	.1	.165	4.2	.639	16.0	.056	.58	-.045	.175
165 25	5.0	.2	.1	.157	4.0	.647	16.2	.057	.59	-.044	.175
170 30	4.9	.1	.1	.149	3.8	.655	16.4	.057	.59	-.044	.175
175 35	4.8	.0	.1	.149	3.8	.655	16.4	.054	.56	-.044	.175
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.551'	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	1.999'	*****

361'

-.055'

PREBURN DATA SHEET #13

UNIT: Jotul F55 RUN: 5 DATE: 9-29-2011 PAGE: 1 of 1

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	~~FIREBOX~~ Inlet	~~SEC/CAT~~	~~AMBIENT~~ baffle	STATIC	COMMENTS
0 / 1025	23.7	—	279	402	374	446	485	474	478	673	70		PREBURN START: # 18.9 UP
5 / 30	22.6	1.1	333	421	387	424	485	458	458	670	69		COAL BED SCALE RANGE:
10 / 35	20.7	1.9	407	471	371	404	475	445	451	779	68		4.8 → 3.9
15 / 40	18.5	2.2	431	496	374	393	472	430	453	845	69		PRIMARY AIR: MAX
20 / 45	16.2	2.3	463	514	372	387	475	413	466	890	70		SECONDARY AIR: N/A
25 / 50	14.3	1.9	477	530	385	386	481	401	479	922	72		FAN: HIGH
30 / 55	12.3	2.0	488	545	401	342	493	386	502	952	75		PUMPS ON AT: 1055
35 / 1100	10.4	1.9	493	566	411	402	498	383	515	997	76		CHECK WB/DB: N/A
40 / 05	8.7	1.7	498	577	422	408	521	383	534	1013	76		
45 / 10	7.6	1.1	500	581	431	416	539	380	551	971	76		
50 / 15	6.7	.9	444	562	436	423	549	390	555	916	77		
55 / 20	6.1	.6	385	523	445	428	550	394	556	900	78		
*****	****	***	****	*****	*****	****	*****	*****	*****	*****	*****	****	
60 / 1125	5.7	.4	341	495	434	434	546	398	561	883	78		
65 / 30	5.4	.3	300	470	437	433	540	401	545	850	79		
70 / 35	5.1	.3	285	452	431	433	535	410	536	838	80		
75 / 40	4.8	.3	290	411	420	426	532	411	571	840	80		
80 /													
/													
/													
/													
/													
/													
/													
/													

Jotul F55

Temperature Data Sheet 14

Run 5
9/29/11

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	325	411	420	426	532	411	571	824	81	1353	234	51	229	35	33
5	378	481	440	408	536	436	457	726	81	1350	234	40	230	35	33
10	485	532	431	372	522	421	419	833	81	1346	234	42	238	35	34
15	537	586	421	348	518	408	404	888	83	1345	233	41	244	36	34
20	558	629	419	335	520	393	405	934	82	1345	233	43	248	36	35
25	540	647	424	325	531	382	413	982	84	1346	233	43	248	36	35
30	530	666	432	322	541	372	432	1020	85	1350	232	47	248	36	36
35	506	663	445	321	555	363	462	1029	85	1354	233	44	248	37	36
40	486	659	455	329	574	359	487	1042	86	1358	236	45	247	37	37
45	448	649	459	338	588	354	502	1011	85	1363	237	45	247	37	37
50	422	625	460	353	597	357	539	994	86	1366	237	45	247	37	38
55	396	595	461	367	603	356	560	965	88	1369	237	46	247	38	38
60	366	567	457	372	601	357	549	939	87	1372	237	46	245	38	38
65	340	532	452	360	593	359	517	855	88	1375	236	45	242	38	39
70	323	505	445	355	579	360	492	821	88	1377	236	45	240	38	39
75	308	479	436	356	565	360	473	783	88	1378	236	46	235	37	39
80	296	456	426	364	551	360	475	773	86	1379	236	46	232	37	39
85	284	436	418	370	540	358	477	756	87	1379	235	46	230	37	38
90	274	419	410	375	528	352	480	736	86	1380	235	47	228	37	38
95	267	403	398	382	517	355	484	725	87	1379	235	47	228	37	38
100	262	390	393	384	507	347	483	709	87	1378	234	47	228	36	38
105	257	377	387	379	498	347	477	695	86	1378	234	47	228	36	37
110	251	364	379	373	491	347	463	676	86	1378	233	47	228	36	37
115	246	354	377	373	483	346	454	661	86	1378	233	48	228	36	36
120	240	343	370	369	475	345	447	643	85	1378	233	47	229	35	36
125	236	333	364	362	466	344	438	624	86	1378	233	48	229	35	36
130	231	323	359	359	456	339	432	609	86	1378	232	48	229	35	35
135	227	315	353	356	447	336	425	599	86	1377	232	48	228	35	35
140	223	308	348	347	439	331	415	586	86	1376	231	48	228	35	35
145	219	299	340	335	430	327	397	573	86	1375	231	48	228	35	34
150	216	294	335	327	424	324	386	565	86	1375	231	47	229	34	34
155	214	287	331	322	418	320	376	560	87	1374	230	47	229	34	34
160	212	282	325	318	414	317	369	553	86	1374	231	48	229	34	34
165	211	278	321	311	410	312	362	545	86	1373	230	48	228	34	33
170	208	273	318	306	405	309	355	534	86	1372	230	48	229	34	33

Jotul F55

Temperature Data Sheet 14

Run 5
9/29/11

175	204	266	312	300	400	303	346	523	85	1371	229	48	229	34	33

TEMPERATURE DATA SHEET #14A

		TEST TIME	175		
STACK AVG	**326**	TOP AVG	**445**	LT SIDE AVG	**398**
BACK AVG	**353**	RT SIDE AVG	**507**	BOTTOM AVG	**355**
FIREBOX AVG	**451**	SEC/CAT AVG	**758**	AMBIENT AVG	**86**

END	**316.0**	
START	**440.0**	
	-124.0	DELTA T

CIRCLE: **LOSS** / **GAIN**

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 9-26-2011 Analyte : CO_2 (15-1)

Unit : Total FGS Run # : 5

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

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

Span Cyl. # : 487905 Conc. : 12.20 % CO_2 Cyl. Press. : 1400 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 : C. Walters Time : 0950 Temp : 63 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.109	.109	.437
SPAN	48.8	.488	12.20	48.8	.488	12.234	.034	.137

POST RUN Audit : by : C. Walters Time : 1515 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	-.001	.084	.084	.338
SPAN	48.8	.488	12.20	49.0	.490	12.284	.084	.335

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

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

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

ZERO / SPAN CHECK DATA SHEET #15-2

Date : 9-29-2011 Analyte : O_2 (15-2)

Unit : Jotul F55 Run # : 5

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

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

Span Cyl. # : 487905 Conc. : 12.60 % O_2 Cyl. Press. : 1400 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % O_2

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

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

PRE RUN Audit : by : C. Watlington Time : 0950 Temp : 63 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-.025	-.025	-.100
SPAN	12.60	.504	12.6	12.6	.504	12.575	-.025	-.100

POST RUN Audit : by : C. Watlington Time : 1515 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	.003	.050	.050	.200
SPAN	12.60	.504	12.6	12.6	.503	12.550	-.050	-.200

± 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 : 9-26-2011 Analyte : CO (15-3)

Unit : Total FSS Run # : 5

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

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

Span Cyl. # : 487905 Conc. : 4.90 % CO Cyl. Press. : 1400 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 10.0 % CO

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

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

PRE RUN Audit : by : C. Watmough Time : 0950 Temp : 63 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.013	.013	.128
SPAN	49.0	.490	4.90	49.0	.490	4.906	.006	.061

POST RUN Audit : by : C. Watmough Time : 1515 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	.023	.023	.227
SPAN	49.0	.490	4.90	49.0	.490	4.906	.006	.061

± 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 : 9-26-2011 Analyte : SO_2 (15-4)

Unit : Jotul F55 Run # : 5

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

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

Span Cyl. # : CC82089 Conc. : 1250 ppm SO_2 Cyl. Press. : 1670 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 2500 ppm SO_2

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

PRE RUN Audit : by : C. Wentz Time : 0950 Temp : 63 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-1.900	-1.900	-.076
SPAN	50.0	.500	1250	50.0	.500	1246.7	-3.300	-.132

POST RUN Audit : by : C. Wentz Time : 1515 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	-.001	-4.398	-4.398	-.176
SPAN	50.0	.500	1250	49.8	.498	1241.7	-8.300	-.332

± 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 FS5 RUN : 5 DATE : 9-26-2011

Thermocouple Check:

T/C # 1	— °F	T/C # 13	54.6 °F
T/C # 2	— °F	T/C # 14	54.5 °F
T/C # 3	54.5 °F	T/C # 15	54.6 °F
T/C # 4	51.8 °F	T/C # 16	53.6 °F
T/C # 5	51.2 °F	T/C # 17	54.7 °F
T/C # 6	51.4 °F	T/C # 18	57.8 °F
T/C # 7	51.3 °F	T/C # 19	— °F
T/C # 8	51.1 °F	T/C # 20	— °F
T/C # 9	51.3 °F	T/C # 21	— °F
T/C # 10	52.0 °F	T/C # 22	— °F
T/C # 11	50.4 °F	T/C # 23	— °F
T/C # 12	58.5 °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 -.3 °F Difference -.015 %

SPAN 1999.2 °F Adj. to 2000.0 °F SPAN 1999.8 °F Difference -.010 %

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 200.3 °F	400	= 400.0 °F
600	= 599.8 °F	800	= 799.8 °F	1000	= 999.7 °F
1200	= 1199.7 °F	1400	= 1399.4 °F	1600	= 1599.5 °F
1800	= 1799.7 °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 : 15.1 − 5.1 = 10.0

Post : 14.6 − 4.6 = 10.0

Stack Cleaned Prior to Test Run : YES ____ NO X

TABLE 1 ----- RAW DATA

CLIENT : Jotul TEST No. : 3

MODEL: F55 DATE: 26-Sep-11

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	608.000	0.150	82	0.90	4.90	475
5	609.500	0.440	83	0.45	8.10	275
10	612.178	0.110	85	0.32	2.50	550
15	613.529	0.120	85	0.32	2.70	525
20	614.944	0.120	85	0.38	3.10	525
25	616.359	0.110	85	0.59	4.50	550
30	617.710	0.110	85	0.59	4.50	550
35	619.061	0.110	85	0.63	5.00	550
40	620.412	0.100	85	0.82	5.30	575
45	621.705	0.100	85	0.86	6.60	575
50	622.997	0.180	85	0.29	8.00	425
55	624.745	0.230	85	0.18	10.40	375
60	626.725	0.200	85	0.22	11.70	400
65	628.586	0.270	85	0.11	10.20	350
70	630.713	0.270	85	0.09	10.50	350
75	632.839	0.230	85	0.06	12.00	375
80	634.824	0.160	86	0.42	10.10	450
85	636.485	0.160	86	0.53	8.50	450
90	638.146	0.140	86	0.92	8.10	475
95	639.719	0.130	86	1.13	6.90	500
100	641.214	0.140	86	1.09	7.20	475
105	642.788	0.160	86	0.85	7.70	450
110	644.448	0.180	86	0.71	8.20	425
115	646.207	0.160	86	0.78	7.50	450
120	647.867	0.120	86	1.52	6.40	525
125	649.291	0.120	86	1.33	6.70	525
130	650.715	0.070	86	2.92	5.30	675
135	651.823	0.120	86	1.13	7.00	525
140	653.246	0.110	86	1.59	6.30	550
145	654.606	0.120	86	1.92	5.80	525
150	656.029	0.120	86	2.13	5.60	525
155	657.453	0.130	86	1.75	5.70	500
160	658.948	0.120	86	1.99	5.40	525
165	660.372	0.110	86	2.05	5.30	550
170	661.731	0.100	86	1.97	4.90	575
175	663.031	0.110	86	2.00	4.40	550

180	664.390	0.120	86	1.98	4.30	525
185	665.814	0.140	86	1.59	4.50	475
190	667.388	0.140	86	1.89	4.40	475
195	668.961	0.130	86	2.82	4.50	475
200	670.535	0.130	86	1.42	5.60	500
205	672.030	0.130	86	1.58	5.30	500
210	673.525	0.130	86	1.45	4.60	500
215	675.020	0.130	86	1.40	4.50	500
220	676.514	0.130	86	1.38	4.40	500
225	678.009	0.130	86	1.33	4.40	475
230	679.582	0.140	86	1.31	4.10	475
235	681.156	0.140	86	1.16	4.00	475
240	682.730	0.140	89	1.10	3.90	475
245	684.305	0.140	86	1.05	3.90	475
250	685.880	0.140	86	1.04	3.90	475
255	687.455	0.140	86	1.03	3.90	475
260	689.030	0.130	86	1.07	3.50	500
265	690.526	0.140	86	1.06	3.40	475
270	692.101	0.140	86	1.02	3.40	475
275	693.676	0.140	86	1.01	3.30	475
280	695.251	0.140	86	1.01	3.40	475
285	696.826	0.140	86	0.98	3.40	475
290	698.401	0.130	86	1.12	3.40	500
295	699.898	0.130	86	1.20	3.40	500
300	701.394	0.130	86	1.26	3.40	500
305	702.891	0.130	86	1.28	3.40	500
310	704.387	0.130	86	1.23	3.40	500
315	705.884	0.130	86	1.20	3.30	500
320	707.380	0.120	86	1.09	3.10	525
325	708.808	0.120	86	1.11	3.10	525
330	710.230	0.120	86	1.09	3.10	525
335	711.656	0.130	86	1.09	3.00	500
340	713.152	0.120	86	1.12	3.00	525
345	714.577	0.120	86	1.08	2.90	525
350	716.003	0.120	86	1.06	3.00	525
355	717.428	0.130	86	1.06	3.00	500

TABLE 2---RAW DATA

CLIENT : Jotul TEST No. 3

MODEL: F55 DATE: 26-Sep-11

METER CAL. FACTOR (Y) -------	0.927		Wt. WOOD BURNED(LB) -------	17.6	Lbs
BAROMETRIC PRESS.(Pb) -------	29.83	in Hg	WET,FUEL MOISTURE % -------	15.804	%
LEAK RATE POST (Lp) -------	0.000	cfm	Wt. PART. COLLECTED -------	0.6934	g
WATER VOL. (V1c) -------	106.5	Ml	METER VOLUME Vm -------	109.428	mcf
TEST TIME (MIN) -------	355	min	HC MOLE FRACTION -------	0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT : Jotul TEST No. 3

MODEL: F55 DATE: 26-Sep-11

****

AVG DELTA H	-------	0.14	in H2O	AVG PRCNT CO	-------	1.13	%
AVG METER TEMP. Tm	-------	86	deg F	AVG PRCNT CO2	-------	5.25	%
AVG PPM SO2	-------	492	PPM	AVG BAL CO2/CO	-------	4.66	%

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul TEST No. 3

MODEL: F55 DATE: 26-Sep-11

****

STD SAMPLE VOL. Vm(std) d) ------	97.90	dscf	STACK GAS FLOW Qsd -------	531.475	dscf/Hr &
				8.86	dscf/min
VOL. WATER VAPOR Vw(s td) -----	5.013	scf	PARTICULATE CONCTRT. C s ------	0.0071	g/dscf
PRCNT MSTR Bws -------	4.87	%	PARTC.EMISS. RATE E -------	3.76	g/Hr
BURN RATE BR -------	1.14	Kg/Hr	MOLES OF GAS PER Lb WOOD Nt ----	0.55	Lb-mole/Lb
CO EMISSION RATE -------	200.75	g/Hr &	PART.EMISS. RATE ------	3.31	g/Kgdry fuel
	176.71	g/Kgdry fuel			

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Jotul TEST No. : 3

MODEL: F55 DATE: 26-Sep-11

TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR	PROPRTN RATE VAR. AVERAGE
5	641.2	96	100
10	661.4	99	
15	665.6	100	
20	665.5	100	
25	665.5	100	
30	665.6	100	
35	665.6	100	
40	665.6	100	
45	666.0	100	
50	665.5	100	
55	665.6	100	
60	665.3	100	
65	667.0	100	
70	667.1	100	
75	666.8	100	
80	666.4	100	
85	668.4	100	
90	668.4	100	
95	668.1	100	
100	668.4	100	
105	668.5	100	
110	668.0	100	
115	668.5	100	
120	668.0	100	
125	668.5	100	
130	668.5	100	
135	668.7	100	
140	668.0	100	
145	668.8	100	
150	668.0	100	
155	668.5	100	
160	668.4	100	
165	668.5	100	
170	668.3	100	
175	668.3	100	
180	668.3	100	

185	668.5	100
190	668.5	100
195	668.1	100
200	668.5	100
205	668.4	100
210	668.4	100
215	668.4	100
220	668.0	100
225	668.4	100
230	668.1	100
235	668.5	100
240	666.7	100
245	667.1	100
250	669.0	100
255	669.0	100
260	669.0	100
265	668.8	100
270	669.0	100
275	669.0	100
280	669.0	100
285	669.0	100
290	669.0	100
295	669.3	100
300	668.8	100
305	669.3	100
310	668.8	100
315	669.3	100
320	668.8	100
325	670.3	100
330	667.5	100
335	669.4	100
340	668.8	100
345	668.9	100
350	669.4	100
355	668.9	100

COMPUTER INPUT DATA SHEET #1

Client: Total North America

Address: 55 Hutcherson
Gorham, ME. 04038

3,76

Phone: 1-800-797-5912 Fax:

Run No.: 3 Date of Test: 9-22-2011 Burn Rate: 1,136

Model No.: FSS ☐ min ☐ min-1.25 ☒ fan

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

Dry Gas Meter Y Factor: .927 (0.000) (Data Sheet #2) Post Leak Rate: .000 cfm (.000) (Data Sheet #2) Time: 355 min. (000) (Data Sheet #2)

Dry Gas Meter Volume: 109.428 cf (00.000) (Data Sheet #2)

Stack Flow: 7,040 dscfm (00.000) (Data Sheet #2) Δ H: .141 in. H_2O (.000) (Data Sheet #2)

Maximum Vac.: 3.0 (0.0) (Data Sheet #2) Barometric Pressure: 29.83 in. Hg (00.00) (Data Sheet #2)

H_2O Captured: 106.5 g (00.0) (Data Sheet #3)

Front Half Catch % Of Total: 56.0 % (00.0) (Data Sheet #6) Total Particulate Catch: .6934 g (0.0000) (Data Sheet #6)

Flue Gas Moisture: 4.876O % (00.000) (Data Sheet #7)

Particulate Emission: .1094 gr/dscf (0.0000) (Data Sheet #7)

Relative Humidity: 52.0 % RH (00.0) (Data Sheet #8) Ambient Moisture: 1.1 % H_2O (0.00) (Data Sheet #8)

Preburn Fuel Wt.: 44.2 lbs. (00.0) (Data Sheet #8) Coal Bed Wt.: 43 lbs. (00.0) (Data sheet #8) Test Fuel Wt.: 17.6 lbs. (00.0) (Data sheet #8)

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

Kindling Fuel % Moisture (wet): 12.255 % (00.000) (Data Sheet #10) Pretest Fuel % Moisture (wet): 16.597 % (00.000) (Data Sheet #10)

Test Fuel % Moisture (dry): 18,771 % (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove]) Test Fuel % Moisture (wet): 15.804 %

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

Stack Static Pressure: -.039 in. H_2O (+/- .000) (Data Sheet #12)

Average Ambient Temperature: 80 °F (00) (Data Sheet #14) Stove Temperature Change: -85.6 °F (+/- 000.0) (Data Sheet #14)

325 Start = 1010

End = 1405

meter temp = 54

METER BOX DATA SHEET PAGE # 2

Page: 1 of 4

UNIT: Jotul FSS RUN: 3 DATE: 9-26-2011

Meter Box: SH Y Factor: .927

Leak checks: 15 " Hg @ .003 cfm _____ " Hg @ _____ cfm

15 " Hg @ .004 cfm _____ " Hg @ _____ cfm

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

ROTO: PRESS: .18			SAMPLING RATIO: 24 : 1				BP: 29.90		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1010	608.000	—	7.242	.15	82	475	82	2.0
5	15	609.500	—	12.486	.44	83	275	83	3.0
10	20	612.178	612.178	6.220	.11	85	550	85	2.0
15	25	613.529	613.529	6.516	.12	85	525	85	2.0
20	30	614.944	614.944	6.516	.12	85	525	85	2.0
25	35	616.359	616.359	6.220	.11	85	550	85	2.0
30	40	617.710	617.710	6.220	.11	85	550	85	2.0
35	45	619.061	619.061	6.220	.11	85	550	85	2.0
40	50	620.412	620.412	5.950	.10	85	575	85	2.0
45	55	621.705	621.705	5.950	.10	85	575	85	2.0
50	1100	622.997	622.997	8.050	.18	85	425	85	2.0
55	05	624.745	624.745	9.123	.23	85	375	85	2.0
ROTO PRESS: .18			TOTALS:	86.713'	1.88'	1015'	BP: 29.83		
60	1110	626.725	626.725	8.533	.20	85	400	85	2.0
65	15	628.586	628.586	9.752	.27	85	350	85	2.0
70	20	630.713	630.713	9.752	.27	85	350	85	2.0
75	25	632.839	632.839	9.102	.23	85	375	85	2.0
80	30	634.824	634.824	7.571	.16	86	450	86	2.0
85	35	636.485	636.485	7.571	.16	86	450	86	2.0
90	40	638.146	638.146	7.172	.14	86	475	86	2.0
95	45	639.719	639.719	6.814	.13	86	500	86	2.0
100	50	641.214	641.214	7.172	.14	86	475	86	2.0
105	55	642.788	647.788	7.571	.16	86	450	86	2.0
110	1200	644.448	644.448	8.016	.18	86	425	86	2.0
115	05	646.207	646.207	7.571	.16	86	450	86	2.0
			TOTALS:	96.597'	2.20'	1028'	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	183.310'	4.08'	2043'	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 2 of 4

UNIT: Total FSS RUN: 3 DATE: 9-26-2011

Meter Box: 517 Y Factor: 1.927

Leak checks: 15 " Hg @ 1.003 cfm _____ " Hg @ _____ cfm

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

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

ROTO: PRESS: .18			SAMPLING RATIO: 24			: 1	BP: 29.83		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1200	647.867	647.867	6.489	.12	86	525	86	2.0
125	15	649.291	649.291	6.489	.12	86	525	86	2.0
130	20	650.715	650.715	5.047	.07	86	675	86	2.0
135	25	651.823	651.823	6.489	.12	86	575	86	2.0
140	30	653.246	653.246	6.194	.11	86	550	86	2.0
145	35	654.606	654.606	6.489	.12	86	525	86	2.0
150	40	656.029	656.029	6.489	.12	86	525	86	2.0
155	45	657.453	657.453	6.814	.13	86	500	86	2.0
160	50	658.948	658.948	6.489	.12	86	525	86	2.0
165	55	660.372	660.372	6.194	.11	86	550	86	2.0
170	1300	661.731	661.731	5.925	.10	86	575	86	2.0
175	05	663.031	663.031	6.194	.11	86	550	86	2.0
ROTO PRESS: .18			TOTALS:	75.308'	1.35'	1032'	BP.: 29.83		
180	1310	664.390	664.390	6.489	.12	86	525	86	2.0
185	15	665.814	665.814	7.172	.14	86	475	86	2.0
190	20	667.388	667.388	7.172	.14	86	475	86	2.0
195	25	668.961	668.961	7.172	.14	86	475	86	2.0
200	30	670.535	670.535	6.814	.13	86	500	86	2.0
205	35	672.030	672.030	6.814	.13	86	500	86	2.0
210	40	673.525	673.525	6.814	.13	86	500	86	2.0
215	45	675.020	675.020	6.814	.13	86	500	86	2.0
220	50	676.514	676.514	6.814	.13	86	500	86	2.0
225	55	678.009	678.009	7.172	.14	86	475	86	2.0
230	1400	679.583	679.583	7.172	.14	86	475	86	2.0
235	05	681.156	681.156	7.172	.14	86	475	86	2.0
			TOTALS:	83.591	1.610'	1032'	MAX VACC =		
TOTAL Cu Ft			TOTALS:	158.899	2.96	2064	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 3 of 4

UNIT: Sotul F55 RUN: 3 DATE: 9-26-2011

Meter Box: SH Y Factor: .927

Leak checks: 15 " Hg @ .003 cfm _____ " Hg @ _____ cfm

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

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

ROTO: PRESS: .18			SAMPLING RATIO: 24			: 1	BP: 29.80		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
240	1410	682.730	682.730	7.165	.14	86	475	86	2.0
245	15	684.305	684.305	7.165	.14	86	475	86	2.0
250	20	685.880	685.880	7.165	.14	86	475	86	2.0
255	25	687.455	687.455	7.165	.14	86	475	86	2.0
260	30	689.030	689.030	6.807	.13	86	500	86	2.0
265	35	690.526	690.526	7.165	.14	86	475	86	2.0
270	40	692.101	692.101	7.165	.14	86	475	86	2.0
275	45	693.676	693.676	7.165	.14	86	475	86	2.0
280	50	695.251	695.251	7.165	.14	86	475	86	2.0
285	55	696.826	696.826	7.165	.14	86	475	86	2.0
290	1500	698.401	698.401	6.807	.13	86	500	86	2.0
295	05	699.898	699.898	6.807	.13	86	500	86	2.0
ROTO PRESS: .18			TOTALS:	84.906	1.65	1032	BP.: 29.80		
300	1510	701.394	701.394	6.807	.13	86	500	86	2.0
305	15	702.891	702.891	6.807	.13	86	500	86	2.0
310	20	704.387	704.387	6.807	.13	86	500	86	2.0
315	25	705.884	705.884	6.807	.13	86	500	86	2.0
320	30	707.380	707.380	6.483	.12	86	525	86	2.0
325	35	708.805	708.805	6.483	.12	86	525	86	2.0
330	40	710.230	710.230	6.483	.12	86	525	86	2.0
335	45	711.656	711.656	6.807	.13	86	500	86	2.0
340	50	713.152	713.152	6.483	.12	86	525	86	2.0
345	55	714.577	714.577	6.483	.12	86	525	86	2.0
350	1600	716.003	716.003	6.483	.12	86	525	86	2.0
355	05	717.428	717.428	6.807	.13	86	500	86	2.0
			TOTALS:	79.740	1.50	1032	MAX VACC =		3.0
TOTAL Cu Ft.		109.428	TOTALS:	164.646	3.15	2064	AVG. BP:		29.83

506.855 10.19 6171

7.040 .141 86 546

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PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : T-55 RUN : 3 DATE : 9-26-11

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	709.1	599.0	486.5	900.0
INITIAL WT	617.3	593.2	484.0	893.6
NET WT GRAMS	91.8	5.8	2.5	6.4

TOTAL CATCH : 106.5 GRAMS H_2O

FRONT HALF

FILTER #	31F	
FINAL WT g	.8993	
INITIAL WT g	.6216	
NET WT g	.2777	

BEAKER #	101
DESC.	ACETONE
FINAL WT g	95.7027
INITIAL WT g	95.5916
NET WT g	.1111
VOL. DESC. ml	75

BACK HALF

FILTER #	31B	
FINAL WT g	.4568	
INITIAL WT g	.3510	
NET WT g	.1058	

BEAKER #	102	103	104	105	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	96.4849	102.3917	106.2300	107.0898	
INITIAL WT g	96.3700	102.3539	106.2068	107.0620	
NET WT g	.1199	.0378	.0232	.0278	(.0510)
VOL. DESC ml	125	75	175	150	(325)

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 11-4-2010 Time : 1600 By : CJ

Manufacturer S & S Grade : # 25 Glass Front Size : 11 cm Lot No. : 3935588

Back Size: 8.2 cm Lot No. : J11441535

	DATE: 10-12-10	BY: AV	DATE: 11-15-10	BY: AV	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
31F	0.6217	10:05	0.6216	10:50	R-3	
32F	0.6258	10:06	0.6257	10:51		
33F	0.6225	10:07	0.6224	10:52		
34F	0.6160	10:08	0.6160	10:53		
35F	0.6161	10:09	0.6161	10:54		
36F	0.6216	10:10	0.6216	10:55		
37F	0.6160	10:11	0.6162	10:56		
38F	0.6120	10:12	0.6120	10:57		
39F	0.6142	10:13	0.6141	10:58		
40F	0.6150	10:14	0.6146	10:59		
31B	0.3512	10:15	0.3510	11:00	R-3	
32B	0.3487	10:16	0.3484	11:01		
33B	0.3477	10:17	0.3478	11:02		
34B	0.3522	10:18	0.3525	11:03		
35B	0.3478	10:19	0.3476	11:04		
36B	0.3505	10:20	0.3505	11:05		
37B	0.3493	10:21	0.3491	11:06		
38B	0.3468	10:22	0.3469	11:07		
39B	0.3503	10:23	0.3500	11:08		
40B	0.3494	10:24	0.3490	11:09		

Checked by: C. Wardy Date: 10-2-11 Time: 1500

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
11-14-10	0840	CJ		67	42
11-15-10	0930	CJ		70	48

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 2-13-2011 Time : 1300 By : CP

BEAKER #	DATE: 2-15-2011 BY: AV FIRST WEIGHT	TIME	DATE: 2-16-2011 BY: AV SECOND WEIGHT	TIME	DATE: 2-22-2011 BY: AV THIRD WEIGHT	TIME
101	95,5922	10:00	95,5913	1030	95,5916	1035
102	96,3724	10:01	96,3704	1031	96,3700	1036
103	102,3550	10:02	102,3534	1032	102,3539	1037
104	106,2077	1003	106,2069	1033	106,2068	1038
105	107,0647	1004	107,0616	1034	107,0620	1039
106	96,7105	1005	96,7084	1035	96,7089	1040
107	107,3435	1006	107,3425	1036	107,3420	1041
108	104,9480	1007	104,9471	1037	104,9474	1042
109	98,8658	1008	98,8648	1038	98,8653	1043
110	104,0155	1009	104,0148	1039	104,0149	1044
111	97,7415	1010	97,7406	1040	97,7401	1045
112	104,8863	1011	104,8852	1041	104,8854	1046
113	106,4430	1012	106,4420	1042	106,4421	1047
114	106,1930	1013	106,1917	1043	106,1920	1048
115	106,8185	1014	106,8166	1044	106,8166	1049
116	105,9340	1015	105,9329	1045	105,9329	1050
117	103,8890	1016	103,8872	1046	103,8876	1051
118	107,1541	1017	107,1528	1047	107,1532	1052
119	105,5031	1018	105,5009	1048	105,5014	1053
120	106,0922	1019	106,0903	1049	106,0907	1054
121	106,3694	1020	106,3675	1050	106,3680	1055
122	107,0231	1021	107,0217	1051	107,0216	1056
123	108,6532	1022	108,6519	1052	108,6523	1057
124	106,2102	1023	106,2083	1053	106,2088	1058
125	107,7525	1024	107,7506	1054	107,7509	1059

R-3

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH	
2-15-11	0930	CW	-	75	41	Checked by : CP
2-16-11	0930	CW	-	66	49	Date : 10-21 Y
2-22-11	1000	CW	-	70	48	Time : 1500

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : F-55 **RUN :** 3 **DATE :** 9-26-11 **Page :** 1 **of** 1

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
101	9-28	1400	CP	95.7023	9-30	1007	CP	95.7027	10-1	1524	CP				
102	9-28	1400	CP	96.4894	9-30	1008	CP	96.4899	10-1	1525	CP				
103	9-28	1400	CP	102.3913	9-30	1009	CP	102.3917	10-1	1526	CP				
104	9-28	1400	CP	106.2996	9-30	1010	CP	106.2300	10-1	1527	CP				
105	9-28	1400	CP	107.0893	9-30	1011	CP	107.0898	10-1	1528	CP				

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
31F	9-26	1800	CP	.9256	9-27	1021	CP	.9105	9-29	0851	CP	.8996	9-30	1005	CP
				.8993	10-1	1521	CP								
31B	9-26	1800	CP	.4700	9-27	1021	CP	.4611	9-29	0852	CP	.4573	9-30	1006	CP
				.4568	10-1	1522	CP								

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	9-27-11	1000	CP	77	49
2	9-29-11	0840	CP	72	42
3	9-30-11	1000	CP	70	48
4	10-1-11	1520	CP	70	48
5					

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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 4-13-2011 Through	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0000	10.0001	1.0000	.0998	CR	4-13-11	1030	66	49
100.0001	10.0002	1.0000	.0999	CR	4-15-11	1330	75	48
100.0004	10.0000	.9999	.0998	CR	4-19-11	1600	74	44
100.0003	10.0000	1.0000	.0999	CR	4-20-11	1815	72	46
100.0000	10.0001	.9999	.1000	CR	6-16-11	0900	76	39
99.9997	9.9999	.9998	.0999	CR	6-19-11	1530	74	44
99.9996	10.0002	1.0000	.0999	CR	6-20-11	1600	73	47
100.0000	10.0000	.9998	.0999	CR	6-21-11	1400	73	47
100.0000	10.0000	1.0001	.0999	CR	6-22-11	1200	72	46
99.9999	9.9998	1.0000	.1000	CR	6-23-11	1700	76	49
100.0000	10.0002	1.0000	.0999	CR	6-24-11	1400	75	48
100.0000	10.0000	1.0000	.0999	CR	6-27-11	1230	78	46
100.0001	10.0002	.9999	.0998	CR	6-30-11	1030	78	46
99.9995	10.0000	.9999	.0999	CR	7-1-11	1030	70	48
99.9999	9.9999	1.0000	.1000	CR	7-2-11	1145	75	45
100.0000	9.9999	.9999	.0999	CR	7-5-11	1000	73	47
99.9999	10.0001	1.0000	.0999	CR	7-6-11	0930	76	49
100.0000	9.9997	1.0000	.0997	CR	9-22-11	1700	77	46
100.0000	10.0001	1.0000	.0999	CR	9-24-11	1700	77	49
100.0000	9.9998	1.0001	.1000	CR	9-25-11	1300	76	49
100.0000	9.9999	1.0001	.0998	CR	9-27-11	1000	77	49
99.9996	9.9999	1.0000	.0998	CR	9-29-11	0840	72	42
99.9997	9.9998	.9999	.1000	CR	9-30-11	1000	70	48
99.9996	9.9998	1.0000	.0999	CR	10-1-11	1520	70	45
99.9998	10.0002	1.0000	.0997	CR	10-2-11	1430	74	47

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 11-11-10 Through 4-7-11	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0000	10.0002	1.0000	.0998	CP	11-11	0840	67	42
100.0000	10.0000	1.0001	.1000	CP	11-15	0930	70	48
100.0000	10.0001	1.0000	.0999	CP	11-19	0930	65	48
100.0000	10.0000	1.0000	.1000	CP	11-23	1400	66	45
100.0000	9.9997	1.0000	.0998	CP	11-24	1400	65	48
100.0000	10.0000	.9999	.0998	CP	11-26	1100	67	46
100.0000	10.0001	1.0001	.0997	CP	12-14	1000	75	41
100.0001	10.0003	1.0000	.0999	CP	12-16	1100	75	48
100.0000	10.0002	1.0000	.0999	CP	12-18	1000	77	46
100.0000	10.0000	1.0000	.0999	CP	12-21	1100	66	49
100.0000	10.0004	1.0000	.0997	CP	12-22	1400	72	48
100.0000	10.0001	1.0000	.1001	CP	12-23	1100	76	38
100.0000	10.0000	.9999	.0999	CP	12-24	1000	67	46
100.0000	10.0001	1.0001	.0999	CP	12-25	1100	75	49
100.0000	10.0000	1.0000	.0999	CP	11-19-11	0930	66	49
100.0000	9.9999	1.0000	.0999	CP	1-21-11	1400	77	44
99.9996	10.0000	1.0000	.0998	CP	1-25-11	0900	75	48
100.0000	10.0002	1.0001	.1000	CP	1-26-11	1400	74	44
100.0000	10.0001	.9998	.0998	CP	1-27-11	1200	65	48
100.0000	10.0002	1.0000	.0999	CP	1-28-11	1630	70	48
100.0000	10.0001	1.0001	.0999	CP	1-29-11	1200	68	48
100.0000	10.0002	1.0000	.0999	CP	1-30-11	1500	66	49
100.0000	9.9999	1.0000	.0999	CP	2-15-11	0930	75	41
100.0000	10.0000	1.0001	.1000	CP	2-16-11	0930	66	49
100.0000	10.0002	1.0000	.0999	CP	2-22-11	1000	70	48
100.0000	10.0001	1.0002	.0999	CP	3-4-11	1200	69	47
100.0000	10.0004	.9999	.1000	CP	3-5-11	1000	70	48
100.0000	10.0001	1.0000	.0999	CP	3-8-11	1000	74	47
100.0000	10.0000	1.0000	.1000	CP	3-9-11	1600	67	46
100.0000	10.0002	0.9999	.0999	CP	3-10-11	1600	66	49
100.0000	10.0000	1.0000	.0999	CP	3-12-11	1530	73	47
100.0000	10.0001	.9999	.0998	CP	3-13-11	1200	65	48
100.0000	10.0001	1.0000	.0999	CP	3-29-11	1120	76	49
100.0000	10.0000	.9999	.0998	CP	3-30-11	0800	74	47
100.0000	10.0001	1.0000	.0999	CP	3-31-11	1080	70	48
100.0000	10.0002	.9998	.0999	CP	4-4-11	0830	74	47
100.0000	10.0003	1.0000	.1000	CP	4-5-11	1130	73	47
100.0000	9.9999	1.0001	.0999	CP	4-6-11	1030	77	49
100.0000	10.0000	9.9999	.1001	CP	4-7-11	1000	78	40

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 2-26-2010 Through 11-10-2010	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0001	10.0004	.9999	.0999	CP	2-26-10	0840	72	46
100.0001	9.9999	.9999	.0999	CP	2-27-10	1045	72	46
100.0000	10.0000	1.0000	.0999	CP	2-28	1100	70	48
100.0000	10.0000	1.0000	.0999	CP	3-1	0900	66	49
100.0000	10.0002	.9998	.1002	CP	3-5	1200	70	48
100.0001	9.9999	.9999	.0998	CP	3-7	1330	68	47
100.0000	9.9999	.9999	.0999	CP	3-9	1130	70	41
100.0000	10.0001	1.0000	.0999	CP	3-10	1200	70	44
100.0000	10.0001	.9999	.0999	CP	3-11	0900	66	49
99.9999	9.9999	.9999	.0999	AV	3-15	1000	70	48
100.0000	10.0000	1.0000	.0998	CP	3-17	0900	72	46
100.0000	9.9998	1.0001	.1000	CP	4-8	1930	76	49
99.9999	10.0001	1.0000	.0999	CP	4-10	1430	73	42
99.9999	10.0001	1.0001	.1000	CP	4-11	1430	74	47
100.0000	10.0002	1.0000	.1000	CP	4-21	1830	77	49
100.0000	10.0000	1.0000	.0999	CP	4-22	1130	74	47
100.0000	10.0001	1.0000	.0999	CP	4-23	1015	74	44
100.0002	9.9999	1.0000	.1000	CP	4-24	0930	68	47
100.0000	9.9999	.9999	.1000	CP	4-25	0930	73	47
100.0000	9.9999	1.0001	.0999	CP	4-26	0900	76	42
100.0000	10.0002	1.0000	.0999	CP	4-30	1320	78	43
99.9998	10.0000	1.0002	.0999	CP	8-26	0845	78	49
100.0000	9.9998	1.0001	.0999	CP	8-27	0955	78	43
100.0000	10.0000	1.0000	.1000	CP	8-28	1600	73	47
99.9998	10.0000	.9999	.1000	CP	8-29	1400	70	48
100.0000	10.0000	1.0000	.0999	CP	8-31	0720	72	46
100.0001	10.0000	1.0000	.1000	CP	9-1	1330	76	49
100.0000	10.0001	1.0000	.0999	CP	9-2	1300	68	47
100.0000	10.0000	1.0000	.1000	CP	9-3	1130	72	46
100.0000	10.0001	1.0000	.0999	CP	10-26	0750	70	48
100.0000	10.0000	.9998	.0997	CP	10-27	1250	74	47
100.0000	9.9999	1.0000	.0999	CP	10-29	1400	71	49
100.0000	9.9999	1.0000	.0999	CP	11-1	1000	78	49
100.0000	10.0000	.9999	.0999	CP	11-2	0715	70	48
100.0000	10.0000	1.0000	.0999	CP	11-3	0900	70	48
100.0000	10.0001	.9999	.1000	CP	11-5	1320	76	42
100.0000	10.0001	.9999	.1000	CP	11-8	1230	70	48
100.0000	10.0001	1.0000	.0998	CP	11-9	1015	71	41
100.0000	10.0000	.9999	.0999	CP	11-10	0900	70	44

BLANK PROCESSING DATA SHEET # 5

UNIT : F55 RUN : 3 DATE : 9-26-11

BLANKS DONE : 8-31-2010

BEAKER	A	B	C
	200 ml ACETONE	75 ml DICHLOR	200 ml WATER
	FISHER OPTIMA LOT # 023283	FISHER OPTIMA LOT # 066390	DWNA, Inc Sparkletts Distilled
FINAL WEIGHT	108.9019	106.3074	106.9680
TARE WEIGHT	108.9001	106.3058	106.9640
NET WEIGHT	.0018	.0016	.0040

TARE BEAKERS INTO DESC : TIME : 1410 DATE : 8-7-2010

DATE : 8-26 BY : CP DATE : 8-27 BY : CP DATE : BY :

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.8999	0435	108.9001	1050		
B	106.3061	0436	106.3058	1051		
C	106.9641	0437	106.9640	1052		

FINAL BEAKERS INTO DESC : TIME : 8-28 DATE : 0820

DATE : 8-29 BY : CP DATE : 8-31 BY : CP DATE : BY :

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9019	1501	108.9019	0742		
B	106.3076	1502	106.3074	0743		
C	106.9676	1503	106.9680	0744		

TARE QC

DATE	TIME	BY	WB	DB	%
8-26-11	0845	CP		78	49
8-27-11	0955	CP		78	43

FINAL QC

DATE	TIME	BY	WB	DB	%
8-29	1400	CP		70	48
8-31	0720	CP		72	46

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT: F55 RUN: 3 DATE: 9-26-11

BLANK CALCULATIONS

Acetone :	.0018	g ÷	200	ml =	.000009	g/ml
Dicholoromethane :	.0016	g ÷	75	ml =	.000021	g/ml
Distilled Water :	.0040	g ÷	200	ml =	.000020	g/ml

FRONT HALF CATCH

FILTERS : .2777 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .2777 g

BEAKERS : .1111 (Total Catch) g - 75 (ml Acetone) (.000009 g) (Blank Value / ml Acetone) = .1104 g (.0007)

TOTAL FRONT HALF CATCH : .3881 g

BACK HALF CATCH

FILTERS : .1058 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .1058 g

BEAKERS :

Acetone : .1199 (Total Catch) g - 125 (ml Acetone) (.000009 g) (Blank Value / ml Acetone) = .1188 g (.0011)

Extract : .0378 (Total Catch) g - 75 (ml Dichloromethane) (.000021 g) (Blank Value / Dichloromethane) = .0362 g (.0016)

Water : .0510 (Total Catch) g - 325 (ml Water) (.000020 g) (Blank Value / Water) = .0445 g (.0065)

TOTAL BACK HALF CATCH : .3053 g

TOTAL CATCH : .6934 g

% FRONT HALF : 56.0 %

CALCULATIONS DATA SHEET # 7

UNIT: Jotul F55 RUN: 3 DATE: 9-26-2011

1) $Vm(std) = \dfrac{(109.428\ Vm)(17.64)(.927\ mcf)\left(29.83\ "Hg + \frac{.143\ "H_2O}{13.6}\right)}{(546\ TmA)} = \dfrac{97.7959}{000.0000}$ dscf

2) $Vw(std) = (.04707)(1065\ ml\ H_2O) = \dfrac{5.0130}{00.0000}$ scf

3) $Asw = \dfrac{(5.0130\ scf)}{(5.0130\ scf + 97.7959\ dscf)} = \dfrac{.0488}{.0000}$ Bws × 100 = $\dfrac{4.8760}{00.0000}$ % H_2O

4) $Cs = \dfrac{(.1934\ g.)}{(97.7959\ dscf)}(15.43) = \dfrac{.1094}{0.0000}$ gr / dscf

5) Estimated g / hr = $\dfrac{(.1934\ g.)}{(97.7959\ dscf)}\left(\dfrac{7.040}{00.0000}\ dscfm\right)(60) = \dfrac{2.9949}{00.0000}$ 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: Total FSS RUN: 3 DATE: 9-26-2011

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

Wet Bulb / Dry Bulb

Pre : WB: 64 DB: 75 = 54.0 % RH 1.2 % H_2O

Post : WB: 64 DB: 77 = 50.0 % RH 1.0 % H_2O

Average: 52.0 % RH 1.1 % H_2O

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

Kindling Weight (lbs): Paper: .1 Wood: 1.1

Preburn Fuel Weight: 21.0 + 19.3 + 2.8 Total: 43.1

Kindling & Preburn Fuel Weight (wood only) (lbs): **Total:** 44.2

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

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

Lower : .20 x fuel weight : Always round UP to nearest tenth **Actual Coal Bed Weight:** 4.3

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

Test Fuel (.75" x 1.5" x 5" spacers) = 24 pcs

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" x 4"	16	5	9.9	56.3
4" x 4"	16	2	7.7	43.8

Test Fuel Weight: 17.6 lbs

Estimated Dry Burn Rate:

$$\frac{17.6 - (17.6 \times .1580)}{2.2046} \times \frac{60}{\frac{355}{\text{TIME}}} = 1.136 \text{ kg / hr}$$

Estimated BTU's/hr: 19,140 x $\frac{63}{100}$ x $\frac{1.136}{\text{DBR}}$ = 13698.1 BTU's/hr

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

WOOD STOVE OPERATING DATA PAGE #9

Unit : Total F55 Run : 3 Date : 9-26-2011

FIRE STARTED: 0607

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 ½ min. prior to loading last fuel, raked and leveled. In stove 20 sec.

TEST:

DOOR wide open during loading 6 min. 35 sec.

PRIMARY AIR : Opened full for first 5 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 first ALL minutes of test

Fan speed set at OFF

ON / OFF during preburn

ON / OFF balance of test run

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

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

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

All Grades WCLB rules:

WARM UP INFORMATION:

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

1st warm up / pre-burn fuel charge (21.0 lbs.) added at 0611

2nd warm up / pre-burn fuel charge (19.3 lbs.) added at 0724

3rd warm up / pre-burn fuel charge (2-8 lbs.) added at 0835

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 F55 Run : 3 Date : 9-26-2011

Room Temperature : 67 °F Temperature Correction Set? : (Yes) No

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

Time Test Fuel moisture reading taken : 0730

pc #	Dimen.	Use	TOP	BOTTOM	SIDE	Avg Corrected
1	2"×4"×8'	K	13.7	14.2	14.0	13.967
2						
3						
4	2"×4"×8'	P	22.9	23.3	23.2	23.1
5	2"×4"×8'	P	19.0	18.2	18.0	18.4
6	2"×4"×8'	P	17.7	18.8	18.1	18.2
7	2"×4"×8'	P				(59.7)
8	2"×4"×8'	P				
9						
10						
11						
12	2x4x16"	T	18.4	17.6	20.0	18.7
13	"	T	19.9	22.8	17.7	20.1
14	"	T	18.3	19.1	17.2	18.2
15	"	T	18.1	17.9	18.0	18.0
16	"	T	19.3	20.8	20.1	20.1
17	4x4x16"	T	18.2	18.2	18.4	18.3
18	"	T	17.9	18.6	18.3	18.0
19						(131.4)
20	Spacers	T	18.0	18.1	18.1	18.100

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	13.967 %	19.900 %	18.771 %
Wet Moisture % :	12.255 %	16.597 %	15.804 %

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

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

GAS DATA SHEET #12

WEIGHT: 4.3 DATE: 9-26-2011

UNIT: Total FSS RUN: 3 PAGE: 1 OF 2

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
0 1010	21.9	17.6	—	.194	4.9	.599	15.0	.088	.90	.035	.475
5 15	21.1	16.8	.8	.325	8.1	.488	12.2	.043	.45	.045	.275
10 20	20.8	16.5	.3	.100	2.5	.715	17.9	.030	.32	.040	.550
15 25	20.6	16.3	.2	.108	2.7	.707	17.7	.030	.32	.038	.525
20 30	20.3	16.0	.3	.122	3.1	.691	17.3	.036	.38	.038	.525
25 35	19.9	15.6	.4	.177	4.5	.627	15.7	.057	.59	.038	.550
Fan? 30 40	19.5	15.2	.4	.178	4.5	.627	15.7	.057	.59	.038	.550
35 45	19.0	14.7	.5	.198	5.0	.603	15.1	.061	.63	.039	.550
40 50	18.3	14.0	.7	.210	5.3	.583	14.6	.080	.82	.040	.575
45 55	17.8	13.5	.5	.263	6.6	.532	13.3	.084	.86	.041	.575
50 1100	17.1	12.8	.7	.319	8.0	.500	12.5	.027	.29	.049	.425
55 05	16.3	12.0	.8	.418	10.4	.408	10.2	.016	.18	.055	.375
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.496	*****
60 10	15.6	11.3	.7	.468	11.7	.352	8.8	.020	.22	.058	.400
65 15	14.7	10.4	.9	.409	10.2	.416	10.4	.004	.11	.057	.350
70 20	14.0	9.7	.7	.422	10.5	.408	10.2	.007	.09	.056	.350
75 25	13.3	9.0	.7	.480	12.0	.349	8.7	.004	.06	.057	.375
80 30	12.8	8.5	.5	.401	10.1	.408	10.2	.040	.42	.054	.450
85 35	12.4	8.1	.4	.338	8.5	.468	11.7	.051	.53	.052	.450
90 40	12.0	7.7	.4	.323	8.1	.468	11.7	.090	.92	.051	.475
95 45	11.5	7.2	.5	.276	6.9	.508	12.7	.111	1.13	.049	.500
100 50	11.1	6.8	.4	.288	7.2	.500	12.5	.108	1.09	.048	.475
105 55	10.7	6.4	.4	.308	7.7	.488	12.2	.083	.85	.049	.450
110 1200	10.3	6.0	.4	.326	8.2	.472	11.8	.069	.71	.049	.425
115 05	9.9	5.6	.4	.298	7.5	.500	12.5	.076	.78	.048	.450
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.678	*****
120 10	9.5	5.2	.4	.256	6.4	.512	12.8	.150	1.52	.046	.525
125 15	9.2	4.9	.3	.269	6.7	.508	12.7	.131	1.33	.044	.525
130 20	9.0	4.7	.2	.210	5.3	.500	12.5	.290	2.92	.042	.675
135 25	8.7	4.4	.3	.278	7.0	.504	12.6	.111	1.13	.041	.525
140 30	8.5	4.2	.2	.250	6.3	.516	12.9	.157	1.59	.040	.550
145 35	8.2	3.9	.3	.232	5.8	.520	13.0	.190	1.92	.040	.525
150 40	8.0	3.7	.2	.224	5.6	.520	13.0	.211	2.13	.040	.525
155 45	7.8	3.5	.2	.226	5.7	.532	13.3	.173	1.75	.040	.500
160 50	7.6	3.3	.2	.213	5.4	.536	13.4	.198	1.99	.040	.525
165 55	7.4	3.1	.2	.209	5.3	.536	13.4	.203	2.05	.040	.550
170 1300	7.2	2.9	.2	.195	4.9	.556	13.9	.195	1.97	.040	.575
175 05	7.1	2.8	.1	.173	4.4	.575	14.4	.198	2.00	.038	.550
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.491	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	1.615	*****

GAS DATA SHEET #12

WEIGHT: 4.3 DATE: 9-26-2011

UNIT: Total F55 RUN: 3 PAGE: 1 OF 2

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
180 1310	7.0	2.7	.1	.172	4.3	.579	14.5	.196	1.98	.038	.525
185 15	6.9	2.6	.1	.180	4.5	.587	14.7	.157	1.59	.038	.475
190 20	6.8	2.5	.1	.175	4.4	.579	14.5	.187	1.89	.037	.475
195 25	6.7	2.4	.1	.178	4.5	.536	13.4	.280	2.82	.037	.475
200 30	6.5	2.2	.2	.222	5.6	.548	13.7	.140	1.42	.037	.500
205 35	6.4	2.1	.1	.211	5.3	.556	13.9	.156	1.58	.037	.500
210 40	6.3	2.0	.1	.183	4.6	.587	14.7	.143	1.45	.038	.500
215 45	6.2	1.9	.1	.178	4.5	.595	14.9	.138	1.40	.037	.500
220 50	6.1	1.8	.1	.174	4.4	.599	15.0	.136	1.38	.036	.500
225 55	6.0	1.7	.1	.173	4.4	.599	15.0	.131	1.33	.036	.475
230 1400	6.0	1.7	.0	.163	4.1	.611	15.3	.129	1.31	.036	.475
235 05	5.9	1.6	.1	.160	4.0	.623	15.6	.114	1.16	.036	.475
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.443'	*****
240 10	5.8	1.5	.1	.156	3.9	.631	15.8	.108	1.10	.036	.475
245 15	5.8	1.5	.0	.154	3.9	.631	15.8	.103	1.05	.035	.475
250 20	5.7	1.4	.1	.153	3.9	.631	15.8	.102	1.04	.035	.475
255 25	5.7	1.4	.0	.154	3.9	.631	15.8	.101	1.03	.035	.475
260 30	5.5	1.3	.2	.138	3.5	.647	16.2	.105	1.07	.035	.500
265 35	5.5	1.2	.0	.136	3.4	.651	16.3	.104	1.06	.035	.475
270 40	5.5	1.2	.0	.133	3.4	.651	16.3	.100	1.02	.035	.475
275 45	5.4	1.1	.1	.132	3.3	.695	17.4	.099	1.01	.035	.475
280 50	5.4	1.1	.0	.134	3.4	.651	16.3	.099	1.01	.035	.475
285 55	5.3	1.0	.1	.133	3.4	.655	16.4	.096	.98	.034	.475
290 1500	5.3	1.0	.0	.134	3.4	.647	16.2	.110	1.12	.034	.500
295 05	5.2	.9	.1	.136	3.4	.647	16.2	.118	1.20	.034	.500
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.418'	*****
300 10	5.1	.8	.1	.136	3.4	.643	16.1	.124	1.26	.033	.500
305 15	5.1	.8	.0	.136	3.4	.643	16.1	.126	1.28	.033	.500
310 20	5.0	.7	.1	.133	3.4	.643	16.1	.121	1.23	.033	.500
315 25	4.9	.6	.1	.131	3.3	.651	16.3	.118	1.20	.033	.500
320 30	4.9	.6	.0	.124	3.1	.663	16.6	.107	1.09	.033	.525
325 35	4.8	.5	.1	.123	3.1	.659	16.5	.109	1.11	.033	.525
330 40	4.7	.4	.1	.121	3.1	.663	16.6	.107	1.09	.033	.525
335 45	4.7	.4	.0	.117	3.0	.667	16.7	.107	1.09	.033	.500
340 50	4.6	.3	.1	.120	3.0	.663	16.6	.110	1.12	.033	.525
345 55	4.5	.2	.1	.115	2.9	.671	16.8	.106	1.08	.033	.525
350 1600	4.4	.1	.1	.117	3.0	.667	16.7	.104	1.06	.033	.525
355 05	4.3	.0	.1	.118	3.0	.667	16.7	.104	1.06	.033	.500
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.396	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	1.257	*****

.172

2.872

.039'

PREBURN DATA SHEET #13

UNIT: Jotul F55 RUN: 3 DATE: 9-26-2011 PAGE: 1 of 1

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	~~Inlet~~ FIREBOX	~~baffle~~ SECOAT	AMBIENT	STATIC	COMMENTS
0/0835	7.2	—	377	558	477	528	545	510	641	920	66	-.057	PREBURN START: # 2.8 UP
5/40	6.9	.3	289	519	470	507	527	514	611	840	67	-.054	COAL BED SCALE RANGE:
10/45	6.7	.2	233	478	458	476	596	501	560	734	77	-.048	4.4 → 3.6
15/50	6.4	.3	228	426	418	450	549	490	516	695	82	-.043	PRIMARY AIR: 5/32"
20/55	6.1	.3	225	412	410	444	537	481	503	665	81	-.042	SECONDARY AIR: N/A
25/0900	5.9	.2	205	394	393	424	513	469	482	654	80	-.044	FAN: OFF
30/05	5.6	.3	191	371	376	410	490	448	458	612	78	-.042	PUMPS ON AT: 0905
35/10	5.5	.1	185	360	365	397	476	436	442	607	78	-.041	CHECK WB/DB: N/A
40/15	5.2	.3	183	345	354	386	460	424	426	605	77	-.041	
45/20	4.9	.3	182	340	347	382	448	411	416	602	76	-.041	
50/25	4.8	.1	177	328	342	380	438	400	413	593	76	-.040	
55/30	4.7	.1	169	315	333	379	427	392	407	558	75	-.038	369
*****	****	***	****	*****	*****	****	*****	*****	*****	*****	*****	****	
60/0935	4.7	.0	164	304	325	379	417	385	402	542	76	-.036	
65/40	4.7	.0	161	290	313	376	404	377	395	526	75	-.036	
70/45	4.6	.1	158	280	306	372	394	373	390	518	75	-.037	
75/50	4.6	.0	162	272	300	367	386	365	384	509	74	-.036	
80/55	4.6	.0	157	265	293	355	378	358	372	501	75	-.035	
85/1000	4.5	.1	158	259	290	349	372	356	364	498	75	-.035	
90/05	4.4	.1	158	254	286	342	367	351	356	501	75	-.035	
95/10	4.3	.1	164	250	283	341	366	350	354	501	75	-.035	348
100/15													

at 4.4 add 3 blocks (2.8 lbs)

i5

Temperature Data Sheet 14

Run 3
9/11/11

un 3
1/11

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
164	250	283	341	366	350	354	501	75	1282	246	65	232	34	35
225	257	278	334	361	348	337	489	78	1281	245	42	237	34	35
180	250	271	323	348	346	321	431	77	1281	244	43	242	34	35
164	239	261	314	333	341	307	400	78	1281	244	42	245	35	36
156	231	253	305	319	335	295	385	77	1281	243	42	246	35	36
157	230	243	295	306	327	284	383	77	1278	242	42	248	35	36
157	230	237	287	297	319	276	397	77	1276	242	42	248	35	37
160	232	232	278	290	311	271	395	77	1275	242	42	248	35	37
163	235	228	272	287	299	266	403	75	1274	242	42	248	36	37
169	236	227	264	285	291	263	483	75	1274	240	42	248	36	38
180	249	230	258	293	287	262	499	76	1274	240	43	248	36	38
215	298	235	250	300	280	261	578	77	1273	239	43	248	36	38
249	345	245	246	312	274	268	620	78	1272	238	44	248	37	38
255	384	256	243	332	265	277	660	78	1273	237	43	248	37	39
254	394	264	240	350	263	282	672	80	1274	237	44	248	37	39
260	412	275	238	366	256	289	710	80	1276	237	43	248	37	39
244	416	284	237	377	249	294	666	80	1278	239	44	248	37	39
233	418	288	237	379	246	297	665	80	1281	240	45	248	37	39
225	417	290	238	384	242	301	640	80	1285	241	46	247	38	38
214	391	293	240	386	241	307	625	80	1289	242	45	245	38	38
207	377	297	242	389	241	309	614	80	1292	242	45	243	38	38
204	369	297	243	391	240	311	604	78	1294	242	45	242	38	38
204	368	301	244	394	241	314	610	79	1296	242	45	241	38	38
203	362	307	246	397	246	318	610	80	1297	242	46	240	38	38
197	351	307	249	400	249	321	611	81	1298	242	46	239	38	37
194	342	307	251	404	250	323	622	81	1299	242	46	238	38	37
188	332	306	255	404	252	323	583	81	1299	241	46	237	39	37
187	326	304	258	401	252	321	597	82	1300	241	44	236	39	37
185	322	304	264	402	256	324	581	83	1300	241	41	236	39	37
182	318	304	268	402	260	326	572	83	1300	240	41	234	39	37
178	313	304	273	401	262	328	565	84	1300	239	42	232	39	37
177	307	304	276	401	265	330	569	84	1300	238	42	231	39	36
174	300	305	278	399	267	331	553	83	1300	238	42	230	39	36
172	296	301	280	398	268	332	544	83	1299	238	42	230	38	36
170	289	300	282	395	270	332	538	85	1298	237	42	229	38	36

TEMPERATURE DATA SHEET #14A

		TEST TIME	355		
STACK AVG	**171**	TOP AVG	**271**	LT SIDE AVG	**266**
BACK AVG	**275**	RT SIDE AVG	**346**	BOTTOM AVG	**269**
FIREBOX AVG	**309**	SEC/CAT AVG	**497**	AMBIENT AVG	**80**

END	**232.4**	
START	**318.0**	
	-85.6	DELTA T

CIRCLE: **LOSS** / **GAIN**

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 9-26-2011 Analyte : CO_2 (15-1)

Unit : Total FES Run # : 3

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

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

Span Cyl. # : 487905 Conc. : 12.20 % CO_2 Cyl. Press. : 1400 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 : C. Watkins Time : 0815 Temp : 66 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.109	.109	.437
SPAN	48.8	.488	12.20	48.8	.488	12.234	.034	.137

POST RUN Audit : by : C. Watkins Time : 1630 Temp : 76 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.2	.002	.159	.159	.636
SPAN	48.8	.488	12.20	48.6	.486	12.184	-.016	-.062

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

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

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

ZERO / SPAN CHECK DATA SHEET #15-2

Date : 9-26-2011 Analyte : O_2 (15-2)

Unit : Total F55 Run # : 3

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

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

Span Cyl. # : 487905 Conc. : 12.60 % O_2 Cyl. Press. : 1400 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % O_2

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

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

PRE RUN Audit : by : C. Watkins Time : 0815 Temp : 66 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-.025	-.025	-.100
SPAN	12.60	.504	12.6	12.6	.504	12.575	-.025	-.100

POST RUN Audit : by : C. Watkins Time : 1130 Temp : 76 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-.025	-.025	-.100
SPAN	12.60	.504	12.6	12.6	.505	12.600	0	0

± 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 : 9-26-2011 Analyte : CO (15-3)

Unit : Total FSS Run # : 3

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

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

Span Cyl. # : 1487905 Conc. : 4.90 % CO Cyl. Press. : 1400 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 10.0 % CO

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

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

PRE RUN Audit : by : C. Wortman Time : 0815 Temp : 66 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.013	.013	.128
SPAN	49.0	.490	4.90	49.0	.490	4.906	.006	.061

POST RUN Audit : by : C. Wortman Time : 1630 Temp : 76 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.013	.013	.128
SPAN	49.0	.490	4.90	49.1	.491	4.916	.016	.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 #15-4

Date : 9-26-2011 Analyte : SO_2 (15-4)

Unit : Jotul F55 Run # : 3

Zero Cyl. # : 168TAC3-A Conc. : 0.00 ppm SO_2 Cyl. Press. : 4120 PSI

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

Span Cyl. # : CC82089 Conc. : 1250 ppm SO_2 Cyl. Press. : 1670 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 2500 ppm SO_2

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

PRE RUN Audit : by : C. Worley Time : 0815 Temp : 66 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-1.900	-1.900	-.076
SPAN	50.0	.500	1250	50.0	.500	1246.7	-3.300	-.132

POST RUN Audit : by : C. Worley Time : 1630 Temp : 76 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	-.003	-9.392	-9.392	-.376
SPAN	50.0	.500	1250	50.2	.502	1251.7	1.717	.069

± 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 FS5 RUN : 3 DATE : 9-26-2011

Thermocouple Check:

T/C # 1	— °F	T/C # 13	70.5 °F
T/C # 2	— °F	T/C # 14	68.3 °F
T/C # 3	68.0 °F	T/C # 15	67.9 °F
T/C # 4	67.9 °F	T/C # 16	68.8 °F
T/C # 5	66.6 °F	T/C # 17	61.0 °F
T/C # 6	65.7 °F	T/C # 18	60.6 °F
T/C # 7	65.6 °F	T/C # 19	— °F
T/C # 8	65.9 °F	T/C # 20	— °F
T/C # 9	65.2 °F	T/C # 21	— °F
T/C # 10	65.6 °F	T/C # 22	— °F
T/C # 11	66.0 °F	T/C # 23	— °F
T/C # 12	65.2 °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 -.5 °F Difference -.025 %

SPAN 1998.2 °F Adj. to 2000.0 °F SPAN 2000.2 °F Difference .010 %

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 200.3 °F	400	= 400.1 °F
600	= 600.0 °F	800	= 799.8 °F	1000	= 999.8 °F
1200	= 1199.8 °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 : 14.7 − 4.7 = 10.0

Post : 14.2 − 4.2 = 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		Base	Options Installed	
Make	Weightronix		Printer	
Model	WI-110		Score Board	
SR#	16409		Computer	
Class	III		Other	
Cap.	1000 lbs			

Pre-test	Post-test	Manufacturer Tolerance
Ø	Ø	
	499.9	
998.7	1000.0	

Corner Test P ✓ F __
Shift Test P ✓ F ✓
Static Test 2 min. __ ✓ 5 min. __

Weight Kit# _____ NIST# _____

Serial Numbers of Weights Used (or copy of certificate)

T23-13	T23-14			

Any changes to document or scale not authorized by Phillips & Morris Scale Company VOIDS this certificate.

WASHINGTON STATE DEPARTMENT OF **AGRICULTURE**

METROLOGY LABORATORY

Receipt Date:	January 29, 2002	State Test Number:	L2017-1
Test Date:	February 13, 2002	Group ID:	SHOP
Report Date:	February 13, 2002	Due Date:	February 13, 2004

CALIBRATION REPORT

Phillips Morris Scale Company
934 Elliott Ave. W
Seattle, WA 98119-3608
Contact: Todd Mackie
Phone: 206-284-6090
PO Number: 2-2-009237
SOP: 8

Item(s) Submitted:	See Table Below
Specification:	NIST HB 105-1, Class F
Condition:	Good
Temperature:	21.0 °C
Pressure:	762.0 mmHg
Humidity:	35 % RH
Technician ID:	DW

Description	Value / Range	Qty	Material	Manufacture	Serial Number
Test Weight	1000 lb	5	Cast Iron	Rice Lake	OFT0, OFT1, OFT2, ~~OFSY, OFSZ~~
Test Weight	500 lb	12	Cast Iron	Rice Lake	T23-13 to T23-16, T23-20 T23-24, T23-26, T23-28 t T23-32
Test Weight	50 lb	30	Cast Iron	Rice Lake	877B, N1039, N1041, T2 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

NVLAP

NVLAP LAB CODE 200446

MAR 0 8 2002

W98MR42-01, 11/98

2747 29th Avenue Southwest ▼ Tumwater, Washington 98512 ▼ (360) 753-5042 ▼ (360) 586-4728 fax

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Lokee Testing Labs
13235 Prairie Circle East
Bonney Lake, WA 98390

Report Number: LOKT0137010004110609

CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Balance	Sartorius	A120S	37010004	N/A	Lab
Units	**Readability**	**SOP**	**Cal Date**	**Last Cal Date**	**Cal Due Date**
g	0.0001	QC012	6/9/11	12/3/10	6/2012

FUNCTIONAL CHECKS

ECCENTRICITY	LINEARITY	REPEATABILITY
Test Wt: 100	Test Wt: 50x2	Test Wt: 100
Tol: 0.0003	Tol: 0.0004	Tol: 0.0001
As-Found: Pass: ☑ Fail: ☐	As-Found: Pass: ☑ Fail: ☐	As-Found: Pass: ☑ Fail: ☐
As-Left: Pass: ☑ Fail: ☐	As-Left: Pass: ☑ Fail: ☐	As-Left: Pass: ☑ Fail: ☐

CALIBRATION DATA

Standard	As-Found	As-Left
100	100.0002	99.9999
70	70.0001	70.0000
50	50.0001	50.0000
20	20.0000	20.0000
10	10.0000	10.0000
5	5.0000	5.0000

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Weight Set	R.L./Troemner	1MG-25KG	A45	10/18/10	10/2011	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.

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Lokee Testing Labs
13235 Prairie Circle East
Sumner, WA 98390

Report Number: LOKT0137010004100616

CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Balance	Sartorius	A120S	37010004	N/A	Lab
Units	**Readability**	**SOP**	**Cal Date**	**Last Cal Date**	**Cal Due Date**
g	0.0001	QC012	6/16/10	12/3/09	12/2010

FUNCTIONAL CHECKS

ECCENTRICITY	LINEARITY	REPEATABILITY
Test Wt: 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	99.9999	99.9999
70	70.0000	70.0000
50	50.0000	50.0000
20	20.0000	20.0000
10	10.0000	10.0000
5	5.0000	5.0000

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Weight Set	R.L./Troemner	1MG-25KG	A45	10/12/09	10/2010	822/274334-07

Permanent Information Concerning this Equipment:

Comments/Info Concerning this Calibration:

Technician: D. Deleasa

Signature: D. Deleasa

Instruments listed above were calibrated using standards traceable to the National Institute of Standards and Technology (NIST). Calibration data reflect results at the time and location of calibration. Calibration data should be reviewed to insure that the instrument is performing to its required accuracy. Calibrations comply with ISO/IEC 17025 and ANSI/Z540-1-1994 quality standards.

Established 1974

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Lokee Testing Labs
13235 Prairie Circle East
Sumner, WA 98390

Report Number: LOKT0137010004091203

CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Balance	Sartorius	A120S	37010004	N/A	Lab
Units	**Readability**	**SOP**	**Cal Date**	**Last Cal Date**	**Cal Due Date**
g	0.0001	QC012	12/3/09	6/12/09	6/2010

FUNCTIONAL CHECKS

ECCENTRICITY		LINEARITY		REPEATABILITY	
Test Wt:	Tol:	Test Wt:	Tol:	Test Wt:	Tol:
100	0.0003	50x2	0.0004	100	0.0001
As-Found:		As-Found:		As-Found:	
Pass: ☑	Fail: ☐	Pass: ☑	Fail: ☐	Pass: ☑	Fail: ☐
As-Left:		As-Left:		As-Left:	
Pass: ☑	Fail: ☐	Pass: ☑	Fail: ☐	Pass: ☑	Fail: ☐

CALIBRATION DATA

Standard	As-Found	As-Left
100	100.0002	99.9998
70	70.0001	69.9999
50	50.0001	49.9999
20	20.0000	20.0000
10	10.0000	10.0000
5	5.0000	5.0000

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Weight Set	R.L./Troemner	1MG-25KG	A45	10/12/09	10/2010	822/274334-07

Permanent Information Concerning this Equipment:

Comments/Info Concerning this Calibration:

Technician: D. Deleasa

Signature: D. Deleasa

Instruments listed above were calibrated using standards traceable to the National Institute of Standards and Technology (NIST). Calibration data reflect results at the time and location of calibration. Calibration data should be reviewed to insure that the instrument is performing to its required accuracy. Calibrations comply with ISO/IEC 17025 and ANSI/Z540-1-1994 quality standards.

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Established 1974

Lokee Testing Labs
13235 Prairie Circle East
Sumner, WA 98390

Report Number: LOKT0137010004090612

CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Balance	Sartorius	A120S	37010004	N/A	Lab
Units	**Readability**	**SOP**	**Cal Date**	**Last Cal Date**	**Cal Due Date**
g	0.0001	QC012	6/12/09	11/18/08	12/2009

FUNCTIONAL CHECKS

ECCENTRICITY		LINEARITY		REPEATABILITY	
Test Wt:	Tol:	Test Wt:	Tol:	Test Wt:	Tol:
100	0.0003	50x2	0.0004	100	0.0001
As-Found:		As-Found:		As-Found:	
Pass: ☑	Fail: ☐	Pass: ☑	Fail: ☐	Pass: ☑	Fail: ☐
As-Left:		As-Left:		As-Left:	
Pass: ☑	Fail: ☐	Pass: ☑	Fail: ☐	Pass: ☑	Fail: ☐

CALIBRATION DATA

Standard	As-Found	As-Left
100	100.0002	100.0000
70	70.0001	70.0000
50	50.0001	50.0000
20	20.0000	20.0000
10	10.0000	10.0000
5	5.0000	5.0000

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Weight Set	R.L./Troemner	1MG-25KG	A45	10/6/08	10/2009	822/274334-07

Permanent Information Concerning this Equipment:

Comments/Info Concerning this Calibration:

Technician: D. Deleasa

Signature: D. Deleasa

Instruments listed above were calibrated using standards traceable to the National Institute of Standards and Technology (NIST). Calibration data reflect results at the time and location of calibration. Calibration data should be reviewed to insure that the instrument is performing to its required accuracy. Calibrations comply with ISO/IEC 17025 and ANSI/Z540-1-1994 quality standards.

Established 1974

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Lokee Testing Labs
13235 Prairie Circle East
Sumner, WA 98390

Report Number: LOKT0137010004081118

CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Balance	Sartorius	A120S	37010004	N/A	Lab
Units	**Readability**	**SOP**	**Cal Date**	**Last Cal Date**	**Cal Due Date**
g	0.0001	QC012	11/18/08	5/5/08	11/2009

FUNCTIONAL CHECKS

ECCENTRICITY	LINEARITY	REPEATABILITY
Test Wt: 100 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	70.0001	70.0001
50	50.0001	50.0000
20	20.0000	20.0000
10	10.0000	10.0000
5	5.0000	5.0000

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Weight Set	R.L./Troemner	1MG-25KG	A45	10/6/08	10/2009	822/274334-07

Permanent Information Concerning this Equipment:

Comments/Info Concerning this Calibration:

echnician: D. Deleasa **Signature:** D. Deleasa

struments listed above were calibrated using standards traceable to the National Institute of Standards and Technology (NIST). Calibration data reflect results at the time and cation of calibration. Calibration data should be reviewed to insure that the instrument is performing to its required accuracy. Calibrations comply with ISO/IEC 17025 and ANSI/Z540-1-1994 quality standards.

Established 1974

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Lokee Testing Labs
13235 Prairie Circle East
Sumner, WA 98390

Report Number: LOKT0137010004080505

CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Balance	Sartorius	A120S	37010004	N/A	Lab
Units	**Readability**	**SOP**	**Cal Date**	**Last Cal Date**	**Cal Due Date**
g	0.0001	QC012	5/5/08	11/27/07	11/2008

FUNCTIONAL CHECKS

ECCENTRICITY	LINEARITY	REPEATABILITY
Test Wt: 100	Test Wt: 50x2	Test Wt: 100
Tol: 0.0003	Tol: 0.0004	Tol: 0.0001
As-Found: Pass: ☑ Fail: ☐	As-Found: Pass: ☑ Fail: ☐	As-Found: Pass: ☑ Fail: ☐
As-Left: Pass: ☑ Fail: ☐	As-Left: Pass: ☑ Fail: ☐	As-Left: Pass: ☑ Fail: ☐

CALIBRATION DATA

Standard	As-Found	As-Left
100	100.0002	100.0001
70	70.0002	70.0001
50	50.0001	50.0001
20	20.0000	20.0000
10	10.0000	10.0000
5	5.0000	5.0000

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Weight Set	R.L./Troemner	1MG-25KG	A45	5/7/07	8/2008	822/274334-07

Permanent Information Concerning this Equipment:

Comments/Info Concerning this Calibration:

Technician: D. Deleasa

Signature: D. Deleasa

Instruments listed above were calibrated using standards traceable to the National Institute of Standards and Technology (NIST). Calibration data reflect results at the time and location of calibration. Calibration data should be reviewed to insure that the instrument is performing to its required accuracy. Calibrations comply with ISO/IEC 17025 and ANSI/Z540-1-1994 quality standards.

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Lokee Testing Labs
13235 Prairie Circle East
Sumner, WA. 98390
Chip Wadington

Report Number: EESPC37010004071127

CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Balance	Sartorius	A120S	37010004	N/A	Lab
Units	**Readability**	**SOP Used**	**Cal. Date**	**Last Cal.**	**Cal. Due**
Grams	0.0001	QC004	11/27/2007	05/14/2007	05/2008

FUNCTIONAL CHECKS

ECCENTRICITY: Test Wt: 100 Tol: 0.0003	LINEARITY: Test Wt: 50x2 Tol: 0.0004	REPEATABILITY: Test Wt: 100 Tol: 0.0001
AS FOUND: Pass: ☑ Fail: ☐	AS FOUND: Pass: ☑ Fail: ☐	AS FOUND: Pass: ☑ Fail: ☐
AS LEFT: Pass: ☑ Fail: ☐	AS LEFT: Pass: ☑ Fail: ☐	AS LEFT: Pass: ☑ Fail: ☐

CALIBRATION DATA

Standards	As Found	As Left
100	100.0006	100.0002
70	70.0004	70.0001
50	50.0003	50.0001
20	20.0000	20.0000
10	10.0000	10.0001
5	5.0000	5.0000

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal. Date	Cal. Due	Traceable ID#
Weight Set	R.L./Troemner	1MG-25KG	A45	05/07/2007	08/2008	822/274334-07

Comments / Info Concerning This Calibration:

Permanent Information Concerning This Instrument:

Technician: D.Deleasa

Signature: D. Deleasa

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

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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 66.7
Barometric Pressure 30.11
DATE: 5-11-2011

TC	Location	Ice Bath Temp	Boiling Water Temp
1	Wet Bulb	32.0	212.0
2	Dry Bulb	32.0	212.0
3	Stack	32.2	211.7
4	Stove Top	32.1	211.8
5	Left Side	32.4	211.5
6	Back	32.0	211.9
7	Right Side	32.1	212.1
8	Bottom	32.4	211.8
9	Firebox	32.3	211.8
10	Secondary/Cat	31.6	211.6
11	Ambient	32.1	211.8
12	Tube Furnace	32.4	210.8
13	Sample Box	32.2	211.9
14	Impinger Out	32.0	212.0
15	C. Gas Box	32.1	211.9
16	C. Gas Out	32.1	211.9
17	SO2 Out	32.5	211.3
18	Upper Ambient	32.2	211.4
19			
20			
21			
22			
23	Calibrator	32.0	212.0
24	Oven	32.3	211.9

Thermocouple Readout Semi-Annual Calibration Data Sheet

Date: 5-11-2011
Ambient Temperature: 67.0
Technician: CP

Thermocouple Number: T/C Readout
Barometric Pressure: 30.11
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	Ø
212	Boiling Water	212.0	212.0	Ø
250	Omega	250.0	250.0	Ø
300	Omega	300.0	299.8	.067
400	Omega	400.0	399.8	.050
500	Omega	500.0	499.7	.060
600	Omega	600.0	599.7	.050
700	Omega	700.0	699.7	.043
800	Omega	800.0	799.8	.025
900	Omega	900.0	899.7	.033
1000	Omega	1000.0	999.7	.030
1200	Omega	1200.0	1199.7	.025
1400	Omega	1400.0	1399.7	.021
1600	Omega	1600.0	1599.7	.019
1800	Omega	1800.0	1799.8	.011
2000	Omega	2000.0	2000.0	Ø

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

TRACEABILITY DOCUMENTATION Semi-Annual

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

DATE: 5-11-2011

SO^2 INJECTION ROTAMETER FISHER SN 9123454

NIST Traceable

Actual	°C = °F	°F
0.0	32.0	32.0
20.9	69.6	69.6
35.5	95.9	95.9
48.2	118.8	118.8

DRY GAS METER THERMOCOUPLES

Actual	°C = °F	5H in	5H out	KK
0.0	32.0	32.0	32.0	32.0
19.8	67.6	67.6	67.6	67.6
33.2	91.8	91.9	91.8	91.8
45.6	114.1	114.0	114.0	114.0

SLING PSYCHROMETER

Actual	°C = °F	Wet Bulb	Dry Bulb
0.0	32.0	32.0	32.0
19.0	66.2	66.2	66.2
32.4	90.3	90.3	90.3
44.6	112.3	112.3	112.3

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 F55 DATE: 10-17-11

TEST DATA

RUN #	1	2	3	4	5	6	7	8	9	10
AVG. ΔH	.132	.125	.141	.198	.136					
MAX VAC	3.0	3.0	3.0	3.0	2.0					

Avg. Test Series ΔH: .146 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: .927 (mcf)

AUDIT DATA

		Audit # 1	Audit #2	Audit #3
BP		30.14	30.14	30.14
VAC		3.0	3.0	3.0
AUDIT METER :				
VOL.	Final	391.100	395.528	403.640
(Vw)	Initial	386.700	391.100	395.528
	Vol.	4.400	4.428	8.112
TEMP (°F)	Initial	81	87	93
(Tw)	Mid	84	90	97
	Final	87	93	101
(°F / °A)	**Avg.**	84 (544)	550	(557)
ΔH	Initial	.146	.146	.146
	Mid	.146	.146	.146
	Final	.146	.146	.146
	Avg.	.146	.146	.146
DRY GAS METER :				
VOL.	Final	868.500	873.500	882.600
(Vd)	Initial	863.500	868.500	873.500
	Vol.	5.000	5.000	9.100
TEMP (°F)	Initial	81	85	89
(Tm)	Mid	83	87	91
	Final	85	89	93
(°F / °A)	**Avg.**	(543)	(547)	551

$$Y = \frac{(Vw)(mcf)(BP)(Tm)}{(Vd)\left(BP + \frac{DH}{13.6}\right)(Tw)} \qquad \text{Y Factor \% Diff.} = \frac{\text{Act - Exp}}{\text{Exp}} \text{ X 100}$$

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

RUN 1

$$Y = \frac{(4.400)(1.019)(30.14)(543)}{(5.060)\left(30.14 + \frac{.146}{13.6}\right)(544)} = \frac{73378.7}{82010.0} = .895$$

$$\Delta\% = \frac{(.895 - .909)}{.909} \text{ X 100} = -1.540 \%$$

RUN 2

$$Y = \frac{(7.428)(1.019)(30.14)(547)}{(5.000)\left(30.14 + \frac{.146}{13.6}\right)(550)} = \frac{74389.6}{82914.5} = .897$$

$$\Delta\% = \frac{(.897 - .909)}{.909} \text{ X 100} = -1.320 \%$$

RUN 3

$$Y = \frac{(8.12)(1.019)(30.14)(551)}{(9.100)\left(30.14 + \frac{.146}{13.6}\right)(557)} = \frac{137429}{152825.0} = .898$$

$$\Delta\% = \frac{(.898 - .909)}{.909} \text{ X 100} = -1.210 \%$$

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

INTERPOLATED Y FACTOR

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

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

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

$\frac{.915}{(D)} - \frac{.904}{(C)} = .011 \div \frac{10}{(E)} \quad \frac{.0011}{(F)}$

$\frac{.146}{\text{Avg } \Delta H} - \frac{.1}{(A)} = .046 \text{ X } 100 = \frac{4.6}{(G)}$

$\left[\frac{.0011}{(F)} \text{ X } \frac{4.6}{(G)}\right] + \frac{.904}{(C)} = \frac{.909}{\text{Interpolated Y factor}}$

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

DRY GAS METER CALIBRATION

DATE: 5-11-11 DRY GAS METER: H BOX: 5

BAROMETRIC PRESSURE 30.13 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	352.888	359.064	365.307	369.925	375.966	380.630
	Initial	348.435	352.888	359.064	365.307	369.925	375.966
	Vw ft^3	4.453	6.176	6.243	4.618	6.041	4.664
Gas Volume Dry Test Meter Vd ft^3	Final	5.000	11.800	18.600	23.600	30.100	35.100
	Initial	0.000	5.000	11.800	18.600	23.600	30.100
	Vw ft^3	5.000	6.800	6.800	5.000	6.500	5.000
Wet Test Meter Temperature tw	Initial	84	88	87	88	89	89
	Middle	86	87	88	89	89	89
	Final	88	87	88	89	89	89
	Average	86 546	87	88	89	89	89
Dry Test Meter Temperature tm	Initial	88	80	82	84	85	87
	Middle	84	81	83	85	86	88
	Final	80	82	84	85	87	89
	Average	84 544	81	83	85	86	88
$Y = \frac{(W_{mcf})(Vw)(Pb)(tm)}{Vd\left(Pb + \frac{\Delta H}{13.6}\right)(tw)}$		74374.6 82275.0	102583.6 112126.2	104079.8 112358.6	77272.3 82807.8	101268.6 107715.7	78471.6 82908.7
		.904	.915	.926	.933	.940	.946

Average Y= .927

METER BOX CALIBRATION

Date : 04/17/10
Calibrated By : JG
Dry Gas Meterbox ID : K2

Barometric Pressure, Pb = 27.55 in. Hg
Vacuum = 0.0 in. Hg

Orifice Manometer Setting, Delta H in. H20		0.10	0.20	0.30	0.50	0.75	1.00
Gas Volume Wet Test Meter							
Vw, cu. ft.		10.000	10.000	10.000	10.000	10.000	10.000
Gas Volume Dry Gas Meter							
M Final		9.955	19.917	29.861	39.832	49.783	59.728
M Initial		0.000	9.955	19.917	29.861	39.832	49.783
Vd, cu. ft.		9.955	9.962	9.944	9.971	9.951	9.945
Wet Test Meter							
tw Deg F		75	75	75	75	76	76
tw Deg A		535	535	535	535	536	536
Dry Gas Meter Outlet, tmo	**1)**	75	76	76	77	79	81
	2)	75	76	77	78	80	82
	3)	76	76	77	79	81	83
Dry Gas Meter Inlet tmi	**1)**	75	75	76	76	76	76
	2)	75	75	76	76	76	76
	3)	75	75	76	76	76	76
Mean tm, Deg F		75	76	76	77	78	79
Mean tm, Deg A		535	536	536	537	538	539

Results :

	Y =	1.004	1.004	1.007	1.005	1.007	1.008

Averages :

Y = **1.006**

WET TEST METER CALIBRATION LOG

Wet Test Meter Serial Number AA455 Date 4-10-10

Range of Wet Test Meter Flow Rate 0 - 0.25

Volume of Test Flask Vs 37.850

Satisfactory Leak Check? Yes

Ambient Temperature of Equilibrate Liquid in Wet Test Meter and Reservoir 74

TEST #	MANOMETER READING, *a* mm H_2O	FINAL VOLUME (Vf), l	INITIAL VOLUME (Vi), l	TOTAL VOLUME (Vm), *b* l	FLASK VOLUME (Vs), l	PERCENT ERROR, *c* %
1	Ø	3.0	Ø ALL RESET	3.0	3.002	-.067
2	Ø	3.0	Ø	3.0	3.002	-.067
3	Ø	3.0	Ø	3.0	3.001	-.033

a - Must be less than 10 mm H_2O (0.4 ' H_2O)

Calculations:

b - Vm - Vf - Vi

c - % error = $\frac{100\,(V_m - V_s)}{V_s}$ = _____ (± 1 %)

SO_2 ROTAMETER CALIBRATION

Last Cal. : 5-10-10 By KW Date : 5-11-11 By : CMO

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

Barometric Pressure : 30,11 " Hg Temperature : 68.

RUN #	50 CC/MINUTE DIGICAL VOLUME	100 CC/MINUTE DIGICAL VOLUME	150 CC/MINUTE DIGICAL VOLUME
1	55.4	122.1	176.1
2	55.9	121.8	171.3
3	56.1	122.6	171.3
4	55.5	122.5	170.8
5	55.7	123.0	171.7
6	56.2	122.2	171.6
7	55.1	121.6	171.9
8	55.8	121.9	171.2
9	56.0	122.0	171.0
10	56.1	122.0	171.4
AVERAGE	55.8 cc/min	122.2 cc/min	171.3 cc/min

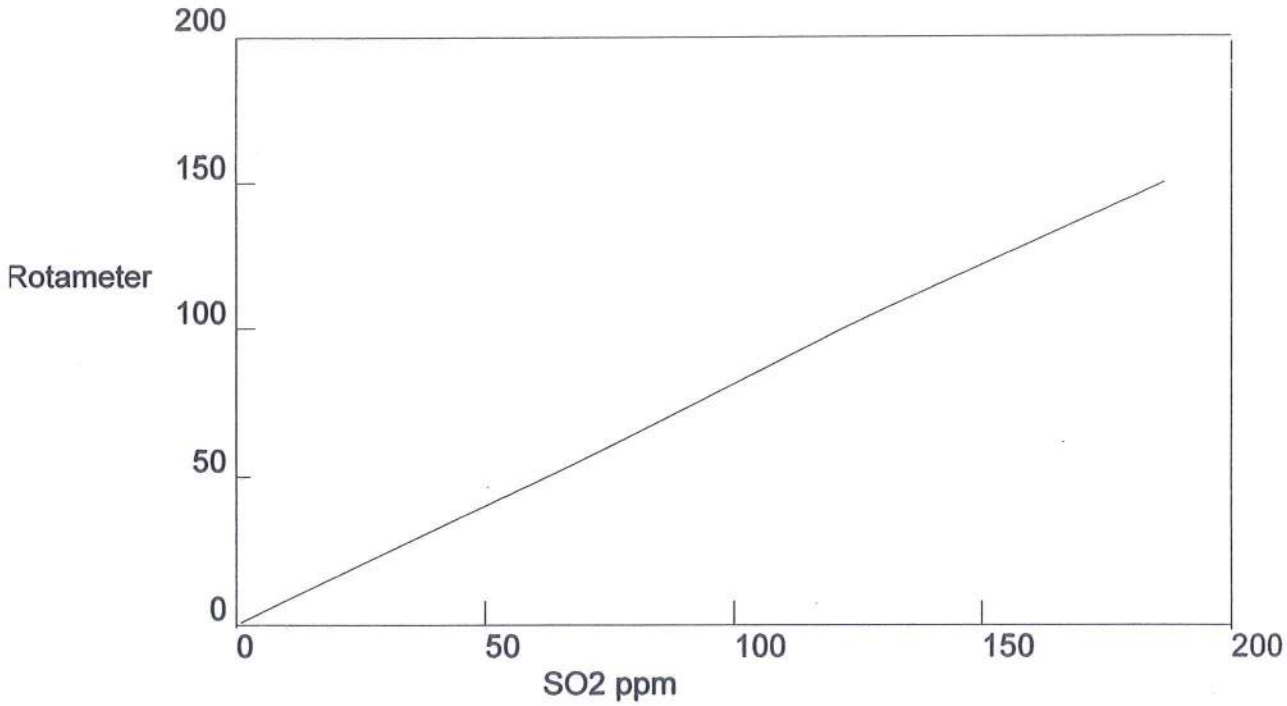
SETTING	cc/min
0	0.0
50	55.8
100	122.2
150	171.3

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

100 CC / MINUTE = 85.9

SO2 Rotameter

05/11/11



Regression Output:

Constant	0.28
Std Err of Y Est	5.007144895
R Squared	0.9970307707
No. of Observations	4
Degrees of Freedom	2
X Coefficient(s)	1.1606
Std Err of Coef.	0.0447852654

range-analyze-regression

0	0
50	55.8
100	122.2
150	171.3

TRACER GAS TRAIN RESPONSE TIME

DATE: 5-11-11

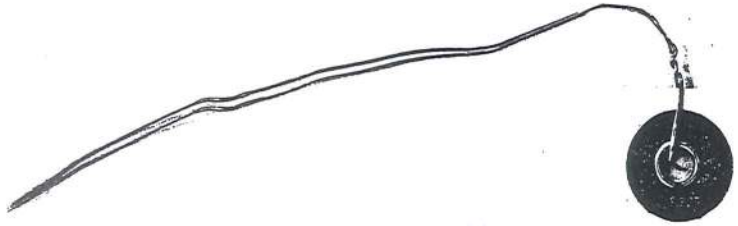
Elapsed Time	SO_2 Conc. (v.)	SO_2 Conc. (v.)	SO_2 Conc. (v.)
00 sec	.499	.499	.500
15	.387	.390	.390
30	.188	.185	.185
45	.072	.070	.070
60	.025	.028	.027
75	.011	.012	.011
90	.003	.002	.003
105	.001	Ø	.001
120	Ø		Ø
135			
150			
165			
180			
Initial Response	8	8	8
95 % Response	55	61	61
Flow Rate	1.5	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	.487	.488	.486	.002	.001	.002	.490	.490	.491
15	.486	.488	.488	.421	.422	.420	.166	.170	.115
30	.425	.428	.427	.742	.740	.740	.055	.051	.051
45	.170	.172	.171	.805	.800	.801	.008	.009	.007
60	.080	.078	.079	.820	.818	.819	.001	.001	.001
75	.037	.038	.038	.825	.824	.825	Ø	Ø	Ø
90	.020	.021	.021	.828	.826	.829			
105	.010	.009	.008						
120	.004	.003	.003						
135	.001	.001	.001						
150	Ø	Ø	Ø						
165									
180									
Initial Response	20	20	20	5	5	5	5	5	5
95 % Response	85	85	85	45	45	45	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 : 5-11-11

Gas	1	2	3	AVE	CONC	TANK ID
CO_2	ϕ	ϕ	ϕ	ϕ	ϕ	168TAC 3A
O_2	ϕ	ϕ	ϕ	ϕ	ϕ	
CO	ϕ	ϕ	ϕ	ϕ	ϕ	
CO_2					12.2	487905
O_2					12.6	New 11-01-07
CO					4.90	Exp. 10-31-2012
CO_2					21.1	CA Cylinder
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	6.3	6.3	6.2	6.27	6.25	
CO	2.0	2.0	2.0	2.0	1.98	
CO_2						
O_2						
CO						



LOW SPAN

AIR LIQUIDE

GASES FOR RESEARCH AND DEVELOPMENT

CYL # CC-12731 CGA 590

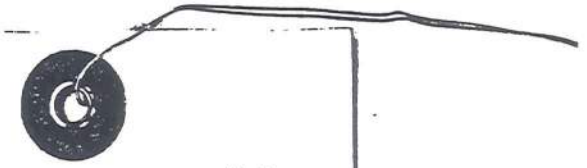
PRES 1665 VOL 130 c.f

TEST # 07203 DATE 03-13-03

Analytical Method GC/Paramagnetic

	Requested	Analyzed
Hydrogen		
Nitrogen	Bal.	Bal.
Argon		
Air		
Carbon Monoxide	2%.	1.98%.
Methane		
Oxygen	6.25%.	6.25%.
Helium		
Carbon Dioxide	6.25%.	6.22%.

SIGNED



AIR LIQUIDE

1451 THORNE RD.
TACOMA, WA 98421
TEL: (253) 383-3637

THE ONLY LIABILITY OF THIS COMPANY FOR GAS WHICH FAILS TO COMPLY WITH THE ANALYSIS SHALL BE REPLACEMENT THEREOF BY THE COMPANY WITHOUT EXTRA COST.

DO NOT REMOVE THIS TAG

AIR LIQUIDE™

CERTIFICATE OF ANALYSIS

Customer : Pacifice Rim Oxygen Service
P.O. Number : 200159
Document # : 23639406-1A
Mix/Lot # : SFS103795
Item Number : SFS103795
Valid Until : 4 January, 2012

Specification : CUSTOM CERTIFIED
Phase : GAS
Cyl. Size : 30AL
Valve : CGA 590
Pressure : 1667
Volume : 120 SCF

Cylinder Number: **CAO6641**

Component	Requested Concentrations MOLE	Actual Concentration MOLE	% Analytical Uncertainty	Equipment Used Scale	Analyt. Inst.	Calibration Standard
NITROGEN	Balance	Balance		2		
CARBON MONOXIDE	8.6 %	8.63 %		2	4620	PQ
OXYGEN	21 %	20.9 %		2	4620	TB
CARBON DIOXIDE	21 %	21.1 %		2	4620	PD
7001-30AL						

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

Comments:

Dewpoint calculated to 40° F, unless otherwise stated. Improper storage or use may affect the accuracy of this standard. Reported impurities are approximate and should not be used for calibration purposes.

Prepared by _____ Date: 5-Jan-2007

8832 Dice Road -- Santa Fe Springs, CA 90670
Phone (562) 945-1383 **Fax** (562) 696-7903
ISO: 9001-2000

A-L WELDING PRODUCTS

A Division of Pacific Rim Oxygen Services, Inc.
15700 Nelson Road South • Tukwila, Washington 98188
Telephone (425) 228-2218 • Fax (425) 228-2397

Certificate of Analysis

Customer: AL Welding Products
Product: 5% CO. 12.5% CO2, 12.5% O2, balance Nitrogen
Grade: Certified Standard
Cylinder Number: 487905
Product Code: 2505COOXCDNTHC
Lot Number: K3171302

11-01-07

CGA 590
Pressure: 1650 psig
Contents: 175 ft^3

Mixture Analysis

Component	Specification	Concentration	Analytical Method
Oxygen	12.5%	12.6%	MTIGC-TCD
CO2	12.5%	12.2%	Varian
CO	5.0%	4.9%	MTIGC-TCD
Nitrogen	Balance	Balance	MTI GC-TCD

I certify the above referenced cylinder was analyzed and found to contain the listed concentrations.

Thomas M Chesser

Thomas M Chesser, Chemist

11-01-07
Date

Scott Specialty Gases

500 WEAVER PARK RD,LONGMONT,CO 80501 Phone: 303-442-4700 Fax: 303-772-7673

CERTIFICATE OF ANALYSIS: Interference-Free™ Multi-Component EPA Protocol Gas

Customer
ENERGY & ENV MEASUREMENT

C/O ED WADINGTON
3730 N. PELLEGRINO DR.
TUCSON,AZ 85749

Assay Laboratory

SCOTT SPECIALTY GASES
500 WEAVER PARK RD
LONGMONT,CO 80501

Project No.: 08-34136-001
P.O. No.: VERBAL

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure #G1; September, 1993.

Cylinder Number: ALM052285 Certification Date: 4/21/97 Exp. Date: 4/21/2000
Cylinder Pressure***: 1996 PSIG

COMPONENT	CERTIFIED CONCENTRATION	ANALYTICAL ACCURACY**
SULFUR DIOXIDE *	506 PPM	+/- 1% NIST Traceable
NITROGEN	BALANCE	

*** Do not use when cylinder pressure is below 150 psig.
** Analytical accuracy is inclusive of usual known error sources which at least include precision of the measurement processes. Product certified as +/- 1% analytical accuracy is directly traceable to NIST standards.
* This Protocol has been certified using corrected NIST SO2 standard values, per EPA guidance dated 7/24/96 and will not correlate with Uncorrected Protocols.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 1681	9/27/98	ALM059505	488.5 PPM	SO2/N2

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	LAST DATE CALIBRATED	ANALYTICAL PRINCIPLE
FTIR System/8220/AAB9400251	03/20/97	Scott Enhanced FTIR

ANALYZER READINGS

(Z = Zero Gas R = Reference Gas T = Test Gas r = Correlation Coefficient)

SULFUR DIOXIDE *

First Triad Analysis			Second Triad Analysis			Calibration Curve
Date: 04/14/97	Response Unit: PPM		Date: 04/21/97	Response Unit: PPM		Concentration = A + B1 + C1² + D1³ + E1⁴
Z1 = 0.3847	R1 = 487.72	T1 = 505.77	Z1 = 0.3241	R1 = 488.29	T1 = 505.43	r = 0.999990
R2 = 488.79	Z2 = 1.8201	T2 = 505.89	R2 = 488.83	Z2 = 1.8099	T2 = 505.75	Constants: A = 0.000000
Z3 = 1.8428	T3 = 505.79	R3 = 488.99	Z3 = 0.8340	T3 = 505.74	R3 = 488.69	B = 1.000000 C = 0.000000
Avg. Concentration:	505.8	PPM	Avg. Concentration:	505.8	PPM	D = 0.000000 E = 0.000000

Special Notes:

ANALYST: Devon VonFeldt
Devon VonFeldt

SO2 concentration analysis
05/11/11

Vm(std)	1.500			
mcf	1.004		dscf=	1.500
Hg	30.13			
DH	0.12			
temp	68	528	ppm =	501
ml BA ++	175			
Normality	0.0101		Run1	510
			Run 2	498
			Run3	501
Tank I.D. #	ALMO52285		avg.	503

AIR LIQUIDE™

CERTIFICATE OF ANALYSIS

Customer : Pacific Rim Oxygen Service Inc
P.O. Number : 200160
Document # : 23540983-1A
Mix/Lot # : SFS103340
Item Number : SFS103340
Valid Until : 2 January, 2010

Specification : CUSTOM CERTIFIED
Phase : GAS
Cyl. Size : 30AL
Valve : CGA 660
Pressure : 2000
Volume : 144 SCF

Cylinder Number: **CC82089**

Component	Requested Concentrations MOLE	Actual Concentration MOLE	% Analytical Uncertainty	Equipment Used Scale	Analyt. Inst.	Calibration Standard
NITROGEN	Balance	Balance		4		
SULFUR DIOXIDE	1250 PPM	1250 PPM	+/- 2%	4	4503	GL
6154-30AL						

This mixture was certified by analysis using one or more calibration standards prepared with scales 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)

First Triad Analysis

SULFUR DIOXIDE *

Date: 04/14/97 Response Unit: PPM

Z1 = 0.7210	R1 = 3127.7	T1 = 1767.1
R2 = 3131.7	Z2 = 4.6770	T2 = 1768.1
Z3 = 4.6770	T3 = 1768.1	R3 = 3133.7

Avg. Concentration: 1768. PPM

Second Triad Analysis

Date: 04/21/97 Response Unit: PPM

Z1 = 0.4020	R1 = 3125.8	T1 = 1770.2
R2 = 3132.3	Z2 = 6.6540	T2 = 1769.3
Z3 = 4.9410	T3 = 1770.9	R3 = 3134.9

Avg. Concentration: 1770. PPM

Calibration Curve

Concentration = A + Bx + Cx2 + Dx3 + Ex4

r = 0.999990	1696
Constants:	A = 0.00000
B = 1.00000	C = 0.00000
D = 0.00000	E = 0.00000

Special Notes:

ANALYST: Devon VonFeldt
DEVON VONFELDT

SO2 concentration analysis
05/11/11

Vm(std)	1.500			
mcf	1.004		dscf=	1.500
Hg	30.13			
DH	0.12			
temp	68	528	ppm =	1770
ml BA ++	618			
Normality	0.0101		Run1	1781
			Run 2	1767
			Run3	1770
Tank I.D. #	ALMO49127		avg.	1773

CO_2 ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Date: 9-20-2011

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

Calibration by: C. Watts

Cal Gas Flow: 1.5 SCFH Measured by: Rotameter

BP: 29.46 Instrument ID: PRINCO

Temp: 70 Instrument ID: TR

Cylinders:

1. # 168TAC 3-A Concentration: 00.00 % CO_2 Cyl. Press.: 420 PSI
   Certified by: AIR LIQUIDE Date: 04-19-04
2. # 487905 Concentration: 12.20 % CO_2 Cyl. Press.: 1400 PSI
   Certified by: AIR LIQUIDE Date: 11-1-07
3. # CA0666 41 Concentration: 21.1 % CO_2 Cyl. Press.: 1480 PSI
   Certified by: AIR LIQUIDE Date: 1-5-2007
4. # CC-12731 Concentration: 6.22 % CO_2 Cyl. Press.: 1100 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	0.00	.000	0.00	.000
2	2	12.20	48.8	.488	48.0	.480	48.8	.488
3	3	21.1	84.4	.844	84.6	.846		
4	4	6.22	24.9	.249	23.9	.239		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 12.532

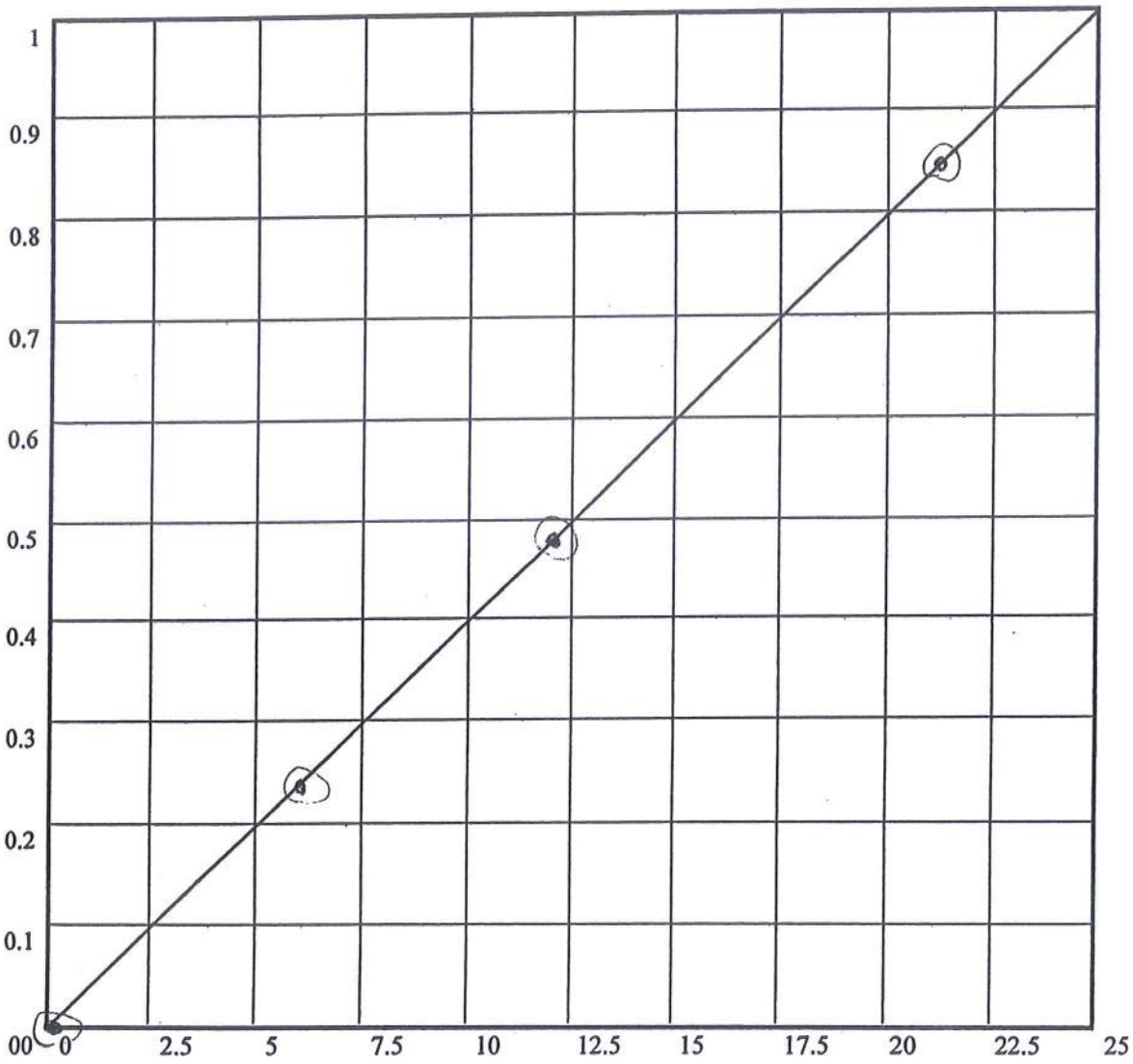
CO_2 Linear Regression Results:

Y = MX +B
Slope (M) = -.0043277

Y Intercept (B) = .0402407

Correlation Coefficient (r) = .9999098

r^2 = .9998196

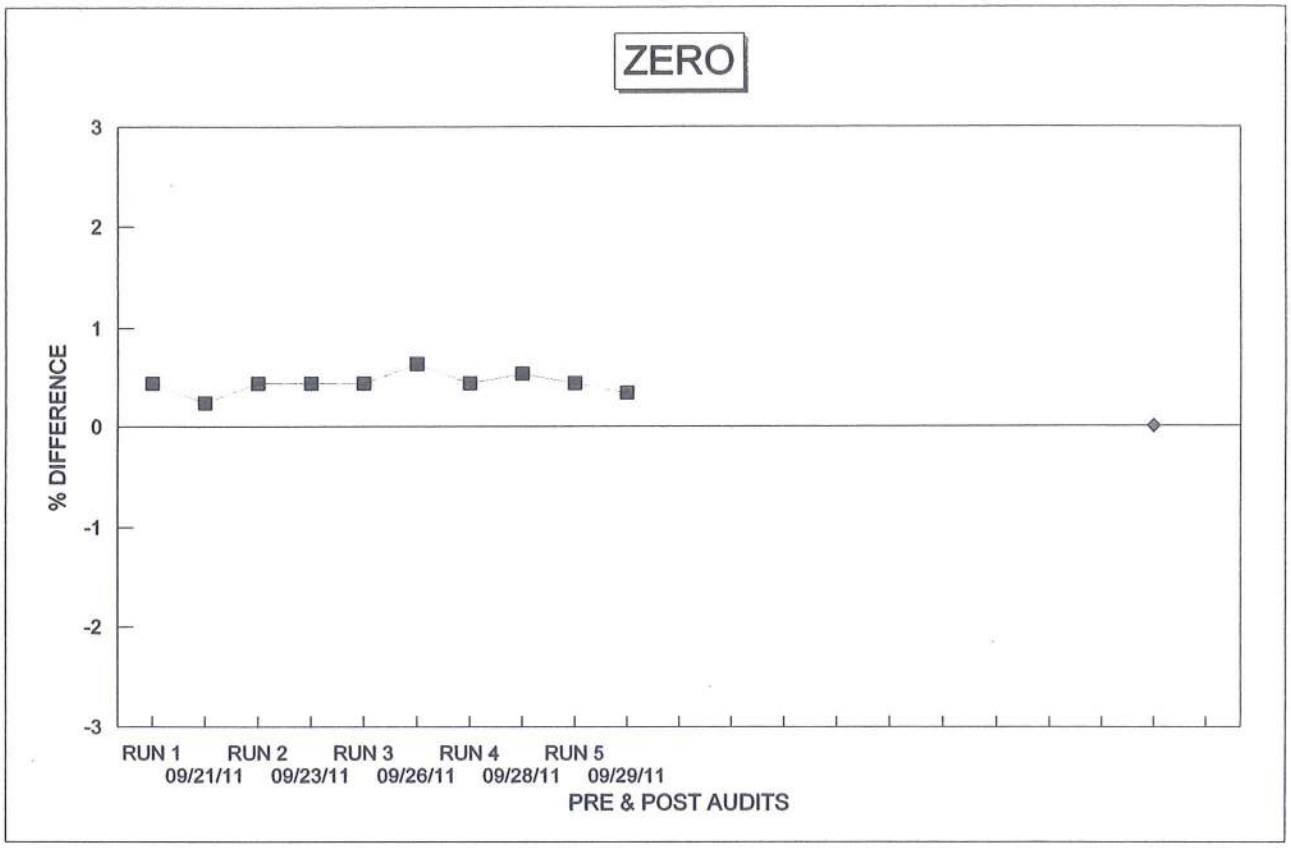


EPA Span Value = ± 2.0% of 25% CO_2 = ± .5%

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

HIGH VOLTS .846 = 21.15 - 21.10 = .050 = .200

LOW VOLTS .239 = 5.98 - 6.22 = -.240 (= -.960)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RUN 1
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RUN 3
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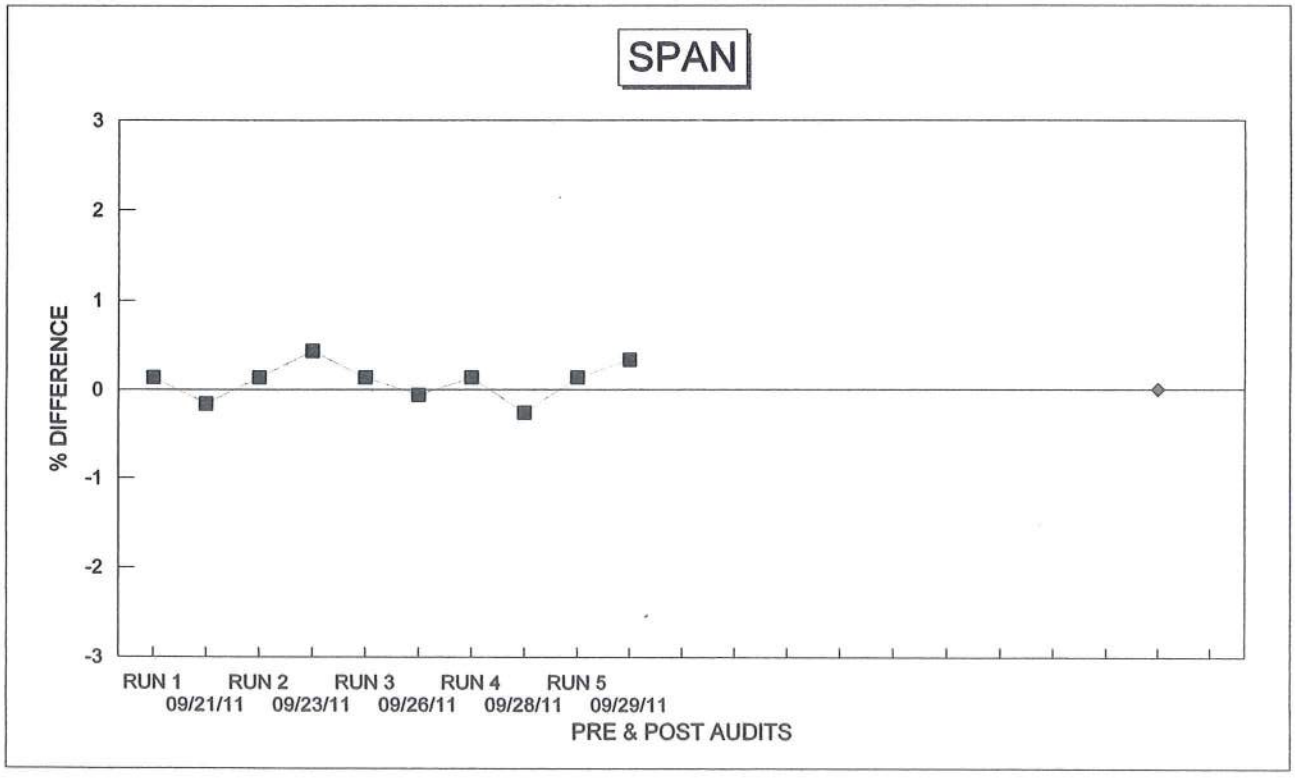
RUN 5
09/29/11
PRE & POST AUDITS


SPAN
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RUN 1
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RUN 3
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RUN 4
09/28/11
RUN 5
09/29/11
PRE & POST AUDITS

O_2 ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Date: 9-20-2011

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

Calibration by: C. [illegible]

Cal Gas Flow: 1.5 SCFH

Measured by: Rotameter

BP: 29.66

Instrument ID: PRINCO

Temp: 70

Instrument ID: TR

Cylinders:

1. # 168TAC 3-A Concentration: 00.00 % O_2 Cyl. Press.: 420 PSI
   Certified by: AIR LIQUIDE Date: 04-19-04
2. # 487905 Concentration: 12.0 % O_2 Cyl. Press.: 1400 PSI
   Certified by: AIR LIQUIDE Date: 11-1-07
3. # CA06641 Concentration: 20.9 % O_2 Cyl. Press.: 1480 PSI
   Certified by: AIR LIQUIDE Date: 1-5-2007
4. # CC-12731 Concentration: 6.25 % O_2 Cyl. Press.: 1100 PSI
   Certified by: AIR LIQUIDE Date: 03-13-03

Analyzer: **Calibrated Range:** 0-25.0 % **Output:** 0-1.0 V.
Flow: 1.5 SCFH **Measured by:** Rotameter

Calibration Results

Point #	CYL. #	% O2	EXPECTED METER	EXPECTED DVM	ACTUAL METER	ACTUAL DVM	ADJ. METER	ADJ. DVM
1	1	0.00	00.0	.000	00.0	.000	0.00	.000
2	2	12.60	12.60	.504	12.6	.505	12.6	.504
3	3	20.9	20.9	.836	20.8	.833		
4	4	6.25	6.25	.250	6.2	.251		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 12.475

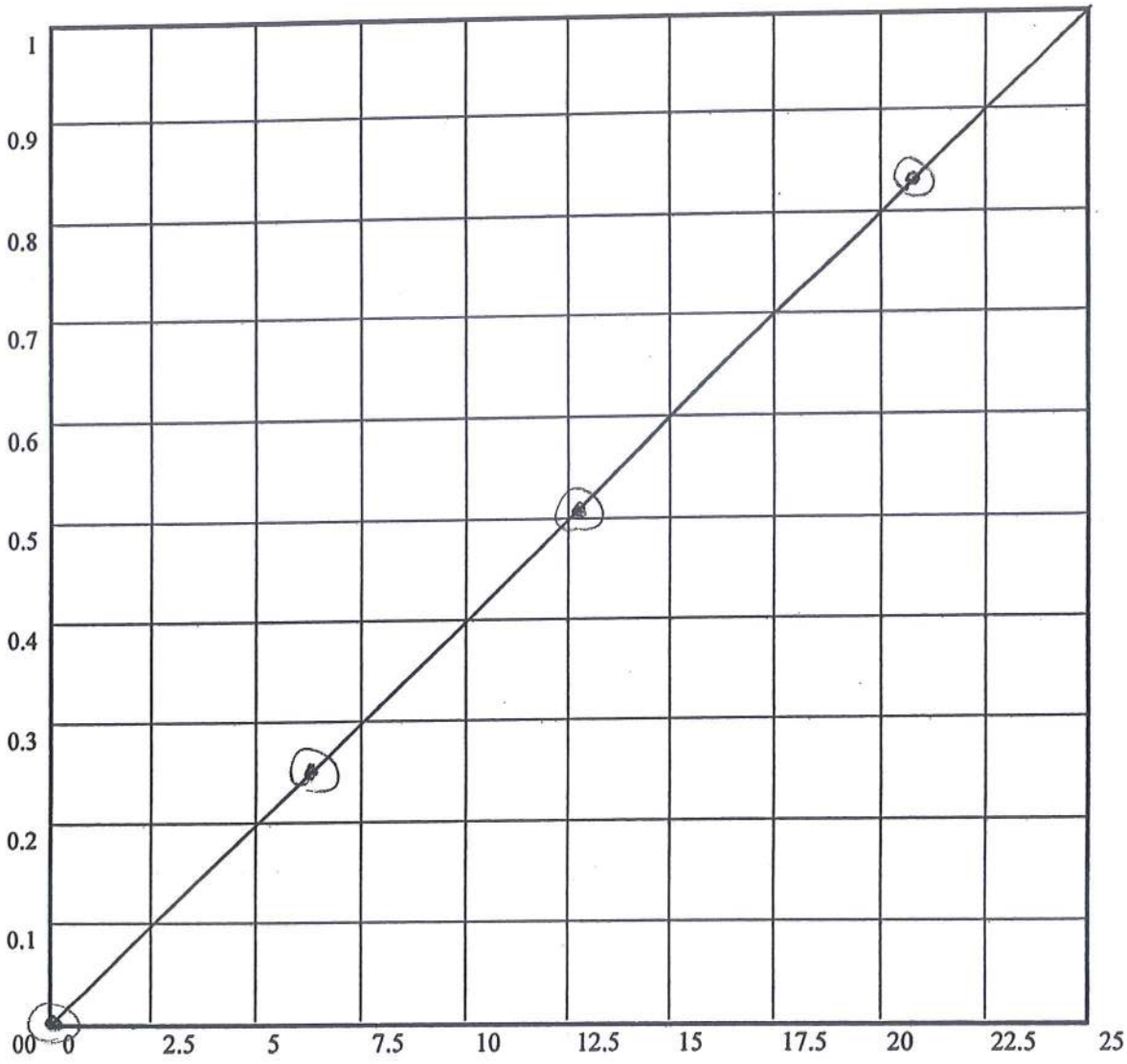
O_2 Linear Regression Results:

Y = MX +B
Slope (M) = .0010169

Y Intercept (B) = .0398474

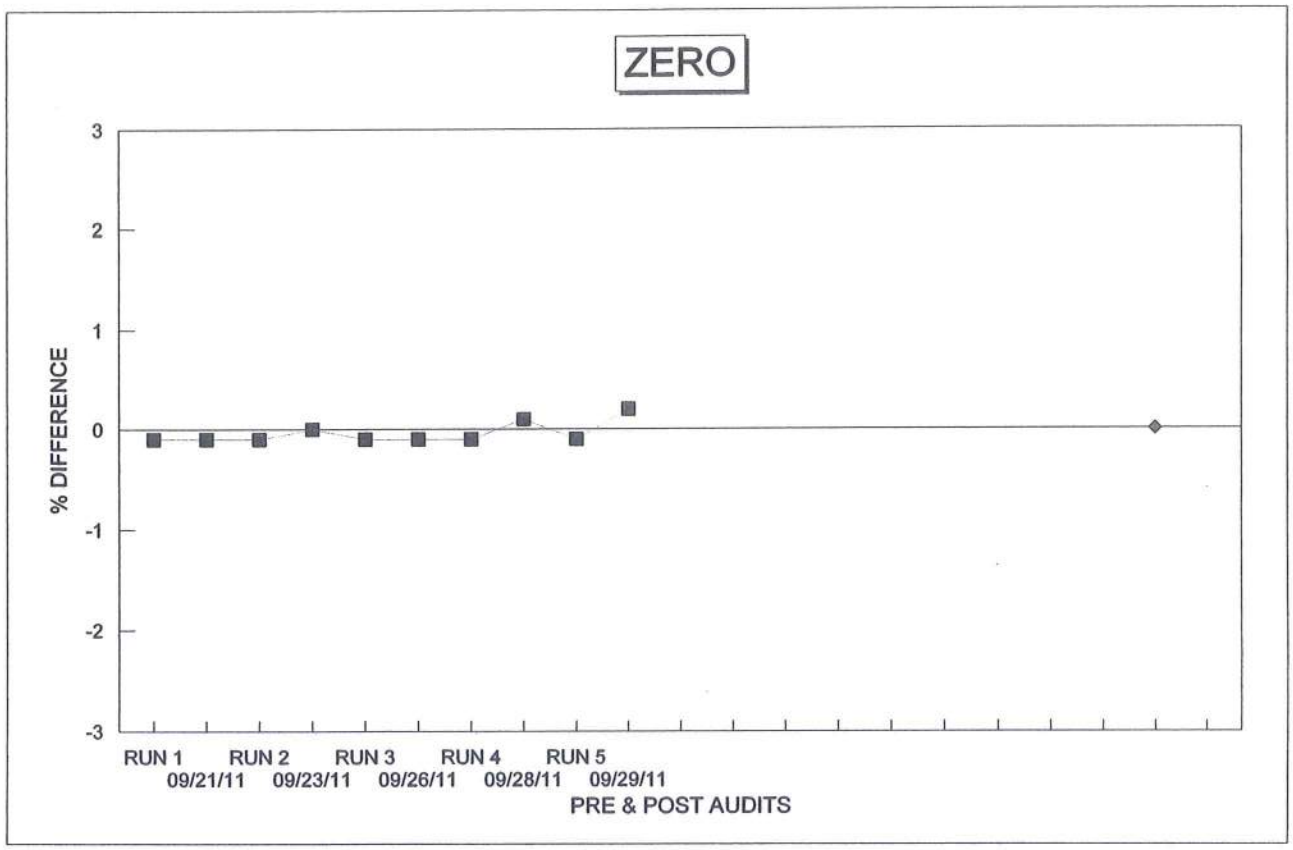
Correlation Coefficient (r) = .9999955

r^2 = .9999910



EPA Span Value = ± 2.0% of 25% O_2 = ± .5%
Cal Volts = Cal Volt Conc - Std Conc = ± Conc Diff = ± Δ %

HIGH VOLTS	.833	= 20.825 - 20.9	= -.075	= -.300	
LOW VOLTS	.251	= 6.275 - 6.25	= .025	= .100	


ZERO
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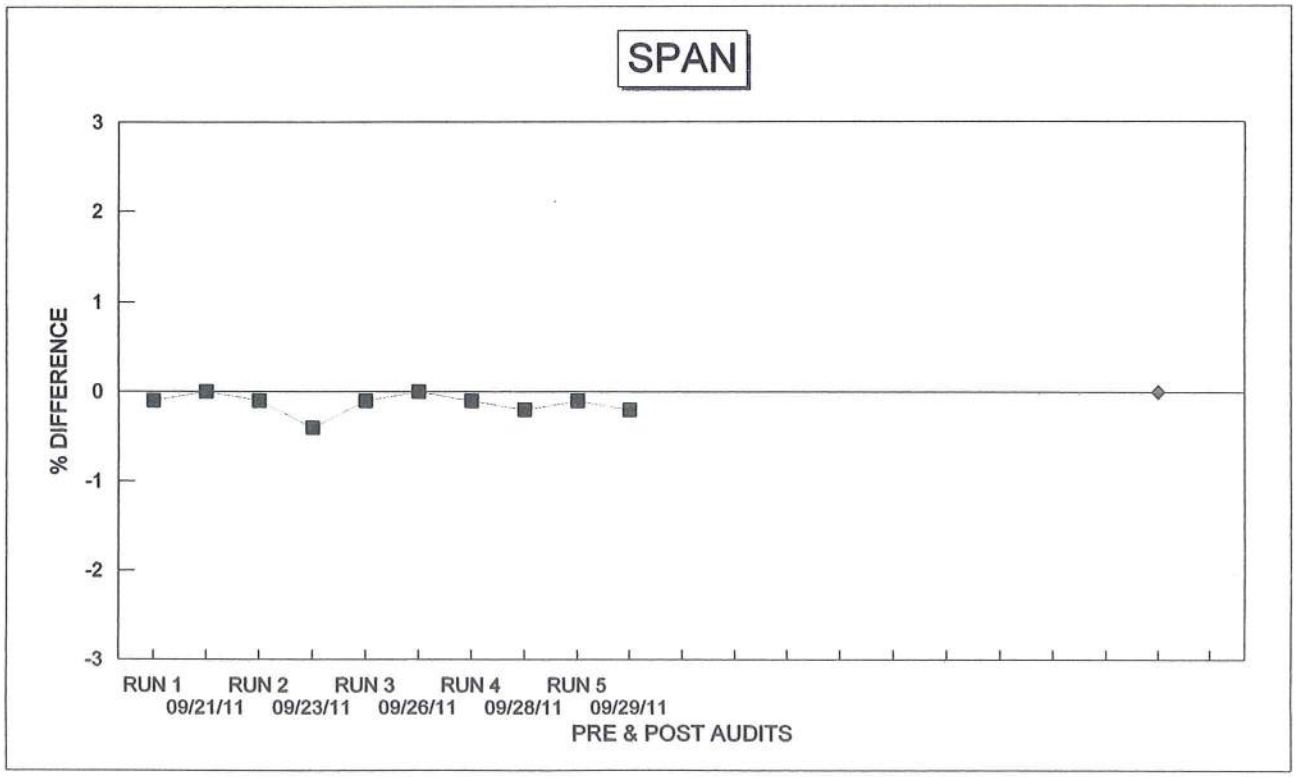
RUN 5
09/29/11
PRE & POST AUDITS


SPAN
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RUN 1
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RUN 4
09/28/11
RUN 5
09/29/11
PRE & POST AUDITS

CO ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Date: 9-20-2011

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

Calibration by: C. Wachendorf

Cal Gas Flow: 1.5 SCFH

Measured by: Rotameter

BP: 29.66

Instrument ID: PRINCO

Temp: 70

Instrument ID: TR

Cylinders:

1. # 168TAC 3-A Concentration: 00.00 % CO Cyl. Press.: 420 PSI
   Certified by: AIR LIQUIDE Date: 04-19-04
2. # 487905 Concentration: 4.90 % CO Cyl. Press.: 1400 PSI
   Certified by: AIR LIQUIDE Date: 11-1-07
3. # CA06641 Concentration: 8.63 % CO Cyl. Press.: 1480 PSI
   Certified by: AIR LIQUIDE Date: 1-5-2007
4. # CC-12731 Concentration: 1.98 % CO Cyl. Press.: 1100 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	0.00	.000	0.00	.000
2	2	4.90	49.0	.490	48.2	.482	49.0	.490
3	3	8.63	86.3	.863	86.3	.863		
4	4	1.98	19.8	.198	19.5	.195		
5	1	0.00	00.0	.000	0.00	.000		

.5 = 5.006

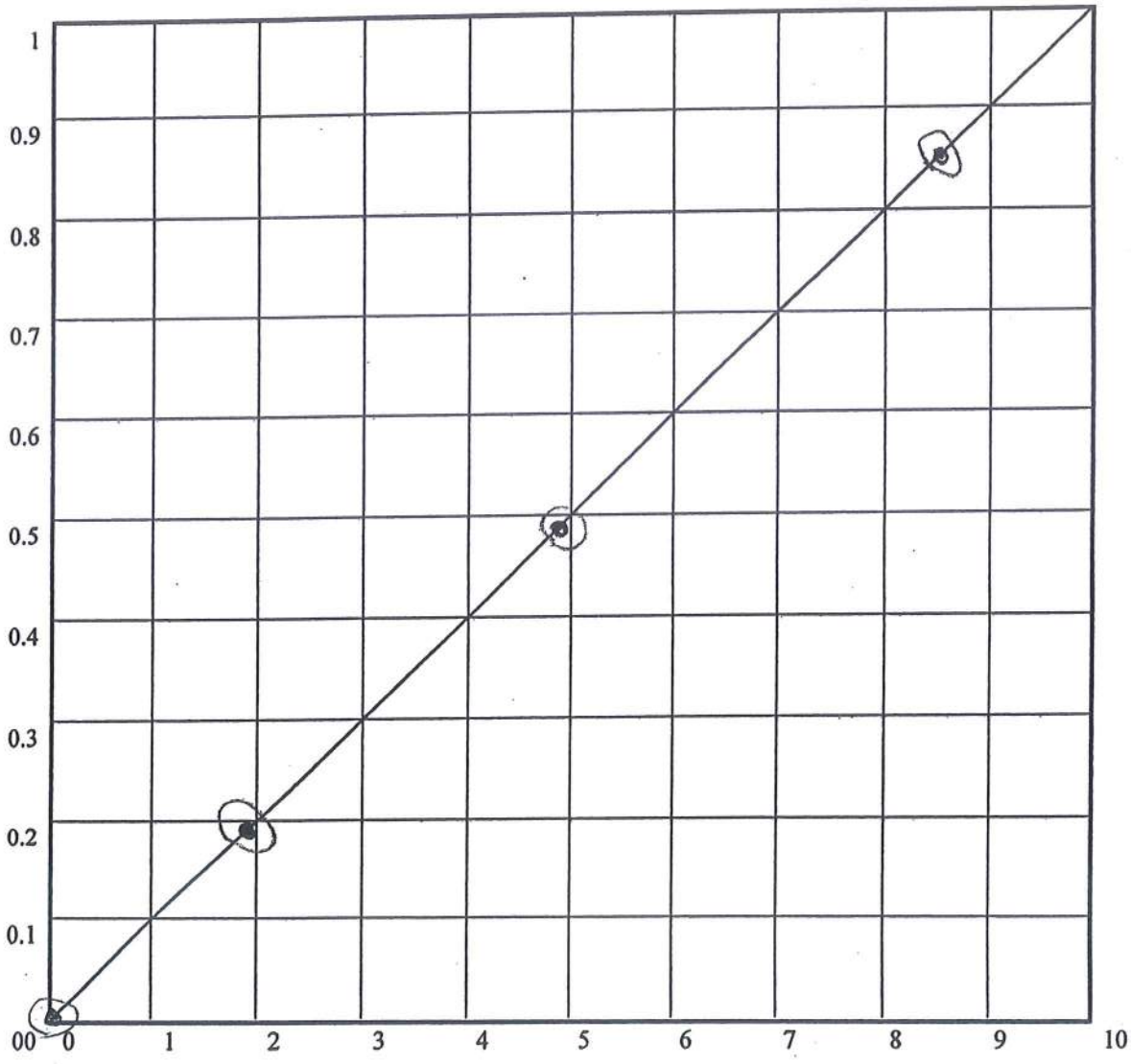
CO Linear Regression Results:

Y = MX +B
Slope (M) = ~.0012722

Y Intercept (B) = .1001347

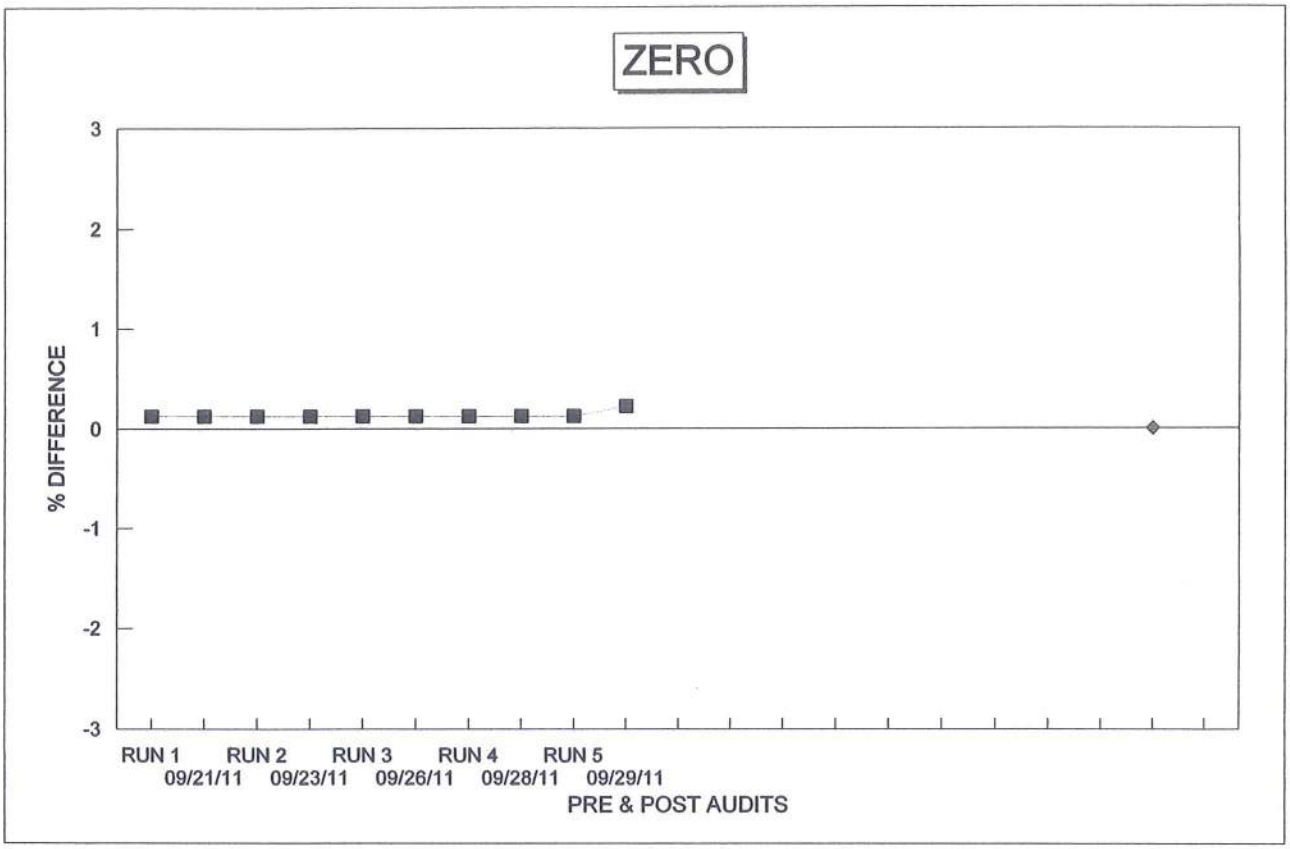
Correlation Coefficient (r) = .9999929

r^2 = .9999859



EPA Span Value = ± 2.0% of 10% CO = ± .2%
Cal Volts = Cal Volt Conc - Std Conc = ± Conc Diff = ± Δ %

HIGH VOLTS	.863	= 8.63 -	8.63	= ∅	= ∅
LOW VOLTS	.195	= 1.95 -	1.98	= -.030	= -.300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RUN 1 09/21/11
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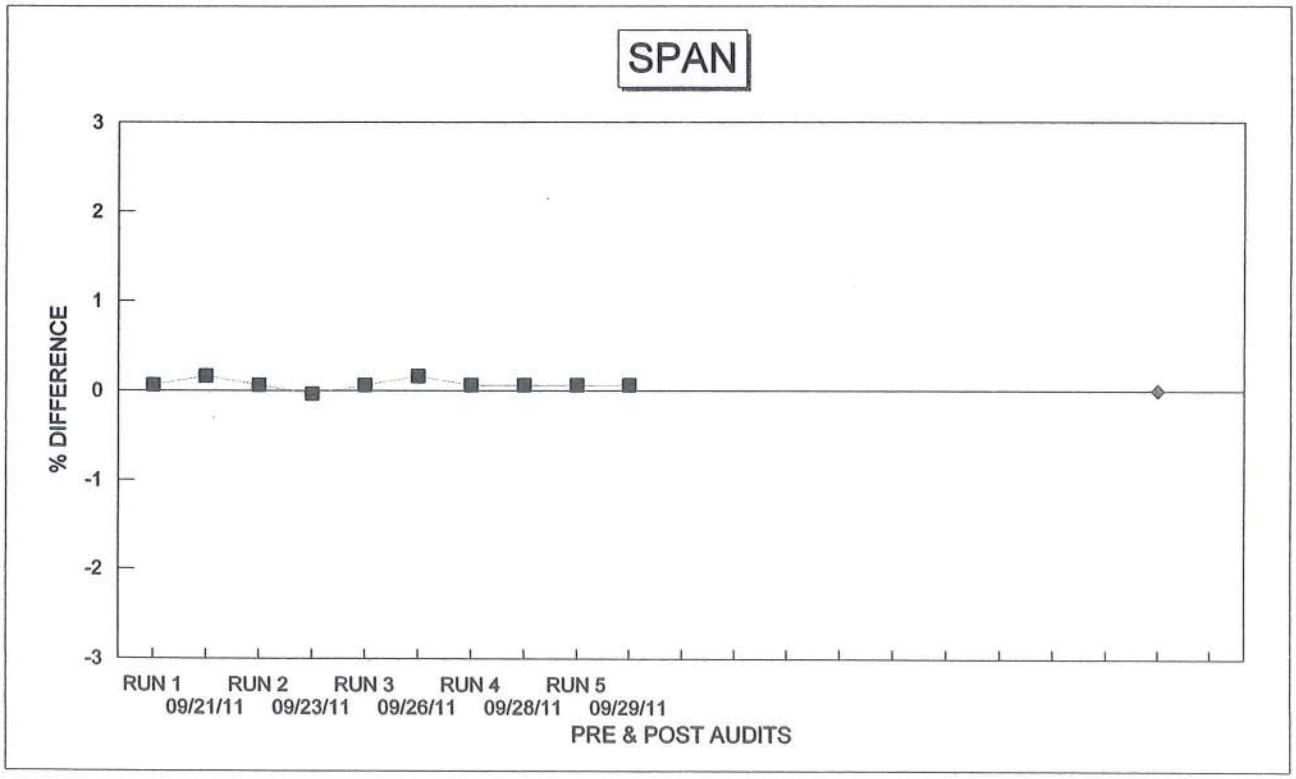
RUN 3 09/26/11
RUN 4 09/28/11
RUN 5 09/29/11
PRE & POST AUDITS


SPAN
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% DIFFERENCE
RUN 1 09/21/11
RUN 2 09/23/11
RUN 3 09/26/11
RUN 4 09/28/11
RUN 5 09/29/11
PRE & POST AUDITS

SO_2 ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Date: 9-20-2011

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

Calibration by: C. Waelnn

Cal Gas Flow: 1.5 SCFH Measured by: Rotameter

BP: 29.66 Instrument ID: PRINCO

Temp: 70 Instrument ID: TR

Cylinders:

1. # 168TAC 3A Concentration: 30.00 % SO_2 Cyl. Press.: 420 PSI
   Certified by: AIR LIQUIDE Date: 04-19-04
2. # CC82089 Concentration: 1250 % SO_2 Cyl. Press.: 1680 PSI
   Certified by: AIR LIQUIDE Date: 1-3-2007
3. # ALMO 49127 Concentration: 1970 % SO_2 Cyl. Press.: 840 PSI
   Certified by: SCOTT SPECIALTY GASES Date: 05-15-97
4. # ALMO 52285 Concentration: 506 % SO_2 Cyl. Press.: 800 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 METER	EXPECTED DVM	ACTUAL METER	ACTUAL DVM	ADJ. METER	ADJ. DVM
1	1	0.00	00.0	.000	0.00	.000	0.00	.000
2	2	1250	50.0	.500	50.3	.503	50.0	.500
3	3	1970	70.8	.708	71.0	.710		
4	4	506	20.2	.202	20.5	.205		
5	1	0.00	00.0	.000	0.00	.000		

.5 = 1246.722

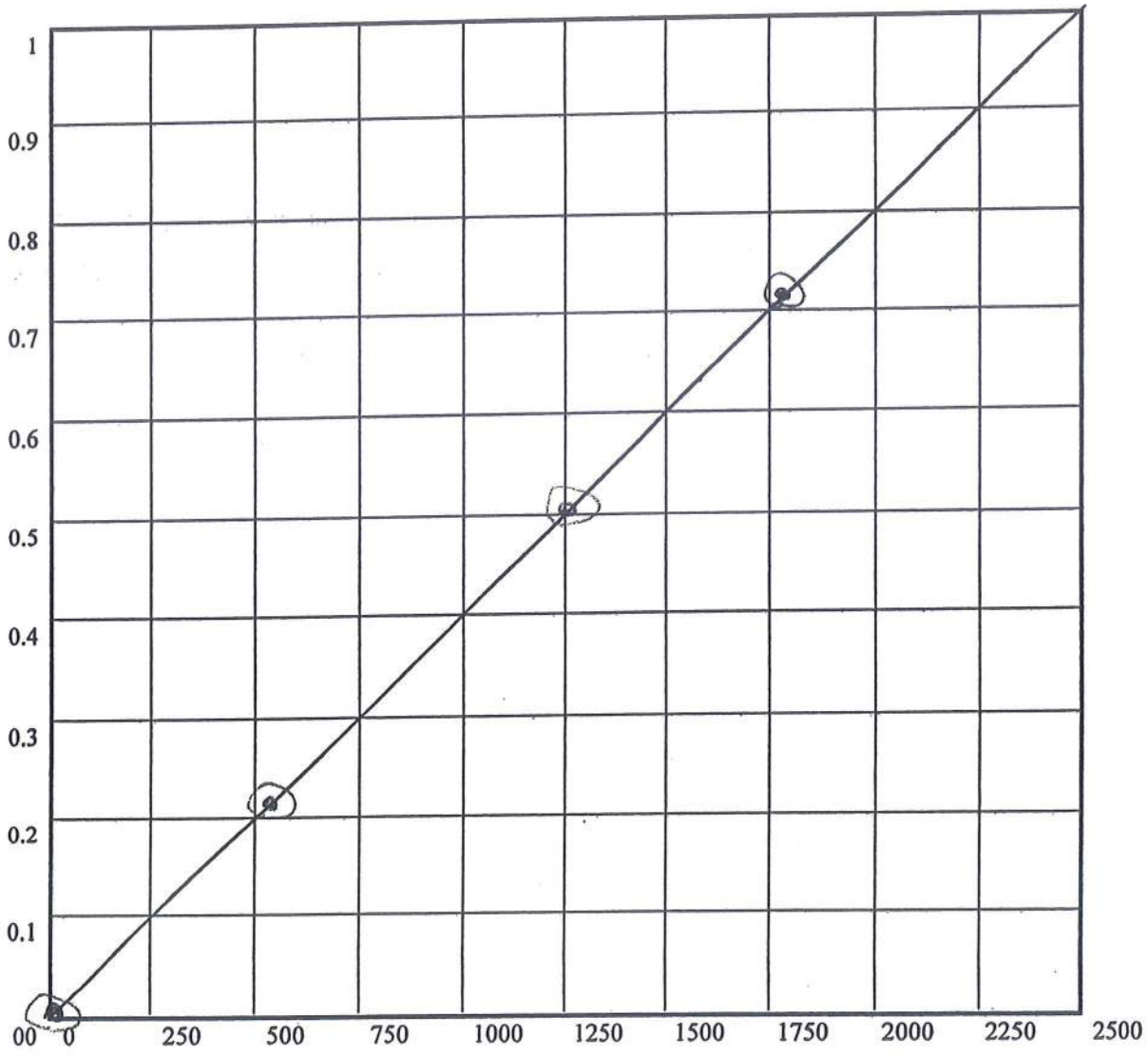
SO_2 Linear Regression Results:

Y = MX +B
Slope (M) = .0007671

Y Intercept (B) = .0004004

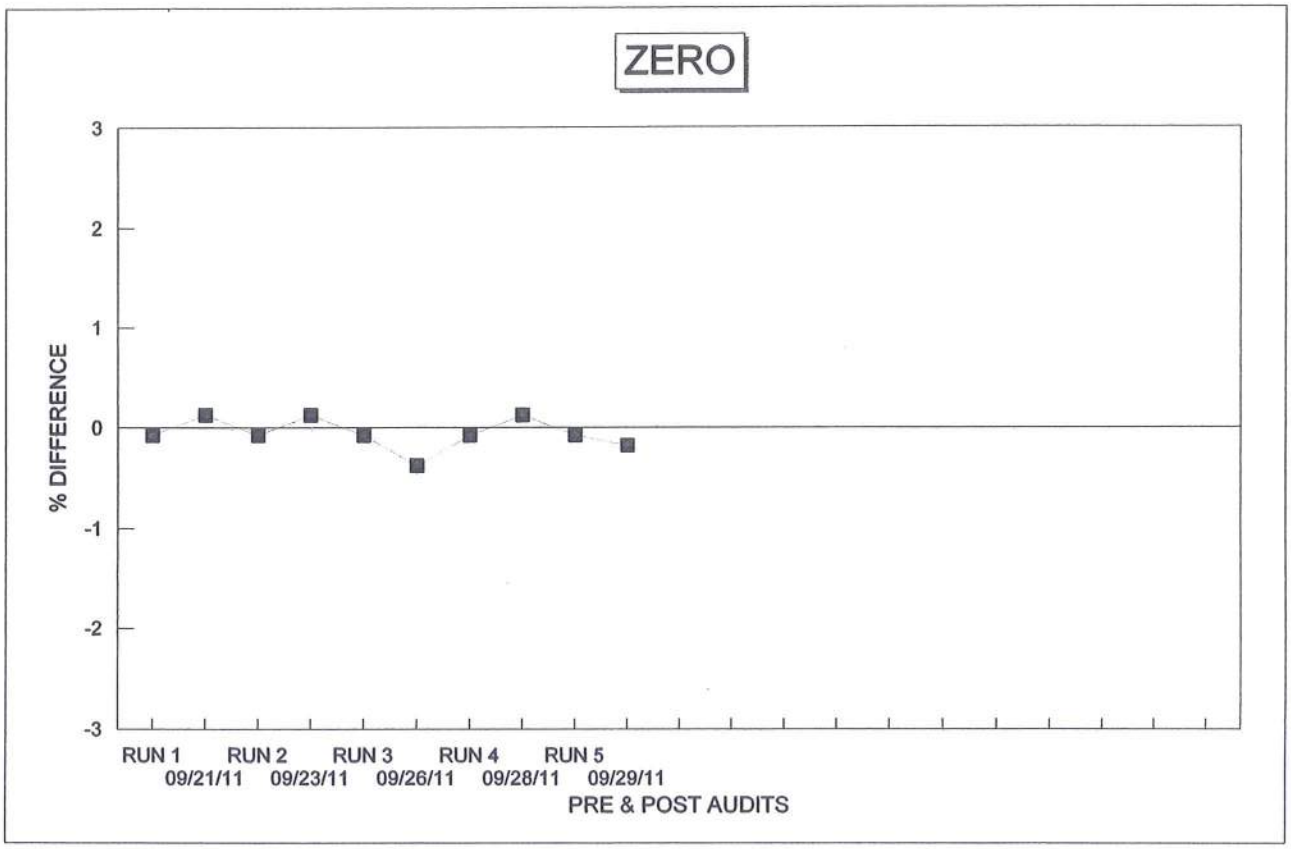
Correlation Coefficient(r) = .9999913

r^2 = .9999827



EPA Span Value = ± 2.0% of 2500 PPM SO_2 = ± 50 PPM
Cal Volts = Cal Volt Conc - Std Conc = ± Conc Diff = ± Δ %

HIGH VOLTS	.710	1775.0 - 1770.0	5.000	.200	
LOW VOLTS	.205	512.5 - 506.0	6.500	.260	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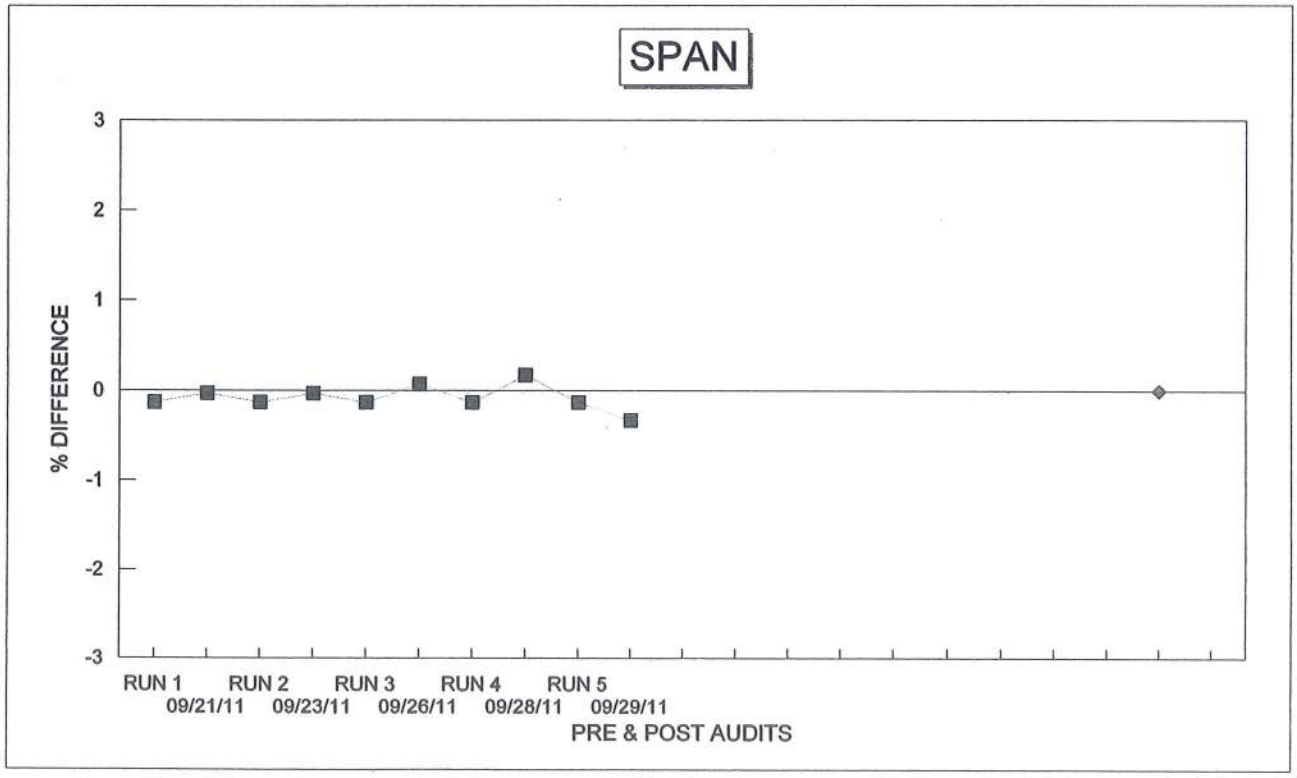
RUN 1 09/21/11
RUN 2 09/23/11
RUN 3 09/26/11
RUN 4 09/28/11
RUN 5 09/29/11
PRE & POST AUDITS


SPAN
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% DIFFERENCE
RUN 1 09/21/11
RUN 2 09/23/11
RUN 3 09/26/11
RUN 4 09/28/11
RUN 5 09/29/11
PRE & POST AUDITS

Certificate of Analysis

ANALYTICAL CONTROL LABORATORY ANALYSIS
METHYLENE CHLORIDE - OPTIMA

Catalog No. D151
Lot No. 035941

July 23, 2003

This is to certify that this lot was tested and found to comply with the specifications for this product. The following are the actual analytical results obtained:

TESTS		ACTUAL ANALYSIS
Assay		99.9%
Color		5 APHA
Description		Clear, Colorless Liquid
Free Halogens		Pass Test
Identification		Pass Test
Fluorescence Background (as Quinine Sulfate)		Not more than 1 ppb
Certified for EPA Test #1625		Pass Test
Pesticide Residue Analysis (as Heptachlor Epoxide)		Not more than 10ng/l
Density (g/ml) at 25°C		1.317 .
Optical Absorbance	At 254 nm	0.002
	At 240 nm	0.10
	At 233 nm	0.54
Refractive Index at 25°C		1.4209
Residue after Evaporation		0.4 ppm
Titratable Acid		0.00004 Meq/g.
Preservative (Amylene)		64 ppm
Water (H_2O)		0.008%

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

Approved By: Edgar E. Hess

Edgar E Hess
Q.C. Laboratory Manager

Certificate of Analysis

ANALYTICAL CONTROL LABORATORY ANALYSIS
METHYLENE CHLORIDE - OPTIMA

Catalog No. D151
Lot No. 035941

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

Approved By: Edgar E. Hess

Edgar E Hess
Q.C. Laboratory Manager

KEITHLEY

Keithley Instruments, Inc.
28775 Aurora Road
Cleveland, Ohio 44139
(440) 248-0400
Telefax: (440) 248-6168

Certificate of Calibration

Model 2700 **Serial No** 0872585 **Date** 13 Mar 2002

This notification serves to certify that the unit described above has been inspected and tested in accordance with specifications published by Keithley Instruments, Inc.

The accuracy and calibration of this instrument are traceable through reference standards that are compared, at planned intervals, to national standards maintained by the National Institute of Standards and Technology (NIST), by comparison to natural physical constants or self-calibrating ratio type measurements.

The measurement standards which support this calibration are calibrated on a schedule to maintain required accuracy level.

James A. Crane
Metrology Services

KEITHLEY

Keithley Instruments, Inc.
28775 Aurora Road
Cleveland, Ohio 44139
(440) 248-0400
Telefax: (440) 248-6168

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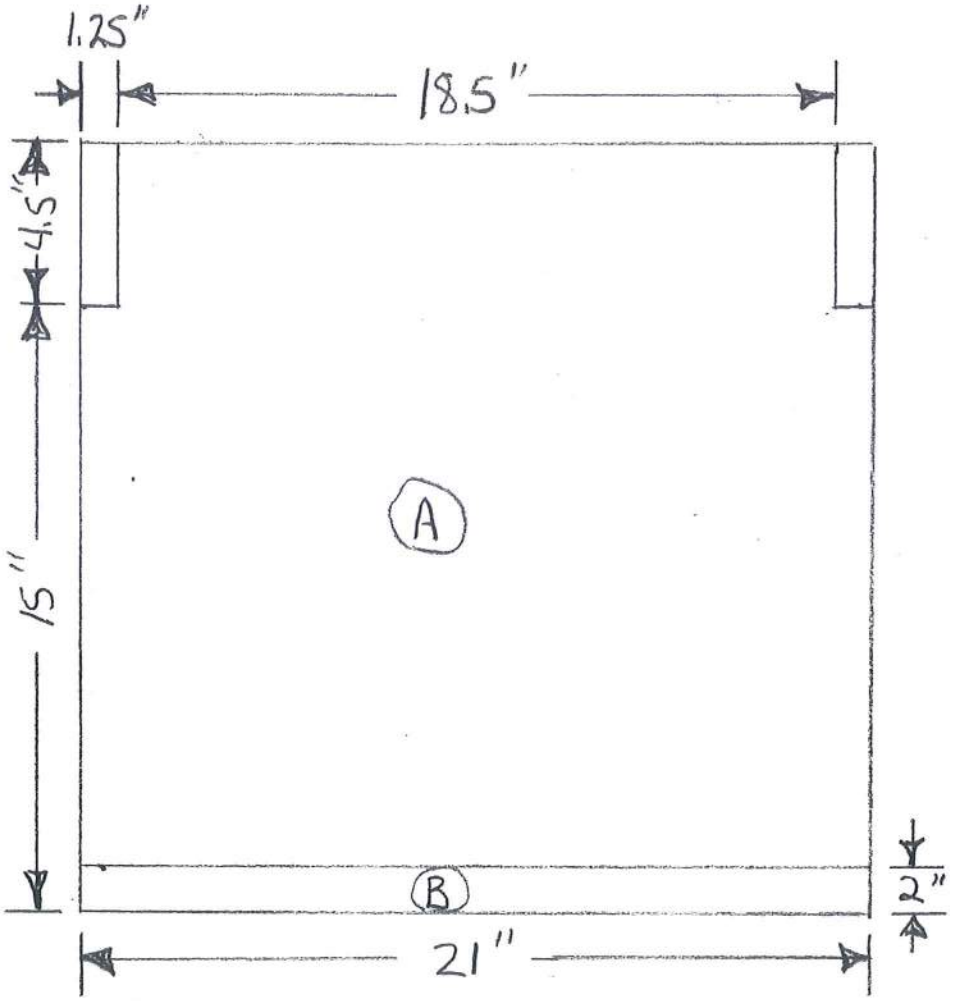
James A. Crane
Metrology Services

Firebox and Fuel Load Calculations for the Jotul F55



A = 21.0" × 19.5" × 11.875" = 4862.813

− B = 21.0" × 2" × 1.75 = −73.500

(×2) − C = 4.5" × 1.25" × 11.875 = −133.594

4655.719 in^3

2.694 ft^3

Fuel Load Weight

Low	Ideal	High
17.0	18.860	20.7

MANUAL

August 31, 2011

Mr. Chip Wadington
Lokee Testing Laboratory
13235 Prairie Circle East
Sumner, Washington 98390

Dear Mr. Wadington,

The following is guidance for adjusting the air control of the Jøtul F 55 in order to achieve burn rates in the appropriate categories. The blower speed for each test category is also indicated.

The primary air is operated by a single control located below the ash lip at front center of the stove.

The secondary air is controlled through an opening located at the center rear bottom of the stove. Secondary air is a non-adjustable fixed opening size.

Air Control and Blower Setting

Burn Rate	Primary Air	Blower Speed / Time on
Low (Min. dry kg/hr)	9/32" open	Low / On at 30 minutes
Med. Low (< 1.25 dry kg/hr)	3/8" open	Low / On at 30 minutes
Med. High (1.25-1.90 dry kg/hr)	5/8" open	Low / On at 30 minutes
High (Max dry kg/hr)	Max. open	High / Entire test

Air and blower setting information contained in the operation manual will be presented in a way as to be representative of the information contained above.

Sincerely,

Roger W. Purinton
Product Development Manager
Jotul North America
55 Hutcherson Drive
Gorham, Maine 04038

5.0 Operation

Please read the following section before building the first fire in your new Jøtul F 55.

5.1 Use Solid Wood Fuel Only

This stove is designed to burn **natural wood only**. Wood that has been air-dried for a period of 6 to 14 months will provide the cleanest, most efficient heat.

Do not burn:

- Coal
- Garbage
- Cardboard
- Solvents
- Drift wood
- Treated or painted wood
- Chemical Chimney cleaners
- Colored paper
- Any synthetic fuel or logs
- Laminated wood

The burning of any of these materials can result in the release of toxic fumes. Never use gasoline, gasoline-type lantern fuel, kerosene, charcoal lighter fluid, or similar liquids to start or "freshen-up" the fire. Always keep such liquids away from the heater at all times.

Important: Never build or allow the fire to rest directly on the glass panel. Try to keep the logs spaced at least one inch from the glass to allow for proper air flow over the glass and within the firebox.

5.2 How your Jøtul F 55 works

When used with dry wood and a well-drafting chimney system, modern non-catalytic wood stoves burn fuel efficiently by the precise control and delivery of primary and secondary air to the fire.

Primary Air is drawn into a front inlet in the stove bottom and directed through a regulator shutter under the front door before entering the lower fire chamber. Additional primary air is directed to the top of the load door to act as an air wash to help prevent extreme soot build-up on the glass panel. The amount of primary air available to the fire determines the intensity of heat output and rate of fuel combustion; the greater the amount of air, the greater the heat output, the faster the wood burns. The primary air setting also determines the effectiveness of the air wash over the glass; the higher the setting, the cleaner the glass.

Additional air is separately directed into the top of the fire chamber to support combustion of exhaust gasses before passing out of the stove. This unregulated ***Secondary Air*** enters through an inlet in the rear of the stove bottom and is heated as it passes through the rear of the stove into a two-tiered manifold at the top of the firechamber. Additional secondary air is directed through a stainless steel tube built into the baffle plate hinge.

WARNING

ALWAYS WEAR STOVE GLOVES WHILE TENDING THE FIRE.

NEVER ALLOW THE FIRE TO REST DIRECTLY ON THE GLASS. KEEP THE LOGS SPACED AT LEAST ONE INCH FROM THE GLASS TO ALLOW FOR PROPER AIR FLOW WITHIN THE STOVE. AVOID STRIKING THE GLASS WITH LOGS.

OPERATE THIS STOVE ONLY WITH THE FRONT DOOR FULLY CLOSED OR FULLY OPEN WITH THE OPTIONAL SPARK SCREEN IN PLACE. OPERATION WITH THE DOOR PARTIALLY OPEN MAY RESULT IN OVER-FIRING. IF THE DOOR IS LEFT PARTIALLY OPEN, GAS AND FLAME MAY BE DRAWN OUT OF THE STOVE CREATING SAFETY RISKS FROM BOTH FIRE AND SMOKE.

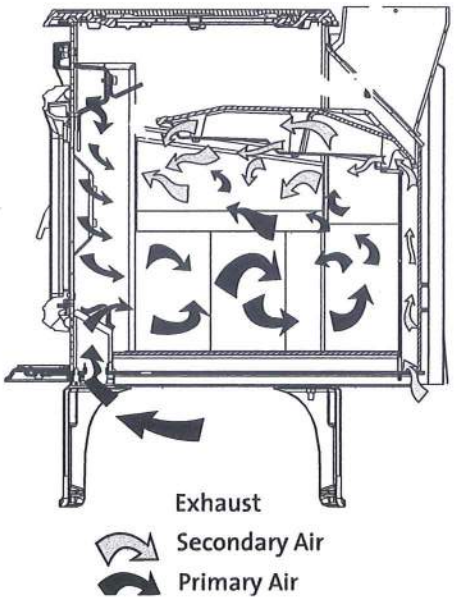


Figure 16. Combustion air paths

Volatile gases, released unburned from the fuel bed, rise to the baffle where they are turbulently mixed with the hot, fresh oxygen. Secondary combustion then occurs before the gases pass into the heat exchange chamber. See fig. 16.

5.3 Controlling the Fire

Combustion intensity is controlled by the position of an air shutter located under the front door. You adjust its position using the handle located under the ash lip. Slide the handle to the left to decrease air to the fire. Sliding it to the right increases air delivery and consequently, fire intensity. See fig. 17. The shutter regulates and directs primary air to the front of the burn chamber. Push it to the right to allow maximum air to support combustion. It should be fully open when first starting or rekindling a fire, or when greater heat output is desired.

5.4 Air Control / Blower Settings

Use the following guide for best performance.

Burn Rate	Air Control Setting	Blower Speed
Min. Low	Min. Open	Low / On at 30 min.
Med. Low	3/8" Open	Low / On at 30 min.
Med. High	3/4" Open	Low / On at 30 min.
High	Max. Open	High / On

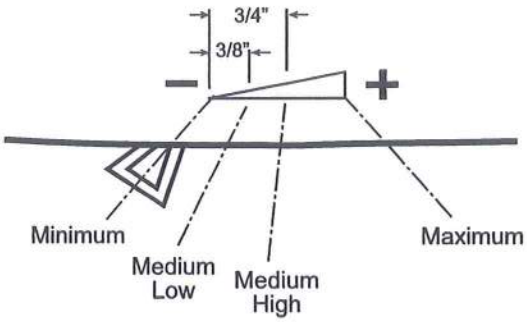


Figure 17. Air Control Settings

5.5 Break-In Procedure

Although your Jøtul F 55 is constructed of welded, 1/4" steel plate, it also incorporates cast iron components. This material requires the stove to be"broken-in" gradually so that heat expansion does not occur too quickly and cause damage. The following steps describe the proper break-in procedure for your stove. Use a magnetic stove-top thermometer to monitor stove temperature, placed directly on the cook plate.

Set the Primary Air Shutter fully open, all the way to the right.

1. Light a small fire of newspaper and kindling at the front of the stove. Gradually add small pieces of wood, but only allow the stove to reach a maximum surface temperature of 200°F (93° C). Continue burning at this low rate for approximately 1 hour.
2. Allow the stove to cool to room temperature.
3. Light a second fire, allowing the stove to reach a maximum temperature of 300°F (149°C) for 1 hour.
4. Cool the stove to room temperature.
5. Light a third fire and gradually allow the stove to reach a surface temperature of 400°F (204°C)
6. Cool the stove to room temperature. This completes the "break-in" procedure.

Note: If the temperature exceeds the limit during any break-in fire, move the Air Shutter all the way to the left to shut off the air supply completely. It is normal that the stovetop temperature will continue to climb until the fuel burns down somewhat. Once the fire is out and the stove has cooled to room temperature, continue the break-in procedure. Never attempt to reduce the temperature by removing burning logs from the fire.

Break-in Odors: It is normal for a newly-painted stove to emit odor and smoke during the first few fires, and these may set off smoke alarms. This condition is caused by curing of the high temperature paint and will diminish with each subsequent fire. It is advisable to open windows or doors to provide plenty of fresh air and cross-ventilation during the break-in period.

5.6 Starting and Maintaining a Fire

Burn only solid wood directly on the bottom of the stove firechamber. Do not elevate the fire in any way.

We recommend use of a magnetic stovetop thermometer to monitor the surface temperature of the stove. Locate the thermometer directly on one of the rear corners of the Griddle plate. The optimum surface temperature range for most efficient combustion is between 400° and 700° (204°C -371°C). Chimney draft should be in the .05 - 1.0 w.c. range.

1. With the **Primary Air Shutter** in the full open position (to the right), start with several sheets of crumpled newspaper placed directly on the grate. On top of the newspaper, place several pieces of small dry kindling * (1" - 2" in diameter or less) with two to three larger logs (approx. 3" to 4" in diameter) on top.

2. Light the fire and close the door. Allow the chimney to warm and establish a strong draft. Use your stove glove and slowly build the fire by adding larger and larger logs. Be sure to follow the break-in procedure (Sect. 5.6) before creating a hot fire that might damage the stove.

3. Once the stove has reached a surface temperature range of between 400° and 700°, (204°C -371°C), adjust the primary air control lever as appropriate to generate the desired heat output and burn time.

   With time and experience, you will soon become acquainted with the operating characteristics of your particular installation.

You can also monitor stove performance through the window. Peak combustion efficiency occurs when exhaust gas is burned at the baffle in the top of the firebox. This is apparent as rolling yellow-orange flames appearing at the secondary air ports in the underside of the baffle plate and forward tube. At this stage, little or no smoke will be visible exiting the chimney.

WARNING:

NEVER OVER-FIRE THE STOVE. IF ANY PART OF THE STOVE OR CHIMNEY GLOWS, YOU ARE OVER-FIRING. A HOUSE FIRE OR SERIOUS DAMAGE TO THE STOVE OR CHIMNEY COULD RESULT. IF THIS CONDITION OCCURS, IMMEDIATELY CLOSE THE AIR CONTROL.

5.7 Adding Fuel

Follow this procedure when reloading the stove while it is still hot and a bed of hot embers remains:

- Always wear gloves when tending to the stove.
- Adjust the Primary Air Shutter Lever to the fully open position and open the baffle plate. Wait a few seconds to re-establish strong draft before opening the load door. This will allow fresh air to flush the firebox and prevent smoke escaping when the door is opened.
- Open the door slightly, and hesitate a moment to allow exhaust purge, then open the door fully.
- Use a stove tool or poker to evenly distribute coals and embers around the firebox.
- Load the fuel, usually with smaller logs first.
- Close the door, being sure to latch the door tightly.
- Wait 5 – 10 minutes to re-establish the fire before setting the air controls for the desired heat output and burn time. (If there is at least a 2" thick ember bed when reloading, it may be possible to close the door and immediately adjust the air control setting).
- Set the Air Shutter for the desired heat output.

5.8 Open Door Fire-viewing

Warning: This stove should be operated with the door either fully open with optional Spark Screen in place or with the door fully closed. If the door is left partly open, there is risk of overfiring. Also, gas and flame may be drawn out of the fireplace stove opening, creating risks from both fire and smoke.

Be aware that, when operating with the door open, there exists the possibility of carbon monoxide generation by charcoal, Good draft is essential to minimize the potential for CO to be introduced into the living space. Be sure adequate fresh air and ventilation are available to the stove when using the spark screen.

5.9 Creosote Formation and the Need for Removal

When wood is burned slowly, it produces tar and other vapors that combine with moisture to form creosote. Creosote vapors condense in the relatively cool chimney flue, and creosote residue accumulates on the flue lining. When ignited, this creosote fuels an extremely hot fire.

The chimney connector and chimney flue should be inspected at least bi-monthly during the heating season to determine if creosote buildup has occurred.
If creosote has accumulated, it should be removed to reduce the chance of a chimney fire.

In the event that creosote ignites in the flue, the resulting fire is often accompanied by a roaring noise and crackling sound as flakes of burning creosote break loose. If you suspect you are having a chimney fire, immediately close the air controls and make sure the door is closed securely. Call the fire department and have everyone leave the house.

Do not attempt to extinguish the fire. Opening the door will only supply additional oxygen and intensify the fire. When the fire in the flue has subsided, resist the temptation to open the door to check on the fire. The fire may have suffocated, but could re-ignite with a supply of fresh air. After a chimney fire, do not use the stove until the chimney connector and flue have been cleaned and inspected to ensure no damage has been sustained.

See Section 6.6 of this manual regarding chimney cleaning.

5.10 Ash Removal

Remove ashes whenever accumulation nears the primary air port located inside the firechamber just under the door opening.

Always wear safety gloves when handling the ashes.

Ashes should only be placed in a metal container equipped with a tight sealing lid. The container should be placed on a noncombustible floor or on the ground, well away from all combustible materials, pending final disposal. If the ashes are to be disposed of by burial in soil or otherwise locally dispersed, they should be kept in the closed container until all cinders have thoroughly cooled.

Appendix A

EXAMPLE CALIBRATION/DATA FLOW

All individual test run raw data sheets are organized in a manner that would allow a data reviewer to follow the data as it is being calculated in a step by step fashion. In many cases, the equations used to calculate a specific required data are given on the raw data sheets themselves.

For example, the particulate emission rate in g/dscf is calculated on Data Sheet #7. However, the data used to derive this data begins on Data Sheet #2 (Meterbox Data Sheet) where the meter volume (cubic feet), average meter temperature (°F), average ΔH (in. H_2O), and average Barometric pressure (in. Hg) are recorded and averaged. Each of the averages for these parameters are used in equation 1 on P. 7 where the volume (MCF) is converted to dscf.

The moisture catch total (g. H_2O) on the Particulate Catch/Moisture Data sheet (p. 3) is transferred to P. 7 and the percent stack moisture is calculated in equations 2 and 3.

The gross and net gravimetric (g) particulate catches are determined and calculated on PP. 3-6. Pages 4-1, 4-2 and 4-3 show the initial (tare) constant weights for filters (p. 4-1) and beakers (p. 4-2) and the final constant weights (p. 4-3) for those filters and beakers used for each run. Final and tare weight data is transferred to P. 3 and the gross gravimetric (g) catch for each filter and beaker is calculated. On P. 5 the gravimetric catch for each blank is calculated. The gross gravimetric catch for each filter and beaker is transferred to P. 6 and the net gravimetric catch (g) is calculated, as well as front half and back half catch totals. The net gravimetric catch (g) is transferred to P. 7 and the grain loading/dscf is calculated in equation 4.

Some data sheet specific information is listed below on a page by page basis.

P. 8 The % ambient moisture is determined by interpolating from psychrometric charts which are contained in the State of Oregon Department of Environmental Quality's "Standard Method for Measuring the Emissions and Efficiencies of Woodstoves".

The % relative humidity is determined from the wet bulb/dry bulb temperature readings using the tables found in Section 3.1.2.4 of the State of Montana Air Quality Bureau's Quality Assurance Manual.

P. 10 The uncorrected moisture meter readings are corrected for pin insulation and may or may not be corrected for ambient (wood) temperatures. All corrections are based upon the correction equations or tables supplied by the moisture meter manufacturer. (These are standard, known corrections.)

P. 11 The moisture meter readings are corrected as discussed above.

P. 12 The gas concentrations shown for each gas monitored (CO_2, O_2, CO and SO_2) are determined by converting the analyzer's voltage output recorded on P. 12 to the concentration shown using the analyzer's current calibration curve. The SO_2 concentration is determined using the manufacturer's calibration curve and the current calibration curve.

The cal. W/B (calculated wet bulb) temperature is obtained by first determining the % moisture in the extracted flue gas stream using the temperature data from thermocouples 1 (Wet Bulb) and 2 (Dry Bulb). Then based upon the stack temperature (thermocouple 3) and the % moisture in the extracted gas stream, a calculated wet bulb temperature is determined. All data is derived from the psychrometric tables found in the State of Oregon's "Standard Method for Measuring the Emissions and Efficiencies of Woodstoves".

The following pages contain the equations used to generate the data on Tables 3-5 on the computer printouts:

Dry Gas Volume (standard):

$$V_{m(std)} = \frac{V_m * 17.65 * mcf * \left(P_{bar} + \frac{\Delta H}{13.6} \right)}{T_m}$$

Volume of Water:

$$V_{w(std)} = (0.04707)(ml\ H_2O)$$

Moisture Content:

$$B_{ws} = \left(\frac{V_w}{V_w + V_{m(std)}} \right) * 100$$

Dry Burn Rate:

$$Br = \left(\frac{Wwt - (Wwt * \%\ H_2O)}{2.2046} \right) * \frac{60}{\theta}$$

Carbon Balance (N_t):

$$Nt = \frac{K_3 Nc}{(YCO_2 + YCO + YHC)}$$

Stack Flow Rate (Q_{sd}):

$$Q_{sd} = K_4 N_t Br$$

Particulate Concentration (C_s):

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

Particulate Emission Rate (E):

$$E = C_s Q_{sd}$$

Proportional Rate Variation (Pr):

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

Where:

Br =	dry wood burn rate, kg/hr.
B_{ws} =	Water vapor in the gas stream, proportion by volume.
c_s =	Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, g/dscm (g/dscf).
E =	Particulate Emission Rate, g/hr.
ΔH =	Average pressure differential across the orifice meter (see Figure 5-2), mm H_20 (in. H_20).
K_3 =	1.0 lb/lb (English) 1000 g/kg (metric)
K_4 =	0.02406 dsm^3/g-mole(metric) 384.8 dscf/lb-mole (English)

m_n = Total amount of particulate matter collected, mg.

mcf = Dry gas meter correction factor.

N_c = Gram atoms of carbon/gram of dry fuel (lb/lb), equal to 0.0425.

N_t = Total dry moles of exhaust gas/Kg of dry wood burned.

P_r = Percent of proportional sampling rate.

Pbar = Barometric pressure at the sampling site, mm Hg (in. Hg).

Q_{sd} = Total gas flow rate, dscf/hr.

S_i = Concentration measured at the SO_2 analyzer for the "i^{th}" 5 minute interval, ppm.

S_1 = Concentration measured at the SO_2 analyzer for the first 5 minute interval, ppm

T_m = Absolute average DGM temperature (see Figure 5-2), °K (°R).

T_{std} = Standard absolute temperature, 293°K (528°R).

V_m = Volume of gas sample as measured by dry gas meter, dcm (dcf).

$V_{m(std)}$ = Volume of gas sample measured by the dry gas meter, corrected to standard conditions, dscm (dscf).

$V_{w(std)}$ = Volume of water vapor in the gas sample, corrected to standard conditions, scm (scf).

W_{wt} = Wet wood weight.

Y = Dry gas meter calibration factor.

Y_{CO} = Measured mole fraction of CO (dry).

Y_{CO2} = Measured mole fraction of CO_2 (dry).

Y_{HC} = Assumed mole fraction of HC (dry);
=0.0088 for catalytic woodheaters
=0.0132 for noncatalytic woodheaters
=0.0080 for pellet fired woodheaters

θ = Total sampling time, min.

13.6 = Specific gravity of mercury.

60 = Sec/min.

100 = Conversion to percent.

M5H PARTICULATE SAMPLING TRAIN

1. Probe

   3/8" seamless SS-20" long. Outlet end of probe is attached to a SS outlet fitting with a Sweglock SS union. The probe is unheated except for the portion that is in the stack and the heated filter box. The probe is sealed to the stack with a washer.

2. Filter Holder

   A 3" or 4" standard M5 filter holder. A SS filter support with gasket.

3. Filters

   3" or 4" fiber glass (#25 glass) manufactured by Schleicher and Schuell.

4. Front Half Filter Heater

   A box containing a fan for air circulation and a cone heater. The temperature in the box is monitored with a type K thermocouple and adjusted with a voltage regulator to maintain a temperature below 248 °F.

5. Desiccant

   Indicating silica gel, 6-20 mesh. The silica gel is changed as needed.

6. Filter (Back Half) Holder

   Same as front half 3" or 4" filter.

7. Impinger Gas

   Type K thermocouple threaded into the exit "arm" of the impinger. Ice is added to the cooler whenever necessary to maintain an exit gas temperature less than 68 °F.

8. Meterbox

   RAC Stack Sampler modified by EEMC

   Ranges: 0-1.0" inclined water manometer

   0-10.0" vertical water manometer

   Accuracy: Dry gas Meter 0-999.999 cu ft ±1.0%

   Temperatures are monitored using two type K thermocouples.

SAMPLING PROCEDURES AND INSTALLATION DESCRIPTION

This section is broken into two major parts. The first contains a brief description of the sampling and procedures used by LoKee Testing Laboratory when performing a test using EPA Methods 28, 28A and 5H. The second section contains a complete listing of all equipment in each of the major sampling trains and a diagram of each major train.

LoKee Testing Laboratory uses EPA M5H for the particulate sampling procedure and collects the required data so that efficiency of a unit can be calculated using the Oregon Method.

TEST FACILITY AND WOOD HEATER EQUIPMENT LIST

1. Flue Pipe

   The diameter of the 24 gauge black steel flue pipe used for each stove varies with the size of the stove's flue collar, e.g., 6" flue pipe is used with a 6" flue collar. The joint at the flue collar is sealed with mortar. The pipe is attached to the stove at the flue collar with three sheet metal screws. All sampling ports are sized for the sampling probes and sealed using washers.

2. Insulated Flue Pipe

   The diameter of the insulated flue pipe matches the diameter of the flue collar on the stove. The 6", 7" and 8" pipe meet the requirements of UL 103 HT. The SO_2 injection loop port is sealed with high temperature silicone sealant.

3. Liquid Seal

   The liquid (oil) seal used by LoKee varies in size with the flue pipe. The seals are made of 12 gauge steel. The liquid sealant is mineral oil. The cooler consists of 3/8" copper tubing which is coiled in the bottom of the lower half of the seal. Ambient air is pumped through this line when necessary to cool the seal.

4. Supports

   The lower half of the seal and the 24 gauge steel black flue pipe is supported by the stove. The upper half of the seal and the insulated flue pipe are hung from wooden supports.

5. Platform Scale

   Platform (30" X 30" deck)

   Manufacturer: Weightronics

   Model: platform: DS-014/SN 4479 readout: W1-110/SN 016409

   Type: Electronic

   Range: 0-1000 lb.

Capacity:	1000 lb.
Resolution:	±0.1 lb.
Accuracy:	±0.1%

6. Fuel Balance Scale

LoKee uses the platform scale listed above to weigh the fuel charges.

7. Fuel Storage Area

LoKee stores the fuel in a humidity and temperature regulated room.

8. Moisture Meter

LoKee has two moisture meters which it uses to determine wood moisture levels.

The primary meter is:

Manufacturer:	Delmhorst Instrument Co.	
Model:	RC-1C/SN 16152 with 26-E probe and #496 insulated pins.	
Type:	Electrical Resistance	
Resolution:	±0.1% moisture	
Ranges:	6-11%, 11-25%, 25-80%	
Accuracy:	Moisture	Content Accuracy
	6-12%	±0.5%
	12-20%	±1.0%
	20%-saturation point	±2.0%

Type of Calibration: The RC-1C is equipped with two potentiometers (Zero and Span) which are checked and adjusted on a daily basis. The unit is also checked with a calibration block.

Electrode and Pin Type: 26-E probe and #496 insulated pins

The backup moisture meter:

Manufacturer:	Delmhorst Instrument Co.	
Model:	G-30SN/2477 with 26-E probe and #496 insulated pins	
Type:	Electrical Resistance	
Resolution:	±0.1% moisture	
Accuracy:	Moisture	Content Accuracy
	6-12%	±0.5%
	12-20%	±1.0%
	20%-saturation point	±2.0%

Type of Calibration: Calibration is accomplished with an internal calibration point and a potentiometer. The calibration can also be checked against a calibration block.

Description of Operation: The pins are pounded into the wood to be sampled. The meter reading is recorded on Data Sheet #10 (Wood Moisture) or Data Sheet #11 (Density Determination). This is the uncorrected reading which is then corrected for pin insulation and, as needed, temperature using the correction tables for each parameter supplied by the manufacturer.

9. Temperature Monitors

The temperatures are monitored with Type K thermocouples. Each thermocouple's calibration is checked prior to use.

The thermocouple readout is an Omega Model 410B-K/SN 05/4475, with a range of -58 °F to 1999 °F (type K) and an accuracy of ±0.9 °C, which can be read at ±0.1 °F. EEMC reads and rounds to 1.0 °F. The single channel readout is interfaced with a manually operated selector switch that allows 24 channels to be monitored with the same readout. The thermocouples are attached to the test unit with sheet metal screws. The thermocouples monitoring internal stove temperature are sealed at the point of entry with sealant.

10. Draft Gauge

Manufacturer:	Dwyer
Model:	
Type:	Inclined Water Manometer
Range:	0-0.25" water
Resolution:	0.001" water
Accuracy:	±0.001" water (readability)

11. Anemometer

Manufacturer:	Dwyer
Model:	480 Vaneometer/SN S 222 D
Range:	0-400 FPM
Accuracy:	±5% of full scale from 0-1 FPM

12. Humidity Gauge

Manufacturer:	Bacharach
Model:	SAC
Type:	Sling Psychrometer
Range:	Wet Bulb: 30-110 °F
Dry Bulb:	30-110 °F
Resolution:	±1 °F
Accuracy:	±1 °F

13. Barometer

Manufacturer:	Princo Instruments, Inc.
Model:	NOVA 469

Type:	Mercury Barometer
Range:	20-32" Hg
Resolution:	0.01" Hg
Accuracy:	±0.01" when calibrated and installed as per the manufacturer's written operating instructions.

Equation 6.3.1a of the "Standard Methods for Measuring the Emissions and Efficiencies of Residential Wood Stoves" and equation #1 are programmed into a Hewlett Packard 15C calculator which first calculates stack gas flow rate and then the ΔH. The stack gas flow rate and ΔH are both recorded on Data sheet #2. The ΔH is used to set the flow rate through the dry gas meter at 5 minute intervals during the test.

In order to successfully maintain the correct sampling ratio, the following data is recorded on Data Sheet #2 (Meter Box Data Sheet): temperature (°F) at the SO_2 injection rotameter (Tr), pressure (inches H_2O) at the SO_2 injection rotameter (Pr), SO_2 injection rate (cc/min), barometric pressure (BP) (inches Hg), stack gas SO_2 concentration (ppm SO_2), sampling ratio (Sr), and the average dry gas meter temperature (°F). This data is entered into the HP15C, which is used to first calculate a stack gas flow rate (dscf) and then a ΔH for every sampling interval. The flow rate through the dry gas meter is adjusted and maintained by maintaining the appropriate ΔH.

CEM MONITORS

1. Calibration Gases

   LoKee uses vendor certified (±2.0%) calibration gases for each CEM. The concentrations purchased coincide with ranges specified in M5H. Upon receipt of the cylinder, the concentrations are verified with Method 3 (ORSAT) analysis.

2. Flow Regulators

   LoKee uses a variety of standard gas flow regulators to meter the flow of calibration gases from the cylinders.

3. Point of Injection

   Calibration gases are injected directly into the end of the probe. The line carrying the calibration gases from the cylinders is connected to the probe with a short piece of rubber tubing.

4. Sample Gas Conditioning System

   The combustion gas is conditioned with a train that is a duplicate of a M5H train. It contains the following components:

   SS probe

   Glass 4" M5H filter and holder in a heated box

4 1000 ml glass impingers

Glass 4" M5H filter and holder

Indicating silica gel

Type K thermocouple to monitor exit gas temperature

Thomas pump

5. Filters

The filters used are the same as EPA M5H filters.

6. Manifold and Exhaust

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

7. CO Analyzer

Horiba PIR 2000/SN 408005

Nondispersive infrared (NDIR)

The gas stream flow is controlled by a SS flowmeter downstream of the analyzer. The calibrated range used is 0-10.0% by volume. The resolution is 0.01% CO. The manufacturer's specification given for linearity is ±1.0%.

8. CO_2 Analyzer

Horiba PIR 2000/SN 407069

The CO_2 analyzer is also a NDIR and is operated in exactly the same manner as the CO analyzer. The range of the CO_2 analyzer is 0-25.0% CO_2.

COMBUSTION GAS ANALYZER TRAIN OPERATING INSTRUCTIONS

A. Pretest Preparation, Checks and Audit Procedures

1. Clean the probe with acetone and a brush. Seal the end of the probe for a leak check.
2. Remove the filter holder from the sample box and change the filter.
3. Empty water from all the impingers in the train. Clean all impingers and fill the first 2 with 100 ml of water.
4. Remove the second filter holder from the train and change the filter.
5. Visually check the indicating silica gel in the fourth impinger. If it is visibly impacted by water, replace the silica gel with dry silica gel.
6. Turn on the pump and perform a leak check on the entire train. This is done by placing the exhaust line in water. A successful leak check is accomplished when no bubbles are detected.
7. Slowly release the plug from the probe to prevent any back flushing.
8. Turn off the pump.

9. Turn on the heat in the sample box. Adjust Variac voltage controller so that temperature in the sample box does not exceed 248 °F.
10. Open the bypass valve on the pump.
11. Connect the probe to the zero/span gas delivery line.
12. Turn on the zero gas and adjust the flow rate to 1.5 SCFH.
13. Wait until the zero gas has completely flushed the train and a stable reading is obtained.
14. Record the zero gas readings of the DVM on Data Sheets #15.
15. Turn off the zero gas at the cylinder.
16. Disconnect the zero/span gas delivery line from the zero gas cylinder.
17. Connect the zero/span gas delivery line to the span gas source for each analyzer.
18. Turn on the span gas and adjust the flow rate to 1.5 SCFH. Wait until a stable reading is obtained on each analyzer. Repeat until all three analyzers are spanned properly.
19. Record the span gas readings of the DVM. Record the analyzer's output and all other pertinent information Data Sheets #15.
20. Turn off the span gas at the cylinder.
21. Disconnect the probe from the zero/span gas delivery line.
22. Insert the probe in the stack.
23. Close the bypass valve on the pumps.
24. Approximately 15-20 minutes before the actual start of the test, turn on the pump and adjust the flow through each analyzer until the flow rate is 1.5 SCFH.

B. Operation During Testing

1. Monitor the flow rate to the analyzers periodically to maintain a flow rate of 1.5 SCFH. Make any necessary adjustments.
2. Record data as follows:
   a. At the start of each 5 minute data cycle, record the scale weight, wet bulb/dry bulb, stack gas temperature and static pressure on Data Sheet #12 (Gas Data).
   b. Record the combustion gas (CO_2, O_2 and CO) analyzer data and the SO_2 analyzer data on Data Sheet #12.
   c. Record the remainder of the temperature data.

C. Post Test Checks and Audit Procedures

1. Remove the probe from the stack. (Be careful when handling the probe as it can be quite hot.)
2. Seal the end of the probe.
3. Perform a leak check on the entire train.
4. Slowly release the plug from the end of the probe to prevent any back flushing.
5. Turn off the pump.

6. Open the bypass valve on the pump.
7. Connect the probe to the zero/span gas delivery line.
8. Turn on the zero gas and adjust the flow rate through each analyzer to 1.5 SCFH.
9. Wait until the zero gas has completely flushed the train and a stable reading is obtained from each analyzer.
10. Record the zero gas reading. Record each analyzer's output and all other pertinent information on Data Sheets #15.
11. Turn off the zero gas at the cylinder.
12. Disconnect the zero/span gas delivery line from the zero gas cylinder.
13. Connect the zero/span gas delivery line to the span gas source for each analyzer.
14. Turn on the span gas and adjust until the flow rate through each analyzer to 1.5 SCFH. Wait until the span gas has completely flushed the train and a stable reading is obtained on each analyzer.
15. Record the span gas reading. Record each analyzer's output and all other pertinent information on Data Sheets #15.
16. Turn off the span gas at the cylinder.
17. Disconnect the probe from the zero/span gas delivery line.

D. Determination of the Combustion Gas Train's Response Time

1. The response time of the combustion gas analyzer train is to be determined using the following procedures. It is best to determine the combustion gas analyzer train response time during the "charcoal phase" of a test burn so that CO levels are relatively stable.
   a. Leak check the combustion gas (CEM) analyzer train.
   b. Zero the CO analyzer using ambient air.
   c. Calibrate the CO analyzer.
   d. Insert the probe for the combustion gas analyzer train in the stack.
   e. Sample flue gas until a stable reading is obtained.
   f. Remove the probe from the stack, note the exact CO concentration as measured on the DVM and start a stop watch at the exact time of removal.
   g. Observe the stop watch and DVM. Record the length of time to initial response, i.e., when the CO levels begin to decline.
   h. Continue observing the stop watch and DVM. Record the time when the analyzer's output equals zero (0.000 v).
   i. Repeat steps d-h 2 or 3 times to verify results.

E. Calibration and Audit Procedures for the Combustion Gas Analyzers

1. Calibrate by presenting zero and span gases to each analyzer at the probe and through the entire sampling train. (See Sections 6.7.2 and 6.9 [M5H].) Record the responses on the appropriate calibration forms.
2. Immediately prior to and after each test run, present the zero and span gases to the analyzers through the entire sampling train as is discussed in section C. Record each analyzer's response on Data Sheets #15.
3. Calculate the ± concentration difference and the actual percent difference as follows using the zero and span gas values obtained in #2 above. All calculations are to be based upon the actual gas concentrations involved.

$$\pm \text{ Concentration Difference} = \text{Actual Conc (\%)} - \text{Std Conc (\%)}$$

$$\text{Zero \% Difference} = \frac{\text{Act Conc (\% or ppm)} - \text{Std Conc (\% or ppm)}}{\text{Full Scale Value (\% or ppm)}} * 100$$

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

Then refer to Section 4.2 and 4.3 (M5H) to determine whether the audits are acceptable or not.

TRACER GAS (SO_2) EQUIPMENT

1. SO_2 Injection Probe

   A circular SS loop about 4" in diameter is positioned in the center of the stack. The loop extends outside the stack and is connected to the line leading from the SO_2 injection rotameter with Sweglock fittings. The loop is inserted in the stack at 9.5 ±0.5 ft above the top of the scale.

2. Rotameter

   A rotameter that has been calibrated with a bubble tube. The rotameter is all glass, stainless steel and Teflon. The rotameter has a flow control mechanism which is set to the calibrated flow.

3. Temperature

   The temperature at the injection rotameter is measured with a type K thermocouple.

4. Injection Gas

   Pure SO_2, 99.999% pure, released from the cylinder through a SS regulator and shut off valve.

5. Calibration Gases

LoKee uses vendor certified calibration gases with traceability established in accordance with EPA Protocol #1 as specified in Section 3.3.1 and verified using EPA Method 6.

6. Sample Probe

3/8" SS tubing inserted at 13.5 ±0.5 feet above the platform scale. No obstructions are in the stack between the injection and sample probes.

7. Combustor

Lindberg tube furnace, Model 55035/SN 800125, range 0-2000 °F. The temperature in the tube furnace is monitored with a type K thermocouple and controlled with a Variac voltage regulator. Power adjustments are made as necessary to maintain temperature at 1425 °F ±25 °F.

8. Sample Condenser

The sample condenser consists of 3 modified M5 impingers immersed in a freezer.

A filter assembly

The exit gas temperature is monitored with a type K thermocouple.

9. Filter

A standard EPA M5H 3" or 4" filter.

10. SO_2 Analyzer

Horiba, PIR 2000/SN 403019

Nondispersive infrared (NDIR)

The analyzer is operated as per the manufacturer's instructions at a flow rate of 1.5 SCFH. The calibration range is 0-2500 ppm SO_2 at a resolution of ±25.0 ppm. The manufacturer's specification for linearity is ±1.0%. The voltage response is displayed on a DVM which is converted to ppm using the manufacturer's calibration curves.

11. Flow Control

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

TRACER GAS TRAIN OPERATING INSTRUCTIONS

A. Pretest Preparation and Checks and Audit Procedures

1. Clean the probe with a brush. After cleaning, seal the end of the probe.

   Note: Do Not Use Acetone Or Other Organic Solvents To Clean The Probe Immediately Prior To Running A Test Or Conducting A Leak Check.

2. Turn on the tube furnace in order to insure that the unit is at the correct operating temperature (1425 °F) at the start of the test.
3. Remove all water and clean the impingers.
4. Change the filter.

5. Turn on the pump.
6. Perform a leak check on the entire tracer gas train. This is done by placing the SO_2 exhaust line in water. A successful leak check is accomplished when no bubbles are detected.
7. Slowly remove the plug from the end of the probe to prevent any back flushing.
8. Turn off the pump.
9. Bypass the pump.
10. Connect the probe to the zero/span delivery gas line.
11. Connect the zero/span gas delivery line to the zero gas cylinder and turn on the zero gas and adjust the flow until the flow rate through the SO_2 analyzer is 1.5 SCFH.
12. Wait until the zero gas has completely flushed the train.
13. Record the zero gas reading. Record the SO_2 analyzer's DVM output on Data Sheets #15.
14. Turn off zero gas at the cylinder.
15. Disconnect the zero/span gas delivery line from the zero gas cylinder.
16. Connect the zero/span gas delivery line to the span gas cylinder.
17. Turn on the span gas and adjust the flow until the flow rate through the SO_2 analyzer is 1.5 SCFH. Wait until the span gas has completely flushed the train and a stable reading is obtained on the analyzer.
18. Record the span gas reading. Record the analyzer's output and all other pertinent information on Data Sheets #15.
19. Turn off the span gas at the cylinder.
20. Disconnect the zero/span gas delivery line from the probe.
21. Insert the probe in the stack.
22. Close the bypass on the pump.
23. Approximately 15 to 20 minutes before the actual start of the test, turn on the SO_2 injection train and the pump for the tracer gas train.

B. Operation

1. Turn on the tube furnace to insure furnace is at approximately 1425 °F when the test begins.
2. Approximately 15-20 minutes before the actual start of the test, turn on the cylinder of pure SO_2.
3. Using the rotameter's current calibration, adjust the SO_2 flow rate to the calibrated level.
4. Turn on the pump in the tracer gas train. Adjust the flow rate through the SO_2 analyzer so that it remains at 1.5 SCFH.

5. Monitor the SO_2 concentrations in the stack and stack gas flow rates in order to establish a sampling ratio for the test and a correct ΔH at the start of the test.

6. At the start of the test and every 5 minutes thereafter, record the SO_2 analyzer output in volts and the stack gas SO_2 concentration in order to calculate the stack gas flow rate and determine the correct ΔH for the meter box.

   Also monitor and record the temperature at the Rotameter (Tr), pressure at the Rotameter (Pr), barometric pressure (BP) SO_2 injection rate (cc/min) and static pressure on Data Sheets #2 and #12.

C. Post Test Checks and Audit (Zero/Span) Procedures

1. Remove the probe from the stack. (Be careful when removing the probe from the stack as it can be quite hot.)
2. Plug the end of the probe.
3. Perform a leak check.
4. Slowly remove the plug from the end of the probe to prevent any back flushing.
5. Turn off the pump.
6. Bypass the pump.
7. Connect the probe to the zero/span gas delivery line.
8. Connect the zero/span gas delivery line to the zero gas cylinder. Turn on and adjust until the flow rate through the SO_2 analyzer is 1.5 SCFH.
9. Wait until the zero gas has completely flushed the train.
10. Record the zero gas reading. Record the SO_2 analyzer's DVM output on Data Sheet #15.
11. Turn off zero gas at the cylinder.
12. Disconnect the zero/span gas delivery line from the zero gas cylinder.
13. Connect the zero/span gas delivery line to the span gas cylinder.
14. Turn on the span gas and adjust the flow until the flow rate through the SO_2 analyzer is 1.5 SCFH. Wait until the span gas has completely flushed the train and a stable reading is obtained.
15. Record the span gas reading. Record the analyzer's output and all other pertinent information on Data Sheet #15.
16. Turn off the span gas at the cylinder.
17. Disconnect the zero/span gas delivery line from the probe.

D. Determination of Tracer Gas Train's Response Time

1. Zero and calibrate the SO_2 analyzer.
2. Prepare and leak check the tracer gas train as per A above.
3. Insert the probe in the stack which contains flue gas and SO_2 concentrations in the ranges normally encountered during wood stove testing.

4. Sample flue gas with SO_2 concentrations until a stable reading is obtained. It is best to determine the tracer gas train's response time during the "charcoal phase" of a test burn so that the SO_2 concentrations are as stable as possible.
5. Remove the probe from the stack, noting the exact SO_2 concentration as measured by the DVM and starting a stop watch at the exact time of removal.
6. Observe the stop watch and DVM. Record the length of time to the initial response, i.e., when the SO_2 levels begin to decline.
7. Continue observing the stop watch and DVM. Record the time when the SO_2 analyzer's output equals zero (0.000 v.).
8. Repeat steps 3-7 two or three times to verify results.

E. Calibration and Audit Procedures for the Tracer Gas (SO_2) Analyzer

1. Calibrate by presenting zero and span gases to the analyzer at the probe and through the entire sampling train. Record the responses on the appropriate calibration form.
2. Immediately prior to and after each test run, present the zero and span gases to the analyzer through the entire sampling train as is discussed in Sections A and C. Record the analyzer's response on Data Sheet #15.
3. Calculate the ± concentration differences and actual percent difference as follows using values obtained in #2 above as the expected response. All calculations are to be based upon the actual gas concentration involved.

$$\pm \text{ Concentration Difference} = \text{Actual Conc (\%)} - \text{Std Conc (\%)}$$

$$\text{Zero \% Difference} = \frac{\text{Act Conc (\% or ppm)} - \text{Std Conc (\% or ppm)}}{\text{Full Scale Value (\% or ppm)}} * 100$$

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

Then refer to Section 4.2 and 4.3 (M5H) to determine whether the audits are acceptable or not.

TEMPERATURE SENSING OPERATING INSTRUCTIONS

A. Operate the thermocouple readout selector switch and record the temperature for each thermocouple. All the temperature in the test facility should be approximately the same. Repair as necessary.

B. Check the operation and output of the thermocouple readout using the Omega NBS Traceable Thermocouple Simulator. The simulator is hooked up to thermocouple readout #23. Check the readout over its full range at 200 °F intervals. Record the data on Data Sheet #16.

C. One hour before the actual test start record stove temperatures (thermocouple readout #'s 4, 5, 6, 7 and 8), firebox (readout #9), post catalytic combustor or secondary burn chamber (readout #10), and room temperature (readout #11). Record the temperatures every 5 minutes until the start of the test on Data Sheet #13 (Preburn).

D. During the test record the temperatures every 5 minutes for each of the thermocouples on Data Sheets #12 and 14.

FUEL PREPARATION

A. No more than 4 hours prior to use, obtain 3 moisture readings from each piece of wood. Record all moisture readings on Data Sheet #10.

B. Obtain kindling by finely splitting pieces that otherwise cannot be used as test fuel. Weigh the kindling and record the weight on Data Sheet #8.

C. Obtain the pretest fuel by using 2 x 4's. The length of the pretest fuel can be no less than 1/3 the length of the test fuel. Weigh the pretest fuel prior to its being loaded in the stove. Record weights on Data Sheets #8 and #9.

D. Obtain the test fuel by cutting dimensional lumber (either 2 x 4's or 4 x 4's) so that the length is 5/6's the length of the longest usable dimension of the firebox. Use the mix of 2 x 4's and 4 x 4's specified in Section 4.3 M28. The test fuel shall be essentially free of knots, sap seams or rotten areas.

E. The spacers shall measure 1 x 5 x 1" (nominally). The spacers shall be free of knots, sap seams or rotten areas. Nail the spacers to the 2 x 4's and 4 x 4's as described in the regulations.

F. Take a photograph of the assembled fuel charge at a 90° angle from the photograph that will be taken when the fuel charge is loaded in the stove.

WOOD DENSITY DETERMINATION

A. When cutting the test fuel, cut a representative piece of 2 x 4 or 4 x 4 that is approximately 3 to 5-inches in length.

B. Take a moisture reading from the top, bottom and side of the piece. Record readings on Data Sheet #11. Determine the % moisture on a wet and dry basis.

C. Weight the piece on a balance.

D. Take measurements of width, depth and length at the four corners with a micrometer. Determine the volume of the piece. (Length x width x depth = Volume in cubic centimeters)

E. Dry the piece in an oven at 95-100 °C for a minimum of 24 hours.

F. Reweigh the piece on the balance.

G. Calculate % moisture on a dried basis.

$$\%\ \text{moisture (dry basis)} = 1 - \frac{\text{dried weight}}{\text{wet weight}} * 100$$

H. Calculate the density.

$$\text{Density (g / cc)} = \frac{\text{dried weight (g)}}{\text{volume (cc)}}$$

BTU'S/LB DETERMINATION

A. When cutting the test fuel (only the test fuel, not the kindling, pretest fuel or spacers), collect a sawdust sample. Place in a clearly marked plastic bag.

B. Forward sample to a commercial laboratory for BTU contents analysis.

STOVE PREPARATION

A. Clean the stove.

B. Weigh the stove, record the weight on Data Sheet #8.

C. Add approximately 0.3 lb. of wadded newspaper to the stove. Record weight of newspaper on Data Sheet #8. Add 4-8 lb. of kindling to the stove, and record the weight of the kindling on Data Sheet #8.

D. Light the paper and kindling, leaving the stove's air draft control(s) wide open and the door cracked until well ignited.

E. Close door.

F. When between 50% - 75% of the weight of the kindling has been burned add the first pretest fuel charge.

G. Continue to add pretest fuel until the stove has thoroughly warmed up. As necessary, rake the coal bed prior to adding additional pretest fuel charges.

H. Remove all material from the firebox after two or more hours of burning on high. Obtain the dry empty stove weight and record on Data Sheet #8.

I. Set the stove's air draft control(s) at the desired setting a minimum of 1 hour before the test run is to begin.

J. As necessary set the heat exchange blower(s) at the specified setting a minimum of one hour before the test is to begin.

K. Record the stove surface temperatures, firebox and post catalytic or secondary burn temperatures and scale weigh for a minimum of one hour before the test run begins. As necessary add fuel, rake the coal bed, level the coal bed and/or remove coals during the first 45 minutes of the hour immediately preceding the start of the test. Record all information concerning raking, fuel additions, etc. on Data Sheet #13.

L. If necessary, sometime during the last 15 minutes before the start of the test, open the door and brake up all large pieces and then rake and level the pretest fuel in the stove. At this time, level the coal bed as necessary to accommodate loading the fuel charge into the stove. Close the door. Total time door can be open during the last 15 minutes is 1 minute. No further manipulation of the stove is allowed during the 15 minutes immediately preceding the start of the test.

M. When the weight of the coal bed equals 20-25% of the weight of the test fuel charge, load the test fuel. Take a photograph of the fuel load in the stove immediately after loading the fuel. Leave the door open as per the manufacturer's instruction, but no longer than 5 minutes.

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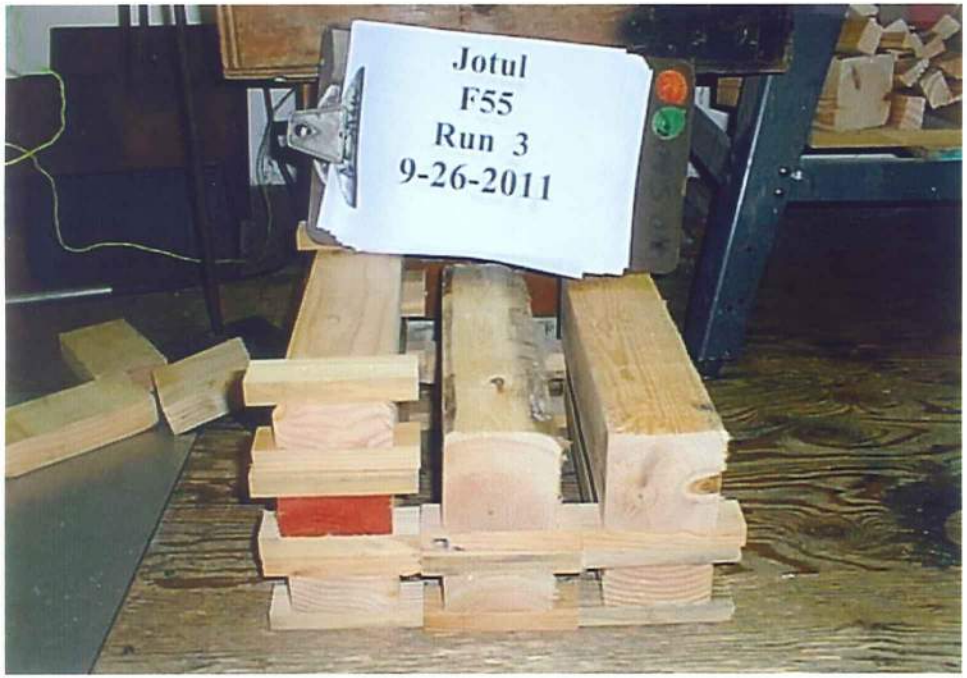
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