LOKEE TESTING Laboratory

United States
Environmental Protection Agency
Wood Heater Certification Test Report

Jotul North America

F118 Black Bear

Volume 1 of 1

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

United States
Environmental Protection Agency
Wood Heater Certification Test Report

Jotul North America
55 Hutcherson Drive
Gorham, ME 04038

F118 BLACK BEAR

Volume 1 of 1

Report By:

Chip Wadington
Kelly Mills

CONFIDENTIAL

RELEASED ONLY BY
AUTHORIZED PERSONNEL

1/8/2015

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TEST SERIES INFORMATION

Unit name and model number: F118 Black Bear

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: 7/18/2014 **Aged**: 12/21-23/2014 **Dates Tested**: 12/24-31/2014

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
Kelly Mills

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.

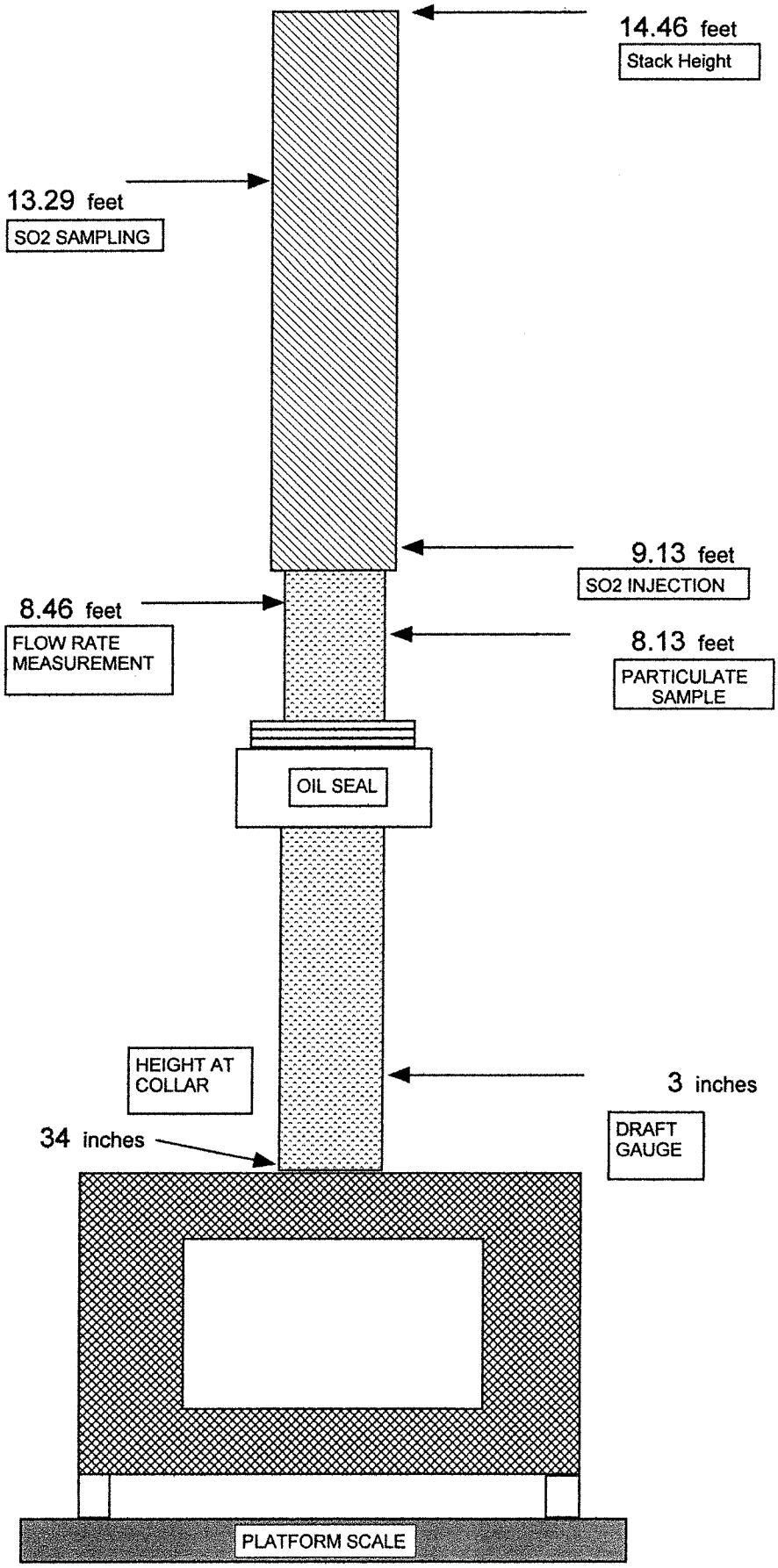
WARNING

SEALED EPA TEST UNIT

DO NOT TAMPER WITH SEALS
TO DO SO WILL VOID CERTIFICATION

JOTUL NORTH AMERICA
F118 BLACK BEAR

Model: F188 Black Bear **Date:** 12/23/14



AGING DATA SHEET

UNIT : F118 Black Bear DATE: 12-23-14

Hr #	DATE	TIME	TEMP Stack 1	TEMP Top 2
1	12-23-14	0830	363	465
2	"	0930	181	233
3	"	1030	479	645
4	"	1130	198	310
5	"	1230	356	528
6	"	1330	220	260
7	"	1430	379	528
8	"	1530	188	261
9	"	1630	463	440
10	"	1730	370	501
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				

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

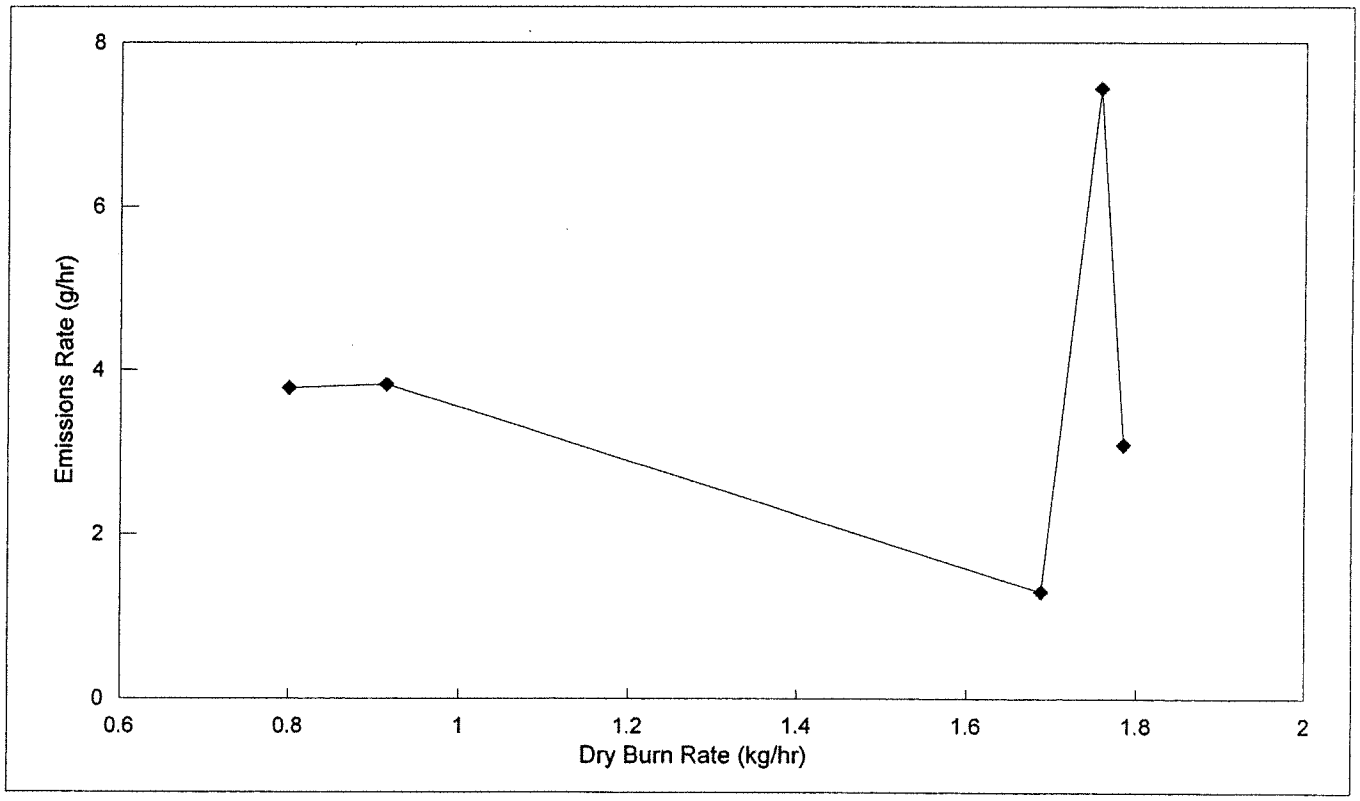
COMMENTS:

Wood Heater Emission Test Summary

Laboratory/Wood Heater Information

Stove Manufacturer:	**Jotul**
Model Identification:	**F118 Black Bear**
Stove Type> 1=cat, 2=noncat, 3=pellet:	**2**
Laboratory Name:	**LoKee Testing Laboratory**
Laboratory Contact:	**Chip Wadington**
Telephone no.:	**360-897-9685**
Test Dates:	**12/24-31/14**
Test Methods Used	
Method 28/Other:	**28**
Sampling Method:	**5H**

Run no.	Burn Rate (kg/hr)	Emission Rate (g/hr)	Heat Output (Btu/hr)	Wtd Avg (g/hr)
				2.98
1	0.80	3.78	9647	
2	0.91	3.82	11021	
5	1.69	1.30	20354	
3	1.76	7.44	21174	
4	1.78	3.09	21512	
			NA	



DATA SUMMARY

Unit:Jotul F118 Black Bear

	RUN #	1	2	5	3	4			
Particulate Emissions:									
Concentration:	grains/dscf:	.1219	.1391	.0343	.1480	.0612			
Emissions Rate	grams/hr:	3.78	3.82	1.30	7.44	3.09			
Emissions Factor	grams/kg:	4.71	4.18	0.77	4.24	1.73			
Front Half Catch	% of total	25.3	22.6	59.1	41.6	33.0			
Total Mass Captured	total catch:	.7951	.5361	.0665	.2840	.1185			
Heat Output (EPA Default):	BTU/hr	9682.7	11021.2	20354.2	21174.2	21511.8			
Fuel Burn Rates:									
Average kg/hr (dry)	Kg/hr	.80	.914	1.688	1.756	1.784			
Fuel Moisture Content:									
Kindling (wet basis)	%	13.019	12.765	13.068	13.019	11.764			
Pretest Fuel (wet basis)	%	16.435	17.012	17.035	16.897	17.196			
Test Fuel (wet basis)	%	17.509	16.926	17.509	17.645	18.050			
Air to Fuel Ratio		-	-	-	-	-			
Average Stack Gas									
Avg CO_2	%	4.77	5.55	8.29	6.00	7.12			
Avg O_2	%	-	-	-	-	-			
Avg CO	%	0.65	0.89	0.80	0.83	0.75			
Avg Moisture	%	5.15	6.93	6.92	7.78	7.10			
Avg Stack Gas Emissions:									
CO	g/Kg	115.57	138.02	92.43	123.22	98.18			
	g/hr	92.80	126.15	156.02	216.37	175.16			

Unit:Jotul F118 Black Bear

	RUN #	1	2	5	3	4			
Avg Stack Gas Flow Rate									
EPA CMB	dscfm	7.16	7.07	9.74	12.93	11.66			
Tracer Gas	dscfm	7.046	8.161	10.455	12.483	11.973			
Draft (static)	in H_2O	-.032	-.036	-.049	-.043	-.046			
Proportionality Average	%	100	100	100	100	100	100	100	100
Average Temperatures									
Stack Gas	°F	202	221	323	282	319			
Firebox	°F	-	-	-	-	-			
Secondary	°F	-	-	-	-	-			
Catalytic Combustor	°F	-	-	-	-	-			
Top	°F	256	287	400	339	376			
Left Side	°F	332	347	466	410	458			
Back	°F	208	219	294	280	324			
Right Side	°F	241	214	430	259	428			
Bottom	°F	281	360	387	365	374			
Temperature Change	°F	-34.2	-19.6	-29.0	-11.4	+0.9			
Test Chamber Enviroment									
Average Barometer	in. Hg	29.97	30.10	30.50	30.30	30.12			
Average Temperature	°F	69	76	70	81	75			
Ambient Moisture	% H_2O	1.40	1.40	.55	1.45	1.45			
Relative Humidity	%RH	45.0	37.5	21.0	38.0	49.5			
Air Velocity	m/sec	0	0	0	0	0	0	0	0
Fuel Weight and Burn Time									
Density (dry basis)	gm/cm^3	-	-	-	-	-			
Coal Bed Weight	lbs	2.3	2.1	2.3	2.0	2.3			
Pre Test Fuel (inc kindling)	lbs	26.3	27.8	25.9	27.4	29.9			
Test Fuel	lbs	9.3	9.3	9.4	9.4	9.2			
Burn Time	min	260	230	125	120	115			

COMPUTER INPUT DATA SHEET #1

3.78

Client: JOTUL U.S.A. Inc.

Address: 55 Hutchenson

Gorham, ME 04038

Phone: (207) 797-5912 Fax: (207) 772-0523

Run No.: 1 Date of Test: 12-24-2014 Burn Rate: .803

Model No.: JOTUL F118 Black Bear ☒ min ☐ min-1.25 ☐ fan

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

Dry Gas Meter Y Factor: .903 (0.000) (Data Sheet #2) Post Leak Rate: .000 cfm (.000) (Data Sheet #2) Time: 260 min. (000) (Data Sheet #2)

Dry Gas Meter Volume: 102.159 cf (00.000) (Data Sheet #2)

Stack Flow: 7.046 dscfm (00.000) (Data Sheet #2) Δ H: .251 in. H_2O (.000) (Data Sheet #2)

Maximum Vac.: 3.0 (0.0) (Data Sheet #2) Barometric Pressure: 29.97 in. Hg (00.00) (Data Sheet #2)

H_2O Captured: 104.2 g (00.0) (Data Sheet #3)

Front Half Catch % Of Total: 25.3 % (00.0) (Data Sheet #6) Total Particulate Catch: .7951 g (0.0000) (Data Sheet #6)

Flue Gas Moisture: 6.6481 % (00.000) (Data Sheet #7)

Particulate Emission: .1219 gr/dscf (0.0000) (Data Sheet #7)

Relative Humidity: 45.0 % RH (00.0) (Data Sheet #8) Ambient Moisture: 1.4 % H_2O (0.00) (Data Sheet #8)

Preburn Fuel Wt.: 26.3 lbs. (00.0) (Data Sheet #8) Coal Bed Wt.: 2.3 lbs. (00.0) (Data sheet #8) Test Fuel Wt.: 93 lbs. (00.0) (Data sheet #8)

Heat Output (EPA Default): 9682.7 BTU/hr (00,000.0) (Data Sheet #8)

Kindling Fuel % Moisture (wet): 13.0185 % (00.000) (Data Sheet #10) Pretest Fuel % Moisture (wet): 16.435 % (00.000) (Data Sheet #10)

Test Fuel % Moisture (dry): 21.225 % (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove]) Test Fuel % Moisture (wet): 17.509 %

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

Stack Static Pressure: -.032 in. H_2O (+/- .000) (Data Sheet #12)

Average Ambient Temperature: 69 °F (00) (Data Sheet #14) Stove Temperature Change: -34.2 °F (+/- 000.0) (Data Sheet #14)

TEST START 0950

END 1410

METER TEMP 540

TABLE 1 ----- RAW DATA

CLIENT : Jotul TEST No. : 1

MODEL: F118 Black Bear DATE: 18-Dec-14

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	0.000	0.150	78	0.90	3.40	625
5	1.500	0.410	78	0.28	1.60	375
10	4.040	0.290	78	0.18	1.70	450
15	6.159	0.230	78	0.20	1.10	500
20	8.066	0.260	78	0.17	2.00	475
25	10.073	0.230	78	0.24	1.80	500
30	11.980	0.320	78	0.11	3.70	425
35	14.222	0.470	78	0.34	7.90	350
40	16.943	0.470	78	0.15	6.80	350
45	19.664	0.550	78	0.17	6.50	325
50	22.594	0.640	78	0.11	8.20	300
55	25.766	0.550	78	0.13	9.30	325
60	28.695	0.470	78	0.16	8.30	350
65	31.416	0.470	78	0.22	7.60	350
70	34.137	0.360	80	0.37	6.20	400
75	36.537	0.310	81	0.57	5.30	425
80	38.805	0.310	81	0.63	5.20	425
85	41.072	0.250	81	0.86	4.90	475
90	43.102	0.280	81	0.93	4.40	450
95	45.244	0.230	81	0.80	4.70	500
100	47.172	0.360	81	0.72	5.80	400
105	49.581	0.280	81	0.83	5.20	450
110	51.723	0.280	81	0.91	5.20	450
115	53.865	0.280	81	0.89	4.70	450
120	56.007	0.280	81	0.95	5.30	450
125	58.149	0.280	81	0.57	6.60	450
130	60.292	0.280	81	0.45	7.80	450
135	62.434	0.230	81	0.64	6.20	500
140	64.362	0.230	81	0.47	6.10	500
145	66.290	0.230	81	0.54	5.70	500
150	68.219	0.190	81	0.56	5.40	550
155	69.972	0.170	81	0.77	5.10	575
160	71.649	0.170	81	0.81	4.90	575
165	73.327	0.170	81	0.98	4.10	575
170	75.004	0.160	81	0.80	4.40	600
175	76.611	0.160	81	0.76	4.30	600

180	78.219	0.160	81	0.77	4.50	600
185	79.826	0.150	81	0.76	4.50	625
190	81.370	0.150	81	0.75	4.60	625
195	82.913	0.150	81	0.78	4.60	625
200	84.456	0.150	81	0.84	4.40	625
205	85.999	0.130	81	0.91	4.40	650
210	87.483	0.130	81	0.82	4.40	650
215	88.967	0.130	81	1.00	3.60	650
220	90.451	0.130	81	0.98	3.60	650
225	91.936	0.130	81	0.94	3.70	650
230	93.420	0.130	81	0.88	3.70	650
235	94.904	0.130	81	0.78	3.50	650
240	96.388	0.130	81	0.94	3.10	650
245	97.872	0.130	81	0.91	3.10	675
250	99.301	0.130	81	0.89	3.20	675
255	100.730	0.130	81	1.00	3.30	675
260	102.159	0.130	81	1.08	3.20	675

TABLE 2---RAW DATA

CLIENT : Jotul TEST No. 1

MODEL: F118 Black Bear DATE: 18-Dec-14

METER CAL. FACTOR (Y)	-------	0.903	Wt. WOOD BURNED(LB)	-------	9.3 Lbs
BAROMETRIC PRESS.(Pb)	-------	29.97 in Hg	WET,FUEL MOISTURE %	-------	17.509 %
LEAK RATE POST (Lp)	-------	0.000 cfm	Wt. PART. COLLECTED	-------	0.7951 g
WATER VOL. (V1c)	-------	104.2 Ml	METER VOLUME Vm	-------	102.159 mcf
TEST TIME (MIN)	-------	260 min	HC MOLE FRACTION	-------	0.0132

TABLE 3 -----FIELD DATA AVERAGES

CLIENT : Jotul TEST No. 1

MODEL: F118 Black Bear DATE: 18-Dec-14

****

AVG DELTA H	-------	0.25	in H2O	AVG PRCNT CO	-------	0.65	%
AVG METER TEMP. Tm	-------	80	deg F	AVG PRCNT CO2	-------	4.77	%
AVG PPM SO2	-------	518	PPM	AVG BAL CO2/CO	-------	7.39	%

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul TEST No. 1

MODEL: F118 Black Bear DATE: 18-Dec-14

****

STD SAMPLE VOL. Vm(std) d) ------	90.39	dscf	STACK GAS FLOW Qsd -------	429.465	dscf/Hr
				7.16	& dscf/min
VOL. WATER VAPOR Vw(s td) -----	4.905	scf	PARTICULATE CONCTRT. C s ------	0.0088	g/dscf
PRCNT MSTR Bws -------	5.15	%	PARTC.EMISS. RATE E -------	3.78	g/Hr
BURN RATE BR -------	0.80	Kg/Hr	MOLES OF GAS PER Lb WOOD Nt ----	0.63	Lb-mole/Lb
CO EMISSION RATE -------	92.80	g/Hr	PART.EMISS. RATE ------	4.71	g/Kgdry fuel
	115.57	& g/Kgdry fuel			

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Jotul TEST No. : 1

MODEL: F118 Black Bear DATE: 18-Dec-14

TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR	PROPRTN RATE VAR. AVERAGE
5	832.7	98	100
10	846.5	100	
15	847.2	100	
20	847.0	100	
25	846.9	100	
30	847.0	100	
35	846.6	100	
40	846.5	100	
45	846.5	100	
50	846.6	100	
55	846.2	100	
60	846.3	100	
65	846.5	100	
70	844.9	99	
75	849.1	100	
80	851.7	100	
85	851.3	100	
90	851.9	100	
95	851.6	100	
100	851.6	100	
105	851.5	100	
110	851.6	100	
115	851.6	100	
120	851.6	100	
125	851.6	100	
130	852.0	100	
135	851.6	100	
140	851.6	100	
145	851.6	100	
150	852.1	100	
155	851.7	100	
160	851.7	100	
165	852.2	100	
170	851.7	100	
175	851.6	100	
180	852.2	100	

185	851.6	100
190	852.3	100
195	851.8	100
200	851.8	100
205	851.8	100
210	851.9	100
215	851.9	100
220	851.9	100
225	852.5	100
230	851.9	100
235	851.9	100
240	851.9	100
245	851.9	100
250	851.9	100
255	851.9	100
260	851.9	100

METER BOX DATA SHEET PAGE # 2

Page: 1 of 3

UNIT: JOTUL F118 RUN: 1 DATE: 12-04-2014

Meter Box: 5H Y Factor: .903

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: 185 : 1				BP: 29.97		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	0950	0.000	—	5.558	.15	78	625	78	2.0
5	55	1.500	—	9.263	.41	78	375	78	3.0
10	1000	4.040	4,040	7.719	.29	78	450	78	2.0
15	05	6.159	6.159	6.947	.23	78	500	78	2.0
20	10	8.066	8.066	7.313	.26	78	475	78	2.0
25	15	10.073	10.073	6.947	.23	78	500	78	2.0
30	20	11.980	11.980	8.173	.32	78	425	78	2.0
35	25	14.222	14.222	9.925	.47	78	350	78	2.0
40	30	16.943	16.943	9.925	.47	78	350	78	2.0
45	35	19.664	19.664	10.688	.55	78	325	78	2.0
50	40	22.594	22.594	11.579	.64	78	300	78	2.0
55	45	25.766	25.766	10.688	.55	78	325	78	2.0
ROTO PRESS: .18			TOTALS:	104.725	4.57	936	BP.: 29.97		
60	1050	28.695	28.695	9.925	.47	78	350	78	2.0
65	55	31.416	31.416	9.925	.47	78	350	78	2.0
70	1100	34.137	34.137	8.652	.36	80	400	80	2.0
75	05	36.537	36.537	8.128	.31	81	425	81	2.0
80	10	38.805	38.805	8.128	.31	81	425	81	2.0
85	15	41.072	41.072	7.273	.25	81	475	81	2.0
90	20	43.102	43.102	7.677	.28	81	450	81	2.0
95	25	45.244	45.244	6.909	.23	81	500	81	2.0
100	30	47.172	47.172	8.636	.36	81	400	81	2.0
105	35	49.581	49.581	7.677	.28	81	450	81	2.0
110	40	51.723	51.723	7.677	.28	81	450	81	2.0
115	45	53.865	53.865	7.677	.28	81	450	81	2.0
			TOTALS:	98.284	3.88	965	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	203.009	8.45	1901.	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 2 of 3

UNIT: Total FIIB RUN: 1 DATE: 12-24-2014

Meter Box: 5H" Y Factor: .903

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: 18.5 : 1 BP: 29.97

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1150	56.007	56.007	7.677	.28	81	450	81	20
125	55	58.149	58.149	7.677	.28	81	450	81	20
130	1200	60.292	60.292	7.677	.28	81	450	81	20
135	05	62.434	62.434	6.909	.23	81	500	81	20
140	10	64.362	64.362	6.909	.23	81	500	81	20
145	15	66.290	66.290	6.909	.23	81	500	81	20
150	20	68.219	68.219	6.281	.19	81	550	81	20
155	25	69.972	69.972	6.008	.17	81	575	81	20
160	30	71.649	71.649	6.008	.17	81	575	81	20
165	35	73.327	73.327	6.008	.17	81	575	81	20
170	40	75.004	75.004	5.757	.16	81	600	81	20
175	45	76.611	76.611	5.757	.16	81	600	81	20
ROTO PRESS: .18			TOTALS:	79.577	2.55	972	BP.: 29.97		
180	1250	78.219	78.219	5.757	.16	81	600	81	20
185	55	79.826	79.826	5.577	.15	81	625	81	20
190	1300	81.370	81.370	5.577	.15	81	625	81	20
195	05	82.913	82.913	5.577	.15	81	625	81	20
200	10	84.456	84.456	5.577	.15	81	625	81	20
205	15	85.999	85.999	5.315	.13	81	650	81	20
210	20	87.483	87.483	5.315	.13	81	650	81	20
215	25	88.967	88.967	5.315	.13	81	650	81	20
220	30	90.451	90.451	5.315	.13	81	650	81	20
225	35	91.936	91.936	5.315	.13	81	650	81	20
230	40	93.420	93.420	5.315	.13	81	650	81	20
235	45	94.904	94.904	5.315	.13	81	650	81	20
			TOTALS:	65.070	1.67	972	MAX VACC =		
TOTAL Cu Ft			TOTALS:	144.647	4.22	1944	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 3 of 3

UNIT: Jotd F118 RUN: 1 DATE: 12-24-2014

Meter Box: 5H Y Factor: .903

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: 1.562

ROTO: PRESS: .18 SAMPLING RATIO: 18.5 : 1 BP: 29.97

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
240	1350	96.388	96.388	5.315	.13	81	650	81	2.0
245	55	97.872	97.872	5.118	.13	81	675	81	2.0
250	1400	99.301	99.301	5.118	.13	81	675	81	2.0
255	05	100.730	100.730	5.118	.13	81	675	81	2.0
260	10	102.159	102.159	5.118	.13	81	675	81	2.0
265									
270				25.784	.65	405			
275									
280									
285									
290									
295									
ROTO PRESS:			TOTALS:				BP.:		
300									
305									
310									
315									
320									
325									
330									
335									
340				373.443					
345					13.320				
350						4250			
355						80			
			TOTALS:				MAX VACC =		3.0
TOTAL Cu Ft		102.159	TOTALS:	7.046	.251	540	AVG. BP:		29.97

153

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : 118 RUN : 1 DATE : 12-18-14

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

SCALE	WEIGHT
295.0 g	295.0
590.0 g	590.2
885.0 g	885.4

IMPINGER	# 1	# 2	# 3	# 4
FINAL WT	678.8	579.1	488.1	847.5
INITIAL WT	607.2	572.9	485.1	824.1
NET WT GRAMS	71.6	6.2	3.0	23.4

TOTAL CATCH : 104.2 GRAMS H_2O

FRONT HALF

FILTER #	140F	
FINAL WT g	.6176	
INITIAL WT g	.5118	
NET WT g	.1058	

BEAKER #	36
DESC.	ACETONE
FINAL WT g	94.5426
INITIAL WT g	94.4466
NET WT g	.0960
VOL. DESC. ml	150

BACK HALF

FILTER #	140B	
FINAL WT g	.5600	
INITIAL WT g	.3284	
NET WT g	.2316	

BEAKER #	37	38	39	40	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	106.7931	96.2906	97.1945	106.5512	
INITIAL WT g	106.5933	96.2407	97.1278	106.4601	
NET WT g	.1998	.0499	.0667	.0511	(.1178)
VOL. DESC ml	75	75	150	125	(275)

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 8-21-14 Time : 0942 By : KM

Manufacturer S & S Grade : # 25 Glass Front Size : 11 cm Lot No. : 6775627

Back Size: 8.2 cm Lot No. : 9465841

	DATE: 8-22-14	BY: KM	DATE: 8-26-14	BY: KM	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
131F	.5181	1000	.5181	1000	✓	
132F	.5126	1001	.5126	1001	✓	
133F	.5108	1002	.5107	1002	✓	
134F	.5085	1003	.5084	1003	✓	
135F	.5093	1004	.5095	1004	✓	
136F	.5123	1005	.5124	1005	✓	
137F	.5093	1006	.5091	1006	✓	
138F	.5074	1007	.5075	1007	✓	
139F	.5071	1008	.5073	1008	✓	
140F	.5115	1009	.5118	1009	✓ ← R-1	
131B	.3274	1010	.3275	1010	✓	
132B	.3290	1011	.3289	1011	✓	
133B	.3273	1012	.3274	1012	✓	
134B	.3290	1013	.3290	1013	✓	
135B	.3275	1014	.3275	1014	✓	
136B	.3257	1015	.3258	1015	✓	
137B	.3245	1016	.3247	1016	✓	
138B	.3272	1017	.3272	1017	✓	
139B	.3266	1018	.3263	1018	✓	
140B	.3285	1019	.3284	1019	← R-1	

Checked by: C. Wachter Date: 9-10-14 Time: 1038

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
8-22-14	0955	KM	64	77	49
8-26-14	0955	KM	62	75	48

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 7-7-14 Time : 0900 By : CW

	DATE: 8-21-14	BY: VM	DATE: 8-22-14	BY: KM	DATE:	BY:
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
26	101.0196	0950	101.0199	0915	✓	
27	106.3608	0951	106.3608	0916	✓	
28	105.7304	0952	105.7302	0917	✓	
29	104.4385	0953	104.4386	0918	✓	
30	107.3442	0954	107.3444	0919	✓	
31	95.5359	0955	95.5359	0920	✓	
32	107.8528	0956	107.8530	0921	✓	
33	101.1583	0957	101.1582	0922	✓	
34	106.4505	0958	106.4506	0923	✓	
35	96.5371	0959	96.5367	0924	✓	
36	94.4467	1000	94.4466	0925	✓	
37	106.5936	1001	106.5933	0926	✓	
38	96.2408	1002	96.2407	0927	✓ R-1	
39	97.1276	1003	97.1278	0928	✓	
40	106.4604	1004	106.4601	0929	✓	
41	105.4799	1005	105.4800	0930	✓	
42	104.6623	1006	104.6623	0931	✓	
43	107.3478	1007	107.3475	0932	✓	
44	107.7836	1008	107.7837	0933	✓	
45	94.9295	1009	94.9291	0934	✓	
46	106.0414	1010	106.0413	0935	✓	
47	107.0306	1011	107.0306	0936	✓	
48	97.7411	1012	97.7413	0937	✓	
49	108.3490	1013	108.3493	0938	✓	
50	96.5247	1014	96.5244	0939	✓	

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
8-21-14	0945	CW	-	66	49
8-22-14	0910	CW	-	70	48
		CW	-		

Checked by : CW
Date : 8-22-14
Time : 1100

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : 118 **RUN :** 1 **DATE :** 12-18-14 **Page :** 1 **of** 1

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
36	12-25	0900	Cp	94.5422	12-26	0919	KM	94.5426	12-27	1230	Cp				
37	12-25	0910	Cp	106.7973	12-26	0920	KM	106.7958	12-27	1231	Cp	106.7928	12-28	0946	Cp
				106.7931	12-28	1116	Cp								
38	12-25	0910	Cp	96.2907	12-26	0921	KM	96.2906	12-27	1232	Cp				
39	12-25	0900	Cp	97.1942	12-26	0922	KM	97.1945	12-27	1233	Cp				
40	12-25	0900	Cp	106.5107	12-26	0923	KM	106.5112	12-27	1234	Cp				

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
140F	12-18	1500	Cp	.6161	12-25	1351	KM	.6176	12-26	0917	KM	.6176	12-27	1235	Cp
140B	12-18	1500	Cp	.5739	12-25	1352	KM	.5688	12-26	0918	KM	.5632	12-27	1236	Cp
				.5597	12-28	0905	Cp	.5600	12-28	1115	Cp				

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	12-25-14	1350	KM	74	47
2	12-26-14	0916	KM	69	47
3	12-27-14	1220	Cp	73	47
4	12-28-14	0900	Cp	69	47
5	12-28-14	1110	Cp	71	45

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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 10-18-14 Through	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9997	10.0000	1.0000	.1000	CM	10-18	1610	77	49
100.0002	10.0003	.9999	.1000	CM	10-20	1100	74	47
100.0003	10.0000	1.0001	.0999	CM	10-20	1410	75	48
100.0001	10.0003	1.0000	.0999	KM	10-22	1000	78	49
99.9999	10.0000	1.0000	.1000	CM	10-23	0900	72	46
99.9997	9.9999	1.0000	.1000	CM	10-24	1330	68	47
100.0000	10.0001	1.0001	.1000	CM	10-25	1530	68	47
100.0000	10.0000	1.0000	.0998	KM	11-26	1005	73	47
99.9999	10.0001	1.0000	.0999	KM	11-27	1000	73	47
100.0003	10.0002	.9998	.0999	KM	11-28	1005	77	49
99.9995	10.0002	1.0000	.0999	CM	11-29	0945	68	47
100.0000	10.0002	1.0000	.1000	CM	11-30	1200	72	42
100.0000	9.9998	1.0000	.0998	CM	12-1	1500	75	41
100.0000	10.0001	1.0000	.0999	CM	12-3	1200	77	49
100.0000	10.0001	.9999	.0999	CM	12-4	1130	74	47
99.9998	10.0001	.9999	.0997	CM	12-4	1330	72	46
100.0001	10.0000	.9999	.1000	CM	12-11	0930	70	48
100.0000	10.0000	1.0000	.0999	KM	12-12	1045	77	49
100.0000	10.0000	.9999	.0999	KM	12-13	1110	68	47
100.0000	10.0001	.9999	.0998	CM	12-14	0945	66	49
100.0000	10.0000	.9999	.0997	CM	12-15	1000	65	44
100.0003	9.9999	1.0001	.0999	CM	12-15	1330	68	47
100.0000	10.0002	1.0000	.1000	KM	12-25	1345	74	47
100.0000	9.9999	1.0000	.1000	KM	12-26	0915	69	47
99.9995	9.9999	1.0000	.1000	CM	12-27	1220	73	47
99.9995	9.9999	1.0000	.1000	CM	12-28	0900	69	47
99.9996	9.9999	.9999	.0996	CM	12-28	1110	71	45
100.0000	9.9999	1.0000	.1000	CM	12-29	1000	66	45
99.9997	10.0000	.9999	.0997	CM	12-29	1205	66	45
100.0000	10.0001	1.0002	.1000	CM	1-1-15	1100	65	40
100.0000	10.0000	1.0000	.0999	CM	1-2-15	1300	66	41
100.0000	10.0001	.9999	.0998	CM	1-2-15	1530	67	42
100.0002	10.0001	.9999	.0998	CM	1-4-15	1245	68	47
100.0003	10.0001	1.0002	.1000	CM	1-4-15	1515	69	44

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 4-27-14 Through 10-17-14	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9996	9.9999	1.0000	.0999	Chp	4-27	1730	68	47
100.0000	10.0000	1.0000	.0999	Chp	5-21	0945	76	49
100.0000	9.9997	1.0000	.1002	Chp	5-22	0930	78	48
100.0005	10.0000	.9999	.0999	Chp	5-23	0740	77	46
100.0000	9.9999	1.0000	.1000	Chp	5-24	1330	74	47
99.9996	9.9999	1.0000	.1000	Chp	5-25	1100	72	46
100.0001	10.0000	1.0001	.0998	Chp	5-26	1115	73	47
100.0000	10.0000	1.0000	.0999	Chp	5-27	1115	78	46
100.0004	10.0000	1.0001	.0999	Chp	5-27	1330	74	47
100.0000	9.9999	.9999	.1000	Chp	7-3	0915	76	46
100.0000	10.0000	1.0000	.0999	Chp	7-4	0900	77	42
100.0000	10.0001	.9999	.0998	Chp	7-5	1230	77	49
100.0000	10.0001	1.0000	.0998	Chp	7-6	1510	76	48
100.0000	10.0000	1.0000	.0999	Chp	7-7	0820	70	48
100.0000	10.0001	.9999	.0999	Chp	7-9	0715	74	47
99.9995	9.9999	.9999	.0999	Chp	7-10	0945	75	44
100.0000	9.9999	.9999	.1000	Chp	7-10	1300	73	47
100.0001	10.0001	1.0001	.0998	Chp	7-14	1230	74	47
100.0000	9.9999	1.0000	.1000	Chp	715	0710	72	46
100.0000	10.0000	1.0000	.0998	Chp	8-21	0945	66	49
100.9998	10.0000	1.0000	.0998	KM	8-26	0920	69	47
100.0003	10.0000	1.0000	.1000	KM	9-11	0910	70	48
100.0000	10.0001	1.0001	.1000	KM	9-12	0905	72	42
100.0000	9.9999	.9999	.0999	KM	9-13	1000	73	47
100.0005	10.0001	1.0000	.1000	Chp	9-14	1015	68	47
100.0005	10.0000	1.0000	.0999	Chp	9-15	1030	68	47
99.9999	10.0000	.9999	.1000	KM	9-16	1010	77	49
99.9996	10.0000	1.0001	.1000	KM	9-16	1315	78	46
100.0000	10.0001	1.0000	.0999	KM	9-17	1010	70	48
100.0000	10.0000	1.0000	.1000	KM	9-19	0915	76	49
100.0000	10.0000	.9999	.0998	Chp	9-20	1100	71	49
100.0000	10.0001	1.0001	.0999	Chp	9-22	1000	72	46
100.0005	10.0000	.9999	.0999	Chp	9-22	1330	74	47
100.0000	10.0000	1.0000	.0998	KM	9-24	1120	78	46
100.0001	9.9999	1.0000	.1000	KM	9-25	1005	76	49
99.9998	9.9999	1.0000	.0999	KM	9-26	1105	76	49
100.0000	10.0001	.9999	.0999	KM	9-30	1120	78	49
99.9998	9.9999	.9999	.1000	KM	10-16	0945	76	49
100.0000	10.0001	1.0000	.1000	KM	10-17	0920	72	46

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 1-12-14 Through 4-22-14	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9995	10.0000	1.0001	.0999	CAP	1-12-14	1300	70	48
99.9995	9.9999	1.0000	.0997	CAP	1-13-14	1215	69	47
100.0000	9.9999	1.0001	.0999	CAP	1-23-14	0915	70	48
100.0000	9.9999	1.0000	.0999	CAP	1-31-14	1500	65	48
100.0000	9.9999	1.0000	.0999	CAP	2-4-14	1200	76	32
99.9997	9.9999	1.0001	.0999	CAP	2-5-14	1600	65	40
100.0000	9.9997	.9999	.1000	CAP	2-6-14	1600	65	36
100.0003	10.0000	1.0000	.0998	CAP	2-7-14	1530	65	40
100.0005	10.0001	1.0000	.0999	CAP	2-10-14	1115	65	48
100.0000	10.0000	1.0000	.0998	CAP	2-12-14	1315	70	48
100.0003	10.0002	1.0000	.0998	CAP	2-13-14	1130	75	48
99.9997	10.0001	1.0000	.1000	CAP	2-14-14	1500	66	49
99.9998	10.0001	1.0000	.0999	CAP	2-15-14	1015	69	44
100.0000	10.0001	1.0000	.0999	CAP	2-16-14	1500	68	42
100.0000	9.9999	1.0000	.0997	CAP	2-17-14	1530	74	44
99.9997	9.9998	1.0000	.1000	CAP	2-18-14	1130	65	48
100.0000	10.0000	1.0000	.1000	CAP	2-19-14	1130	70	41
100.0000	10.0000	1.0000	.0998	CAP	2-21-14	1445	72	42
100.0003	10.0002	.9999	.0997	CAP	2-23-14	1445	69	47
100.0006	10.0002	1.0001	.0999	CAP	2-25-14	1830	68	49
99.9999	10.0000	1.0000	.1000	CAP	2-26-14	1020	70	48
100.0005	10.0001	1.0001	.1000	CAP	2-27-14	1600	70	48
99.9996	9.9999	1.0000	.0998	CAP	3-1-14	1200	68	47
100.0000	10.0001	1.0000	.0999	CAP	3-2-14	1500	65	48
100.0000	10.0000	1.0000	.0999	CAP	3-3-14	1300	77	49
100.0000	10.0001	1.0000	.0999	CAP	3-4-14	1500	69	47
100.0000	10.0000	1.0000	.0999	CAP	3-5-14	1700	66	49
100.0000	9.9999	1.0001	.0999	CAP	3-19-14	1300	69	47
100.0000	10.0001	1.0000	.0999	CAP	3-21-14	1600	70	48
99.9995	10.0000	1.0000	.0999	CAP	3-23-14	1600	71	49
100.0000	10.0001	1.0000	.0998	CAP	3-24-14	1510	70	45
100.0004	10.0000	.9999	.0999	CAP	3-26-14	1645	70	48
99.9996	9.9999	1.0000	.1001	CAP	3-27-14	1145	66	49
99.9999	10.0002	1.0000	.0998	CAP	3-29-14	1200	65	48
100.0004	10.0000	.9999	.0998	CAP	4-22-14	1000	73	47
100.0000	10.0001	.9999	.0999	CAP	4-24-14	1030	76	49
99.9995	9.9999	.9999	.0998	CAP	4-25-14	1140	75	48
100.0000	9.9998	1.0000	.0999	CAP	4-26-14	1600	72	46
99.9995	9.9998	.9999	.0999	CAP	4-27-14	1130	65	48

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 3-6-13 Through 1-11-14	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	9.9999	1.0000	.0999	CP	3-6-13	1100	65	48
100.0000	10.0001	1.0000	.1000	CP	3-7-13	1700	68	47
99.9998	10.0002	1.0001	.1000	CP	3-9-13	1500	67	46
100.0001	10.0000	1.0000	.1000	CP	3-11-13	1540	75	41
100.0000	10.0002	1.0000	.0999	CP	3-12-13	1520	76	45
100.0000	9.9999	.9998	.0998	CP	3-19-13	1400	67	46
100.0000	10.0000	1.0000	.0998	CP	3-20-13	1600	74	47
100.0000	10.0001	1.0000	.1000	CP	6-18-13	1430	78	49
100.0000	10.0001	1.0000	.0998	CP	6-19-13	0900	76	49
99.9995	10.0000	.9998	.0998	CP	6-20-13	0820	66	49
99.9996	9.9999	1.0000	.0999	CP	6-21-13	1330	74	47
100.0003	9.9999	1.0000	.0998	CP	6-22-13	0930	76	49
99.9995	9.9999	.9999	.1000	CP	6-23-13	1510	74	47
100.0001	10.0001	1.0000	.0998	CP	6-24-13	1230	70	48
100.0000	10.0000	1.0000	.0999	CP	6-25-13	1400	70	48
99.9993	9.9999	1.0000	.0998	CP	6-26-13	1900	65	48
100.0000	9.9996	1.0001	.0998	CP	7-12-13	1500	72	47
100.0000	9.9999	1.0000	.0998	CP	7-14-13	1400	77	49
100.0005	10.0002	1.0000	.1000	CP	7-15-13	1600	78	48
100.0000	9.9997	1.0000	.1001	CP	7-16-13	1530	78	46
100.0003	10.0000	.9999	.0998	CP	7-17-13	0730	74	47
100.0003	9.9999	1.0000	.1000	CP	7-18-13	1600	78	46
100.0000	9.9999	.9999	.0999	CP	7-19-13	1415	72	46
100.0000	10.0001	.9999	.1001	CP	7-20-13	0800	74	47
100.0000	10.0000	1.0000	.0999	CP	7-21-13	1300	68	47
100.0000	10.0000	1.0000	.0998	CP	7-22-13	1300	70	48
100.0003	9.9998	1.0001	.1000	CP	7-23-13	1230	72	46
100.0000	9.9999	1.0000	.0999	CP	11-15-13	1530	72	46
100.0001	10.0001	.9999	.0999	CP	11-16-13	1035	72	46
99.9997	9.9999	1.0000	.0999	CP	11-17-13	1000	72	46
99.9997	10.0000	.9999	.0998	CP	11-18-13	1600	72	46
100.0000	10.0000	1.0000	.0999	CP	11-20-13	1100	66	49
100.0000	9.9999	1.0001	.0999	CP	11-21-13	1000	70	41
100.0000	9.9999	1.0000	.0998	CP	11-22-13	1730	67	46
100.0000	10.0000	.9998	.0999	CP	11-25-13	1500	70	44
100.0001	10.0000	.9999	.0999	CP	11-26-13	1600	68	47
100.0000	10.0002	.9997	.1001	CP	1-7-14	1630	72	47
99.9997	10.0000	1.0001	.0999	CP	1-9-14	1230	76	42
100.0002	10.0001	.9999	.1000	CP	1-11-14	1800	70	48

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 10-10-12 Through 3-6-2013	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9997	10.0000	1.0000	.0999	CP	10-10-12	1615	75	48
100.0000	10.0001	1.0001	.0999	CP	10-12-12	1230	77	46
99.9997	10.0000	.9999	.0999	CP	10-13-12	0830	77	49
100.0005	10.0000	.9999	.0999	CP	10-14-12	1030	78	46
100.0005	10.0002	.9999	.0998	CP	10-15-12	1000	78	48
100.0001	10.0002	1.0000	.1000	CP	10-16-12	1600	78	49
99.9996	9.9999	.9999	.1000	CP	10-17-12	0900	69	47
100.0000	9.9999	1.0006	.1000	CP	10-18-12	1330	78	37
100.0002	10.0000	.9999	.0999	CP	10-19-12	1130	78	46
100.0001	10.0001	.9999	.0999	CP	10-20-12	1400	78	48
99.9999	10.0001	.9998	.0999	CP	10-22-12	1800	65	45
100.0000	10.0001	1.0001	.0999	CP	10-24-12	1900	65	48
100.0000	9.9998	1.0000	.0998	CP	10-26-12	1750	70	48
100.0001	10.0000	1.0000	.0999	CP	10-28-12	1745	73	47
100.0000	10.0000	1.0000	.0999	CP	11-5-12	1030	74	47
99.9998	10.0000	1.0000	.0999	CP	11-6-12	1000	73	47
100.0000	10.0001	1.0000	.0999	CP	11-7-12	1030	73	47
100.0000	10.0000	1.0000	.1000	CP	11-8-12	0930	66	45
100.0000	9.9999	.9999	.0999	CP	11-12-12	1030	72	42
100.0000	10.0000	1.0000	.1000	CP	11-13-12	1000	71	45
100.0000	10.0000	1.0000	.0999	CP	11-29-12	0910	74	47
100.0000	10.0000	1.0000	.1000	CP	12-1-12	1800	66	49
100.0000	9.9999	1.0001	.0999	CP	12-2-12	1130	67	46
100.0000	10.0000	.9999	.0999	CP	12-3-12	0915	72	46
100.0004	10.0000	1.0000	.1001	CP	12-4-12	1700	69	47
99.9997	9.9999	.9999	.0999	CP	12-5-12	1045	74	44
99.9999	10.0000	1.0000	.0998	CP	12-6-12	1400	66	49
100.0000	9.9999	.9999	.0998	CP	12-7-12	1730	65	48
100.0002	10.0001	1.0000	.1000	CP	12-9-12	1400	66	49
100.0002	10.0001	.9997	.1000	CP	12-10-12	1500	66	49
100.0000	9.9999	1.0001	.0999	CP	12-21-13	1020	78	44
100.0000	9.9998	1.0001	.0999	CP	12-23-13	1900	72	46
99.9995	10.0001	1.0000	.0999	CP	12-24-13	1700	72	46
100.0000	9.9999	.9999	.1000	CP	12-25-13	1000	73	43
100.0000	9.9998	1.0000	.0999	CP	12-26-13	1600	66	49
100.0000	10.0002	1.0000	.0999	CP	12-27-13	0915	67	46
100.0000	10.0001	1.0000	.0999	CP	12-28-13	1530	76	42
100.0000	10.0001	1.0000	.0999	CP	3-2-13	1600	73	47
100.0000	9.9999	.9999	.0998	CP	3-4-13	1900	71	41

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 1-14-2012 Through 9-17-12	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	10.0000	1.0000	.0999	CA	1-14-12	1300	70	48
100.0002	10.0001	1.0001	.1000	AR	1-15-12	1330	68	47
99.9997	10.0000	1.0001	.1000	CA	1-17-12	1030	73	47
99.9997	10.0001	1.0000	.1000	CA	1-18-12	0915	74	44
99.9999	10.0002	1.0001	.1001	CA	1-19-12	1015	70	44
100.0001	10.0001	1.0001	.0998	CA	1-25-12	1600	72	46
99.9999	9.9998	1.0001	.1000	CA	1-26-12	1500	70	48
99.9995	9.9999	1.0000	.0999	CA	1-28-12	1400	70	41
100.0000	10.0000	1.0000	.0999	CA	2-4-12	1500	73	60
100.0000	10.0003	.9999	.0999	CA	2-6-12	1200	69	44
100.0000	10.0000	.9999	.0998	CA	2-7-12	1030	67	42
100.0000	9.9999	1.0001	.0999	CA	2-10-12	1630	78	49
100.0000	10.0001	1.0000	.1000	CA	2-11-12	1430	72	46
99.9997	10.0002	1.0000	.1001	CA	2-12-12	1530	73	47
100.0000	10.0000	.9999	.0999	CA	2-13-12	1100	78	41
99.9995	10.0000	.9999	.0999	CA	2-14-12	1000	72	45
100.0000	9.9999	.9999	.1000	CA	2-15-12	1120	70	44
99.9999	10.0000	1.0000	.0999	CA	2-17-12	1415	73	47
99.9999	10.0000	1.0000	.0998	CA	2-19-12	1600	70	44
99.9997	9.9999	1.0000	.0999	CA	2-20-12	1200	70	48
100.0004	10.0001	1.0000	.1000	CA	2-23-12	1000	73	47
100.0000	9.9997	1.0000	.0999	CA	2-24-12	1015	78	46
100.0000	10.0000	1.0000	.1001	CA	2-25-12	1715	65	43
100.0000	9.9996	1.0000	.0999	CA	2-27-12	1000	70	44
100.0000	10.0000	1.0001	.1002	CA	2-28-12	1125	75	41
99.9997	10.0000	1.0000	.1000	CA	2-29-12	1110	68	43
99.9995	9.9999	.9999	.0997	CA	3-1-12	1330	68	47
99.9996	10.0000	1.0000	.0998	CA	3-2-12	1430	71	45
99.9995	9.9999	1.0000	.0999	CA	3-3-12	1430	72	42
99.9999	10.0000	.9999	.0999	CA	9-2-12	0945	77	46
100.0000	10.0000	1.0000	.1000	CA	9-3-12	1030	71	49
100.0002	9.9999	1.0000	.0998	CA	9-4-12	1000	77	49
100.0000	10.0000	1.0000	.0999	CA	9-5-12	0945	78	46
100.0000	10.0002	1.0000	.0999	CA	9-6-12	1130	76	49
99.9997	10.0001	1.0002	.0999	CA	9-7-12	1400	76	49
100.0000	10.0001	1.0000	.0999	CA	9-8-12	1200	71	49
100.0000	10.0002	1.0000	.1001	CA	9-15-12	1410	78	48
100.0000	10.0000	1.0000	.1000	CA	9-16-12	1100	78	48
100.0000	10.0000	.9999	.0999	CA	9-17-12	1330	75	48

BLANK PROCESSING DATA SHEET # 5

UNIT : F118 RUN : 1 DATE : 12-18-14

BLANKS DONE : 9-8-12

BEAKER	A	B	C
	200 ml ACETONE	75 ml DICHLOR	200 ml WATER
	FISHER OPTIMA LOT # 023283	FISHER OPTIMA LOT # 066390	DWWA, Inc Sparkletts Distilled
FINAL WEIGHT	108.9013	106.3080	106.9659
TARE WEIGHT	108.9005	106.3061	106.9637
NET WEIGHT	.0008	.0019	.0022

TARE BEAKERS INTO DESC : TIME : 1015 DATE : 8-31-12

DATE : 9-2 BY : CP DATE : 9-3 BY : CP DATE : ____ BY : ____

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9002	1016	108.9005	1046		
B	106.3058	1017	106.3061	1047		
C	106.9641	1018	106.9637	1048		

FINAL BEAKERS INTO DESC : TIME : ____ DATE : ____

DATE : 9-6 BY : CP DATE : 9-7 BY CP DATE : ____ BY : ____

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9016	1148	108.9013	1415		
B	106.3077	1149	106.3080	1416		
C	106.9661	1150	106.9659	1417		

TARE QC

DATE	TIME	BY	WB	DB	%
9-2	0945	CP	S	77	46
9-3	1030	CP	S	71	49

FINAL QC

DATE	TIME	BY	WB	DB	%
9-6	1130	CP	S	76	49
9-7	1400	CP	S	76	49

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT : F118 RUN : 1 DATE : 12-12-14

BLANK CALCULATIONS

Acetone : .0008 g ÷ 200 ml = .000004 g/ml

Dicholoromethane : .0019 g ÷ 75 ml = .000025 g/ml

Distilled Water : .0022 g ÷ 200 ml = .000011 g/ml

FRONT HALF CATCH

FILTERS : .1058 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .1058 g

BEAKERS : .0960 (Total Catch) g - 150 (ml Acetone) (.000004 g) (Blank Value / ml Acetone) = .0954 g

TOTAL FRONT HALF CATCH : .2012 g

BACK HALF CATCH

FILTERS : .2316 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .2316 g

BEAKERS :

Acetone : .1998 (Total Catch) g - 75 (ml Acetone) (.000004 g) (Blank Value / ml Acetone) = .1995 g

Extract : .0499 (Total Catch) g - 75 (ml Dichloromethane) (.000025 g) (Blank Value / Dichloromethane) = .0480 g

Water : .1178 (Total Catch) g - 275 (ml Water) (.000011 g) (Blank Value / Water) = .1148 g

TOTAL BACK HALF CATCH : .5939 g

TOTAL CATCH : .7951 g

% FRONT HALF : 25.30 %

CALCULATIONS DATA SHEET # 7

UNIT : JOTUL F118 RUN : 1 DATE : 12-24-2014

1) $Vm(std) = \dfrac{(102.159\ Vm)(17.64)(.903\ mcf)\left(29.97" Hg + \frac{.251" H_2O}{13.6}\right)}{(540\ TmA)} = \dfrac{100.6158}{000.0000}$ dscf

2) $Vw(std) = (.04707)(104.2\ ml\ H_2O) = \dfrac{4.9047}{00.0000}$ scf

3) $Asw = \dfrac{(4.9047\ scf)}{(4.9047\ scf + 100.6158\ dscf)} = \dfrac{.0465}{.0000}$ Bws × 100 = $\dfrac{4.6481}{00.0000}$ % H_2O

4) $Cs = \dfrac{(.7951\ g.)}{(100.6158\ dscf)}(15.43) = \dfrac{.1219}{0.0000}$ gr / dscf

5) Estimated g / hr = $\dfrac{(.7951\ g.)}{(100.6158\ dscf)}\left(\dfrac{7.046}{00.0000}\ dscfm\right)(60) = \dfrac{3.3408}{00.0000}$ g / hr

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

TEST DATA SHEET # 8

UNIT: JOTUL F118 RUN: 1 DATE: 12-24-14

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

Wet Bulb / Dry Bulb

Pre : WB: 62 DB: 75 = 42.0 % RH 1.4 % H_2O

Post : WB: 60 DB: 74 = 43.0 % RH 1.4 % H_2O

Average: 45.0 % RH 1.4 % H_2O

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

Kindling Weight (lbs): Paper: .1 Wood: 1.3

Preburn Fuel Weight: 9.6+8.1+7.3 Total: 25.0

Kindling & Preburn Fuel Weight (wood only) (lbs): **Total**: 26.3

Coal Bed Wt Range (lbs): 2.3 - 1.9 **Scale**: 2.3 - 1.9

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

Lower : .20 x fuel weight : Always round UP to nearest tenth **Actual Coal Bed Weight**: 2.3

Maximum Coal Bed Removal (lbs): ((2.3 (Upper) + 1.9 (Lower)) ÷ 2) .25 = .5 (round down to nearest tenth)

Test Fuel (.75" x 1.5" x 5" spacers) = 16 pcs

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" x 4"	18	4	9.3	100.0
4" x 4"	—	—	—	—

Test Fuel Weight: 9.3 lbs

Estimated Dry Burn Rate:

$$\frac{9.3 - (9.3 \times .17509)}{2.2046} \times \frac{60}{\frac{260}{\text{TIME}}} = 1.803 \text{ kg / hr}$$

Estimated BTU's/hr: 19,140 x $\frac{63}{100}$ x $\frac{1.803}{\text{DBR}}$ = 96827 BTU's/hr

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

210 = .99

WOOD STOVE OPERATING DATA PAGE #9

Unit : JOTUL F118 Run : 1 Date : 12-24-2014

FIRE STARTED: 0600

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 1/2 min. prior to loading last fuel, raked and leveled. In stove 25 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) first ALL minutes of test

Fan speed set at N/A

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 8 or 16 inches.

1st warm up / pre-burn fuel charge (9.6 lbs.) added at 0605

2nd warm up / pre-burn fuel charge (8.1 lbs.) added at 0715

3rd warm up / pre-burn fuel charge (7.3 lbs.) added at 0814

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 F118 Run : 1 Date : 12-24-2014

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

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

Time Test Fuel moisture reading taken : 0900

pc #	Dimen.	Use	TOP	BOTTOM	SIDE	Avg Corrected
1	2"×4"×8'	K	15.6	15.1	14.8	14.967
2						
3						
4	2"×4"×8'	P	19.6	19.7	19.7	19.7
5	2"×4"×8'	P	18.1	18.1	18.2	18.1
6	2"×4"×8'	P	22.0	21.6	19.9	21.2
7	2"×4"×8'	P				59.0
8	2"×4"×8'	P				
9						
10						
11						
12	2"×4"×18"	T	20.8	20.7	20.7	20.7
13	"	T	20.2	20.3	20.3	20.3
14	"	T	20.5	20.5	20.5	20.5
15	"	T	23.1	23.6	23.5	23.4
16						84.9
17						
18						
19						
20	Spacers	T	21.6	23.0	21.9	22.167

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	14.967 %	19.667 %	21.225 %
Wet Moisture % :	13.0185 %	16.435 %	17.509 %

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: 2.3 DATE: 12-24-2014

UNIT: JOTUL F118 RUN: 1 PAGE: 1 OF 2

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
0 0955	11.6	9.3	—	.139	3.4	.611	16.5	.090	.90	-.028	625
5	11.5	9.2	.1	.066	1.6	.699	18.9	.029	.28	-.027	375
10 1000	11.4	9.1	.1	.068	1.7	.699	18.9	.019	.18	-.027	450
15	11.3	9.0	.1	.046	1.1	.720	19.5	.021	.20	-.024	500
20 10	11.2	8.9	.1	.081	2.0	.688	18.6	.018	.17	-.026	475
25	11.1	8.8	.1	.074	1.8	.693	18.8	.025	.24	-.025	500
30 20	10.9	8.6	.2	.150	3.7	.629	17.0	.012	.11	-.032	425
35	10.5	8.2	.4	.315	7.9	.469	12.6	.035	.34	-.041	350
40 30	10.0	7.7	.5	.274	6.8	.516	13.9	.016	.15	-.043	350
45	9.6	7.3	.4	.263	6.5	.526	14.1	.018	.17	-.043	325
50 40	9.1	6.8	.5	.329	8.2	.467	12.5	.012	.11	-.045	300
55	8.7	6.4	.4	.372	9.3	.426	11.4	.014	.13	-.047	325
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.408	*****
60 1050	8.3	6.0	.4	.332	8.3	.461	12.3	.017	.16	-.046	350
65	7.8	5.5	.5	.303	7.6	.484	13.0	.023	.22	-.045	350
70 1100	7.6	5.3	.2	.251	6.2	.529	14.2	.038	.37	-.042	400
75	7.3	5.0	.3	.213	5.3	.555	14.9	.058	.57	-.039	425
80 10	7.1	4.8	.2	.209	5.2	.556	15.0	.063	.63	-.038	425
85	6.9	4.6	.2	.198	4.9	.559	15.0	.086	.86	-.035	475
90 20	6.7	4.4	.2	.178	4.4	.574	15.5	.093	.93	-.035	450
95	6.4	4.1	.3	.189	4.7	.568	15.3	.080	.80	-.034	500
100 30	6.2	3.9	.2	.232	5.8	.531	14.3	.072	.72	-.035	400
105	5.9	3.6	.3	.210	5.2	.549	14.8	.083	.83	-.035	450
110 40	5.7	3.4	.2	.208	5.2	.546	14.7	.091	.91	-.034	450
115	5.5	3.2	.2	.188	4.7	.565	15.2	.089	.89	-.034	450
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.452	*****
120 1150	5.2	2.9	.3	.214	5.3	.541	14.6	.095	.95	-.035	450
125	4.9	2.6	.3	.267	6.6	.508	13.6	.058	.57	-.038	450
130 1200	4.6	2.3	.3	.314	7.8	.469	12.6	.046	.45	-.039	450
135	4.4	2.1	.2	.250	6.2	.520	14.0	.064	.64	-.035	500
140 10	4.2	1.9	.2	.245	6.1	.529	14.2	.048	.47	-.035	500
145	4.0	1.7	.2	.229	5.7	.541	14.6	.055	.54	-.033	500
150 20	3.8	1.5	.2	.218	5.4	.551	14.8	.057	.56	-.033	550
155	3.7	1.4	.1	.207	5.1	.555	14.9	.077	.77	-.032	575
160 30	3.6	1.3	.1	.197	4.9	.560	15.1	.081	.81	-.030	575
165	3.5	1.2	.1	.164	4.1	.583	15.7	.098	.98	-.029	575
170 40	3.4	1.1	.1	.177	4.4	.579	15.6	.080	.80	-.029	600
175	3.3	1.0	.1	.175	4.3	.584	15.7	.076	.76	-.028	600
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.396	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-1.256	*****

GAS DATA SHEET #12

WEIGHT: 2.3 DATE: 12-24-2014

UNIT: JOTUL F118 RUN: 1 PAGE: 2 OF 2

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
180 1250	3.2	.9	.1	.180	4.5	.576	15.5	.077	.77	-.027	600
185	3.2	.9	Ø	.182	4.5	.577	15.5	.076	.76	-.026	625
190 1300	3.1	.8	.1	.186	4.6	.573	15.5	.075	.75	-.026	625
195	3.0	.7	.1	.186	4.6	.572	15.4	.078	.78	-.027	625
200 1310	2.9	.6	.1	.179	4.4	.577	15.6	.084	.84	-.027	625
205	2.9	.6	Ø	.177	4.4	.575	15.5	.091	.91	-.026	650
210 1320	2.8	.5	.1	.176	4.4	.578	15.6	.082	.82	-.026	650
215	2.8	.5	Ø	.146	3.6	.600	16.2	.100	1.00	-.025	650
220 1330	2.7	.4	.1	.146	3.6	.601	16.2	.098	.98	-.024	650
225	2.7	.4	Ø	.150	3.7	.599	16.2	.094	.94	-.024	650
230 1340	2.6	.3	.1	.150	3.7	.601	16.2	.088	.88	-.024	650
235	2.6	.3	Ø	.141	3.5	.612	16.5	.078	.78	-.023	650
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.305	*****
240 1350	2.5	.2	.1	.127	3.1	.621	16.8	.094	.94	-.024	650
245	2.5	.2	Ø	.127	3.1	.622	16.8	.091	.91	-.024	675
250 1400	2.4	.1	.1	.130	3.2	.619	16.7	.089	.89	-.023	675
255	2.4	.1	Ø	.134	3.3	.611	16.5	.100	1.00	-.023	675
260 1410	2.3	Ø	.1	.131	3.2	.612	16.5	.108	1.08	-.023	675
265											
270											
275											
280											
285											
290											
295											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.117	*****
300											
305											
310											
315											
320											
325											
330											
335											
340											
345											
350											
355											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.422	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-1.678	*****

AVG: -.032

53

PREBURN DATA SHEET #13

UNIT: JOTUL F118 RUN: 1 DATE: 12-24-2014 PAGE: 1 of 1

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
0 0854	3.1	-	408	511	545	275	357	391			72	-.055	PREBURN START: # 1 8 UP
5	2.9	.2	315	475	543	282	375	396			71	-.047	COAL BED SCALE RANGE:
10 0900	2.7	.2	280	436	523	285	369	396			71	-.045	2.3 → 1.9
15	2.6	.1	259	405	502	287	362	391			72	-.042	PRIMARY AIR: M/W
20 10	2.5	.1	234	369	480	287	359	386			72	-.039	SECONDARY AIR: N/A
25	2.5	0	223	347	461	288	350	383			71	-.036	FAN: N/A
30 20	2.4	.1	215	329	449	284	338	380			72	-.035	PUMPS ON AT:
35	2.4	0	206	309	434	281	320	376			71	-.035	CHECK WB/DB: N/A
40 30	2.4	0	198	292	418	273	312	372			71	-.033	
45	2.3	.1	191	277	402	269	305	367			72	-.032	
50 40	2.3	0	184	263	387	263	290	362			71	-.030	313
55	2.3	0	180	253	371	258	289	356			72	-.030	
*****	****	***	****	*****	*****	****	*****	*****	*****	*****	*****	****	
60 0956	2.3	0	182	244	358	258	280	354			70	-.028	
65													
70 1000													
75													
80													
85													
90													

Unit:Jotul F118 Black Bear

Temperature Data Sheet #14

Run-1
12-24-14

Time	Stack	Top	Left Side	Back	Right Side	Bottom	Firebox	Secondary	Ambient	Furnace	Sample Box	Bucket	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	182	244	358	258	280	354	#######	#######	70	1382	228	45	N/A	37	36
5	181	229	326	250	259	349	#######	#######	70	1362	229	37		37	36
10	177	224	295	238	233	339	#######	#######	69	1342	231	37		37	36
15	158	213	270	226	214	326	#######	#######	70	1326	231	37		37	36
20	162	205	251	215	199	312	#######	#######	68	1313	232	37		37	36
25	158	200	235	205	187	297	#######	#######	69	1301	233	37		37	36
30	187	201	220	196	177	283	#######	#######	68	1291	233	37		37	36
35	261	245	214	188	172	270	#######	#######	68	1280	233	38		37	36
40	266	282	217	182	175	258	#######	#######	68	1271	233	38		37	36
45	265	300	227	176	180	247	#######	#######	68	1264	234	38		37	37
50	296	330	233	172	186	239	#######	#######	67	1259	235	38		37	37
55	312	364	242	169	196	234	#######	#######	68	1254	236	38		37	37
60	309	391	253	169	208	231	#######	#######	68	1251	237	38		38	37
65	291	388	272	169	219	229	#######	#######	68	1250	239	39		38	38
70	264	371	288	170	233	228	#######	#######	69	1250	239	39		38	38
75	243	348	298	171	240	228	#######	#######	69	1249	239	39		38	38
80	231	328	305	174	247	229	#######	#######	69	1248	239	40		38	38
85	222	312	310	175	250	231	#######	#######	69	1247	239	40		38	38
90	211	297	307	179	244	233	#######	#######	69	1247	240	40		38	38
95	208	285	305	181	236	234	#######	#######	69	1247	240	40		39	38
100	222	281	308	182	233	236	#######	#######	69	1248	240	40		39	38
105	217	276	324	185	232	239	#######	#######	69	1248	240	40		39	38
110	213	271	336	187	233	241	#######	#######	69	1247	241	41		39	38
115	209	265	339	190	238	244	#######	#######	69	1247	241	41		39	38
120	214	262	340	192	250	246	#######	#######	69	1248	242	41		38	38
125	228	264	350	196	266	247	#######	#######	70	1248	243	41		38	38
130	241	279	387	202	283	251	#######	#######	70	1248	243	41		38	38
135	221	280	407	206	290	256	#######	#######	70	1246	243	41		38	38
140	213	277	429	211	290	263	#######	#######	70	1244	242	42		38	38
145	207	272	450	214	287	270	#######	#######	71	1245	244	42		38	38
150	202	268	456	216	286	276	#######	#######	70	1245	243	41		38	38
155	197	262	455	220	288	282	#######	#######	70	1245	243	42		38	37
160	191	256	442	222	286	289	#######	#######	71	1246	243	43		38	37
165	185	250	427	227	283	294	#######	#######	71	1247	244	43		38	37
170	181	243	408	228	274	297	#######	#######	71	1248	243	44		38	37

Unit:Jotul F118 Black Bear

Temperature Data Sheet #14

Run-1
12-24-14

175	179	238	391	230	269	299	#######	######	70	1249	243	44	38	37
180	176	233	381	232	263	304	#######	######	71	1247	242	44	37	37
185	175	229	375	232	261	307	#######	######	70	1248	243	44	37	36
190	174	225	372	232	257	311	#######	######	71	1248	243	44	37	36
195	173	223	370	232	256	314	#######	######	71	1249	243	44	37	36
200	172	220	373	233	254	316	#######	######	69	1249	243	45	36	36
205	171	218	372	233	252	317	#######	######	70	1248	242	45	36	35
210	170	216	372	232	252	318	#######	######	70	1248	242	45	36	35
215	166	213	359	230	249	317	#######	######	70	1248	242	45	36	35
220	163	209	351	230	244	314	#######	######	70	1247	241	46	36	35
225	162	206	344	228	239	311	#######	######	70	1245	242	46	35	35
230	161	203	336	227	236	310	#######	######	70	1244	242	46	35	34
235	158	200	332	226	234	311	#######	######	69	1244	242	46	35	34
240	156	197	325	223	231	311	#######	######	70	1244	242	47	35	34
245	154	194	318	222	230	310	#######	######	69	1244	243	47	35	34
250	153	192	312	219	230	308	#######	######	70	1246	243	48	35	34
255	151	189	306	217	228	308	#######	######	70	1247	243	48	35	34
260	150	187	304	214	228	309	#######	######	70	1246	243	48	35	33

Unit:Jotul F118 Black Bear

Run-1
12-24-14

		TEST TIME	260		
STACK	202	TOP AVG	256	LT SIDE AVG	332
BACK AVG	208	RT SIDE AVG	241	BOTTOM AVG	281
FIREBOX AVG	########	SEC/CAT AVG	########	AMBIENT AVG	69

END	248.3	
START	282.5	
	-34.2	DELTA T

CIRCLE: LOSE / GAIN

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 12-21-14 Analyte : CO_2 (15-1)

Unit : F 118 Run # : 1

Zero Cyl. # : XC3AAM173 Conc. : 0.00 % CO_2 Cyl. Press. : 1980 PSI

Certified by : AIR LIQUIDE Date : 2-14-13

Span Cyl. # : 487905 Conc. : 12.20 % CO_2 Cyl. Press. : 1340 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % CO_2

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

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

PRE RUN Audit : by : [signature] Time : 0830 Temp : 68 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-.052	-.052	-.209
SPAN	48.8	.488	12.20	48.8	.488	12.195	-.005	-.019

POST RUN Audit : by : [signature] Time : 1430 Temp : 68 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.2	.002	-.002	-.002	-.008
SPAN	48.8	.488	12.20	48.7	.487	12.170	-.030	-.120

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

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

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

ZERO / SPAN CHECK DATA SHEET #15-2

Date : 12-24-14 Analyte : O_2 (15-2)

Unit : F118 Run # : 1

Zero Cyl. # : TC3AAM173 Conc. : 0.00 % O_2 Cyl. Press. : 1980 PSI

Certified by : AIR LIQUIDE Date : 2-14-13

Span Cyl. # : 487905 Conc. : 12.60 % O_2 Cyl. Press. : 1340 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 : CJ Dowling Time : 0830 Temp : 68 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-.020	-.020	-.081
SPAN	12.60	.504	12.6	12.6	.504	12.613	.013	.054

POST RUN Audit : by : CJ Dowling Time : 1430 Temp : 68 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.001	.005	.005	.019
SPAN	12.60	.504	12.6	12.6	.505	12.638	.038	.154

± 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 : 12-20-14 Analyte : CO (15-3)

Unit : F118 Run # : 1

Zero Cyl. # : TC3AAM173 Conc. : 0.00 % CO Cyl. Press. : 1980 PSI

Certified by : AIR LIQUIDE Date : 2-14-13

Span Cyl. # : CA487905 Conc. : 4.90 % CO Cyl. Press. : 1340 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 10.0 % CO

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

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

PRE RUN Audit : by : [signature] Time : 0830 Temp : 68 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	000	,000	-.011	-.011	-.106
SPAN	49.0	.490	4.90	49.0	,490	4.931	,031	,313

POST RUN Audit : by : [signature] Time : 1430 Temp : 68 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-.011	-.011	-.106
SPAN	49.0	.490	4.90	48.9	.489	4.921	,021	.214

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

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

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

ZERO / SPAN CHECK DATA SHEET #15-4

Date : 12-24-14 Analyte : SO_2 (15-4)

Unit : F118 Run # : 1

Zero Cyl. # : TC3AAM173 Conc. : 0.00 ppm SO_2 Cyl. Press. : 1980 PSI

Certified by : AIR LIQUIDE Date : 2-14-13

Span Cyl. # : CC82089 Conc. : 1250 ppm SO_2 Cyl. Press. : 1580 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 2500 ppm SO_2

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

PRE RUN Audit : by : Cp Wortmann Time : 0830 Temp : 68 ° F

AUDIT RESULTS

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

POST RUN Audit : by : Cp Wortmann Time : 1430 Temp : 68 ° 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	-1.188	-1.188	-.048
SPAN	50.0	.500	1250	50.2	.502	1253.0	3.000	.120

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

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

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

QUALITY CHECKS DATA SHEET # 16

UNIT : JOTUL F118 RUN : 1 DATE : 12-29-2014

Thermocouple Check:

T/C # 1	—— °F	T/C # 13	56.6 °F
T/C # 2	—— °F	T/C # 14	56.2 °F
T/C # 3	56.7 °F	T/C # 15	56.2 °F
T/C # 4	55.4 °F	T/C # 16	44.1 °F
T/C # 5	55.1 °F	T/C # 17	44.6 °F
T/C # 6	55.1 °F	T/C # 18	58.2 °F
T/C # 7	55.3 °F	T/C # 19	60.5 °F
T/C # 8	55.6 °F	T/C # 20	—— °F
T/C # 9	—— °F	T/C # 21	—— °F
T/C # 10	—— °F	T/C # 22	—— °F
T/C # 11	55.4 °F	T/C # 23	—— °F
T/C # 12	55.9 °F	T/C # 24	—— °F

Thermocouple Readout:

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

ZERO -.9 °F Adj. to 0.0 °F ZERO .6 °F Difference .030 %

SPAN 2001.1 °F Adj. to 2000.0 °F SPAN 1998.9 °F Difference -.055 %

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 200.5 °F	400	= 400.2 °F
600	= 600.1 °F	800	= 800.0 °F	1000	= 999.9 °F
1200	= 1199.8 °F	1400	= 1399.6 °F	1600	= 1599.6 °F
1800	= 1799.9 °F	2000	= 2000.0 °F		

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

Scale Check Pre : 12.5 − 2.5 = 10

Post : 12.3 − 2.3 = 10

Stack Cleaned Prior to Test Run : YES X NO ——

COMPUTER INPUT DATA SHEET #1

Client: JOTUL U.S.A. Inc.

Address: 55 Hutchinson

Gorham, ME 04038

3.82

Phone: (207) 797-5912 Fax: (207) 772-0523

Run No.: 2 Date of Test: 12-25-2014 Burn Rate: .914

Model No.: JOTUL F118 Black Bear ☐ min ☒ min-1.25 ☐ fan

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

Dry Gas Meter Y Factor: .903 (0.000) (Data Sheet #2) Post Leak Rate: .000 cfm (.000) (Data Sheet #2) Time: 230 min. (000) (Data Sheet #2)

Dry Gas Meter Volume: 67.805 cf (00.000) (Data Sheet #2)

Stack Flow: 8.161 dscfm (00.000) (Data Sheet #2) Δ H: .143 in. H_2O (.000) (Data Sheet #2)

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

H_2O Captured: 94.2 g (00.0) (Data Sheet #3)

Front Half Catch % Of Total: 22.6 % (00.0) (Data Sheet #6) Total Particulate Catch: .1536 g (0.0000) (Data Sheet #6)

Flue Gas Moisture: 6.9403 % (00.000) (Data Sheet #7)

Particulate Emission: .1391 gr/dscf (0.0000) (Data Sheet #7)

Relative Humidity: 37.5 % RH (00.0) (Data Sheet #8) Ambient Moisture: 1.4 % H_2O (0.00) (Data Sheet #8)

Preburn Fuel Wt.: 27.8 lbs. (00.0) (Data Sheet #8) Coal Bed Wt.: 2.1 lbs. (00.0) (Data sheet #8) Test Fuel Wt.: 9.3 lbs. (00.0) (Data sheet #8)

Heat Output (EPA Default): 11021.2 BTU/hr (00,000.0) (Data Sheet #8)

Kindling Fuel % Moisture (wet): 12.765 % (00.000) (Data Sheet #10) Pretest Fuel % Moisture (wet): 17.012 % (00.000) (Data Sheet #10)

Test Fuel % Moisture (dry): 20.375 % (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove]) Test Fuel % Moisture (wet): 16.926 %

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

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

Average Ambient Temperature: 76 °F (00) (Data Sheet #14) Stove Temperature Change: -19.6 °F (+/- 000.0) (Data Sheet #14)

TEST START 1445

END 1835

METER TEMP 547

TABLE 1 ----- RAW DATA

CLIENT : Jotul TEST No. : 2

MODEL: F118 Black Bear DATE: 19-Dec-14

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	102.500	0.150	85	0.38	2.50	400
5	104.000	0.270	85	0.26	2.40	300
10	106.051	0.180	85	0.17	5.50	375
15	107.693	0.200	85	0.35	7.20	350
20	109.452	0.200	85	0.29	6.30	350
25	111.211	0.230	85	0.12	7.00	325
30	113.105	0.230	85	0.14	8.20	325
35	114.999	0.230	85	0.19	9.60	325
40	116.892	0.200	86	0.28	10.60	350
45	118.658	0.230	86	0.12	9.10	325
50	120.559	0.230	86	0.09	9.30	325
55	122.459	0.200	86	0.27	8.60	350
60	124.225	0.170	86	0.38	7.40	375
65	125.873	0.170	86	0.23	8.10	375
70	127.520	0.170	86	0.20	7.80	375
75	129.168	0.170	86	0.29	7.70	375
80	130.816	0.170	86	0.33	7.60	375
85	132.464	0.150	87	0.53	7.10	400
90	134.015	0.140	87	0.68	6.40	425
95	135.474	0.140	87	0.65	6.10	425
100	136.934	0.140	87	0.61	6.50	425
105	138.393	0.140	87	0.76	5.80	425
110	139.853	0.120	87	0.82	5.20	450
115	141.232	0.120	87	0.80	5.40	450
120	142.610	0.060	87	3.01	3.50	625
125	143.603	0.070	87	2.81	3.50	600
130	144.634	0.090	87	2.82	3.60	525
135	145.816	0.110	87	1.00	5.00	475
140	147.122	0.110	87	0.97	5.10	475
145	148.428	0.110	87	0.78	5.50	475
150	149.734	0.110	87	0.92	5.00	475
155	151.040	0.110	87	0.96	5.00	475
160	152.346	0.110	87	1.01	5.00	475
165	153.652	0.110	87	0.95	4.50	475
170	154.958	0.110	87	1.06	4.50	475
175	156.265	0.110	87	1.16	4.50	475

180	157.571	0.110	87	1.27	4.40	475
185	158.877	0.110	87	1.24	4.20	475
190	160.183	0.110	87	1.32	4.00	475
195	161.489	0.100	87	1.23	3.90	500
200	162.730	0.110	87	1.34	3.50	475
205	164.036	0.100	87	1.29	3.50	500
210	165.277	0.100	87	1.39	3.30	500
215	166.518	0.110	87	1.39	3.30	475
220	167.824	0.100	87	1.89	2.90	500
225	169.065	0.100	87	1.89	2.60	500
230	170.305	0.100	87	1.07	3.10	500

TABLE 2---RAW DATA

CLIENT : Jotul TEST No. 2

MODEL: F118 Black Bear DATE: 19-Dec-14

METER CAL. FACTOR (Y) -------	0.903		Wt. WOOD BURNED(LB) -------	9.3	Lbs
BAROMETRIC PRESS.(Pb) -------	30.1	in Hg	WET,FUEL MOISTURE % -------	16.926	%
LEAK RATE POST (Lp) -------	0.000	cfm	Wt. PART. COLLECTED -------	0.5361	g
WATER VOL. (V1c) -------	94.2	Ml	METER VOLUME Vm -------	67.805	mcf
TEST TIME (MIN) -------	230	min	HC MOLE FRACTION -------	0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT : Jotul TEST No. 2

MODEL: F118 Black Bear DATE: 19-Dec-14

****

AVG DELTA H	-------	0.14	in H2O	AVG PRCNT CO	-------	0.89	%
AVG METER TEMP. Tm	-------	86	deg F	AVG PRCNT CO2	-------	5.55	%
AVG PPM SO2	-------	434	PPM	AVG BAL CO2/CO	-------	6.25	%

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul TEST No. 2

MODEL: F118 Black Bear DATE: 19-Dec-14

****

STD SAMPLE VOL. Vm(std) d) ------	59.55 dscf	STACK GAS FLOW Qsd -------	424.466	dscf/Hr &
			7.07	dscf/min
VOL. WATER VAPOR Vw(s td) -----	4.434 scf	PARTICULATE CONCTRT. C s ------	0.0090	g/dscf
PRCNT MSTR Bws -------	6.93 %	PARTC.EMISS. RATE E -------	3.82	g/Hr
BURN RATE BR -------	0.91 Kg/Hr	MOLES OF GAS PER Lb WOOD Nt ----	0.55	Lb-mole/Lb
CO EMISSION RATE -------	126.15 g/Hr & 138.02 g/Kgdry fuel	PART.EMISS. RATE ------	4.18	g/Kgdry fuel

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Jotul TEST No. : 2

MODEL: F118 Black Bear DATE: 19-Dec-14

TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR	PROPRTN RATE VAR. AVERAGE
5	528.3	97	100
10	542.0	100	
15	542.2	100	
20	542.2	100	
25	542.2	100	
30	542.1	100	
35	542.1	100	
40	541.4	100	
45	543.3	100	
50	543.1	100	
55	542.9	100	
60	543.3	100	
65	543.2	100	
70	542.9	100	
75	543.2	100	
80	543.2	100	
85	542.7	100	
90	544.3	100	
95	544.0	100	
100	544.4	100	
105	544.0	100	
110	544.4	100	
115	544.4	100	
120	544.0	100	
125	544.4	100	
130	542.6	100	
135	544.4	100	
140	544.2	100	
145	544.2	100	
150	544.2	100	
155	544.2	100	
160	544.2	100	
165	544.2	100	
170	544.2	100	
175	544.6	100	
180	544.2	100	

185	544.2	100
190	544.2	100
195	544.2	100
200	544.3	100
205	544.2	100
210	544.3	100
215	544.3	100
220	544.2	100
225	544.3	100
230	543.9	100
235		

METER BOX DATA SHEET PAGE # 2

Page: 1 of 2

UNIT: JOTUL F118 RUN: 2 DATE: 12-25-2014

Meter Box: 5H Y Factor: .903

Leak checks: 15 " Hg @ 1,000 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: 28 : 1				BP: 30.10		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1445	102.500	—	8.610	.15	85	400	85	2.0
5	50	104.001	—	11.480	.27	85	300	85	3.0
10	55	106.051	106.051	9.184	.18	85	375	85	2.0
15	1500	107.693	107.693	9.840	.20	85	350	85	2.0
20	05	109.452	109.452	9.840	.20	85	350	85	2.0
25	10	111.211	111.211	10.597	.23	85	325	85	2.0
30	15	113.105	113.105	10.597	.23	85	325	85	2.0
35	20	114.999	114.999	10.597	.23	85	325	85	2.0
40	25	116.892	116.892	9.822	.20	86	350	86	2.0
45	30	118.658	118.658	10.577	.23	86	325	86	2.0
50	35	120.559	120.559	10.577	.23	86	325	86	2.0
55	40	122.459	122.459	9.822	.20	86	350	86	2.0
ROTO PRESS: ,18			TOTALS:	121.543	2.55	1024	BP.: 30.10		
60	1545	124.225	124.225	9.167	.17	86	375	86	2.0
65	50	125.873	125.873	9.167	.17	86	375	86	2.0
70	55	127.520	127.520	9.167	.17	86	375	86	2.0
75	1600	129.168	129.168	9.167	.17	86	375	86	2.0
80	05	130.816	130.816	9.167	.17	86	375	86	2.0
85	10	132.464	132.464	8.578	.15	87	400	87	2.0
90	15	134.015	134.015	8.074	.14	87	425	87	2.0
95	20	135.474	135.474	8.074	.14	87	425	87	2.0
100	25	136.934	136.934	8.074	.14	87	425	87	2.0
105	30	138.393	138.393	8.074	.14	87	425	87	2.0
110	35	139.853	139.853	7.625	.12	87	450	87	2.0
115	40	141.232	141.232	7.625	.12	87	450	87	2.0
			TOTALS:	101.959	1.80	1039	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	223.502	4.35	2063	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 2 of 2

UNIT: Jotul F118 RUN: 2 DATE: 12-25-2014

Meter Box: SH Y Factor: .903

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: 28 : 1 BP: 30.10

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1645	142.610	142.610	5.490	.06	87	625	87	2.0
125	50	143.603	143.603	5.719	.07	87	600	87	2.0
130	55	144.634	144.634	6.536	.09	87	525	87	2.0
135	1700	145.816	145.816	7.224	.11	87	475	87	2.0
140	05	147.122	147.122	7.224	.11	87	475	87	2.0
145	10	148.428	148.428	7.224	.11	87	475	87	2.0
150	15	149.734	149.734	7.224	.11	87	475	87	2.0
155	20	151.040	151.040	7.224	.11	87	475	87	2.0
160	25	152.346	152.346	7.224	.11	87	475	87	2.0
165	30	153.652	153.652	7.224	.11	87	475	87	2.0
* 170	35	154.958	154.958	7.224	.11	87	475	87	2.0
175	40	156.265	156.265	7.224	.11	87	475	87	2.0
ROTO PRESS: .18			TOTALS:	82.761	1.21	1044	BP.: 30.10		
180	1745	157.571	157.571	7.224	.11	87	475	87	2.0
185	50	158.877	158.877	7.224	.11	87	475	87	2.0
190	55	160.183	160.183	7.224	.11	87	475	87	2.0
195	1800	161.489	161.489	6.863	.10	87	500	87	2.0
200	05	162.730	162.730	7.224	.11	87	475	87	2.0
205	10	164.036	164.036	6.863	.10	87	500	87	2.0
* 210	15	165.277	165.277	6.863	.10	87	500	87	2.0
215	20	166.518	166.518	7.224	.11	87	475	87	2.0
220	25	167.824	167.824	6.863	.10	87	500	87	2.0
225	30	169.065	169.065	6.863	.10	87	500	87	2.0
230	35	170.305	170.305	6.863	.10	87	500	87	2.0
235				(77.298)	(1.15)	(957)			
			TOTALS:	160.059	2.36	2001	MAX VACC =		3.0
TOTAL Cu Ft		67.805	TOTALS:	383.561	6.71	4064	AVG. BP:		30.10

1.47

(8.161) (.143) (87) 547

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : F118 RUN : 2 DATE : 12-25-14

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

SCALE	WEIGHT
295.0 g	295.2
590.0 g	590.3
885.0 g	885.5

IMPINGER	# 1	# 2	# 3	# 4
FINAL WT	690.7	591.9	488.3	862.1
INITIAL WT	618.8	587.5	486.1	846.4
NET WT GRAMS	71.9	4.4	2.2	15.7

TOTAL CATCH : 94.2 GRAMS H_2O

FRONT HALF

FILTER #	1411	
FINAL WT g	.5854	
INITIAL WT g	.5070	
NET WT g	.0784	

BEAKER #	41
DESC.	ACETONE
FINAL WT g	105.5229
INITIAL WT g	105.4800
NET WT g	.0429
VOL. DESC. ml	60

BACK HALF

FILTER #	1410	
FINAL WT g	.3707	
INITIAL WT g	.3280	
NET WT g	.0427	

BEAKER #	42	43	44	45	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	104.8880	107.3921	107.8434	94.9771	
INITIAL WT g	104.6623	107.3475	107.7837	94.9291	
NET WT g	.2257	.0446	.0597	.0480	.1077
VOL. DESC ml	125	75	125	125	325

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 8-21-14 Time : 0942 By : KM

Manufacturer S & S Grade : # 25 Glass Front Size : 11 cm Lot No. : 6775627

Back Size: 8.2 cm Lot No. : 9465841

	DATE: 8-22-14	BY: KM	DATE: 8-26-14	BY: KM	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
141F	.5072	1025	.5070	0930	~~✓~~ R-2	
142F	.5136	1026	.5137	0931	✓	
143F	.5151	1027	.5151	0932	✓	
144F	.5153	1028	.5153	0933	✓	
145F	.5077	1029	.5078	0934	✓	
146F	.5164	1030	.5165	0935	✓	
147F	.5128	1031	.5128	0936	✓	
148F	.5154	1032	.5152	0937	✓	
149F	.5100	1033	.5101	0938	✓	
150F	.5136	1034	.5136	0939	✓	
141B	.3280	1035	.3280	0940	~~✓~~ R-2	
142B	.3235	1036	.3235	0941	✓	
143B	.3243	1037	.3244	0942	✓	
144B	.3247	1038	.3248	0943	✓	
145B	.3277	1039	.3278	0944	✓	
146B	.3287	1040	.3287	0945	✓	
147B	.3248	1041	.3249	0946	✓	
148B	.3260	1042	.3258	0947	✓	
149B	.3288	1043	.3289	0948	✓	
150B	.3251	1044	.3252	0949	✓	

Checked by: G Wachter Date: 9-10-14 Time: 1039

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
8-22-14	1024	KM	64	78	46
8-26-14	0928	KM	62	70	47

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 7-7-14 Time : 0900 By : CW

	DATE: 8-21-14	BY: VM	DATE: 8-22-14	BY: VM	DATE:	BY:
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
26	101.0196	0950	101.0199	0915	✓	
27	106.3608	0951	106.3608	0916	✓	
28	105.7304	0952	105.7302	0917	✓	
29	104.4385	0953	104.4386	0918	✓	
30	107.3442	0954	107.3444	0919	✓	
31	95.5359	0955	95.5359	0920	✓	
32	107.8528	0956	107.8530	0921	✓	
33	101.1583	0957	101.1582	0922	✓	
34	106.4505	0958	106.4506	0923	✓	
35	96.5371	0959	96.5367	0924	✓	
36	94.4467	1000	94.4466	0925	✓	
37	106.5936	1001	106.5933	0926	✓	
38	96.2408	1002	96.2407	0927	✓	
39	97.1276	1003	97.1278	0928	✓	
40	106.4604	1004	106.4601	0929	✓	
41	105.4799	1005	105.4800	0930	✓	
42	104.6623	1006	104.6623	0931	✓	
43	107.3478	1007	107.3475	0932	✓ R-2	
44	107.7836	1008	107.7837	0933	✓	
45	94.9295	1009	94.9291	0934	✓	
46	106.0414	1010	106.0413	0935	✓	
47	107.0306	1011	107.0306	0936	✓	
48	97.7411	1012	97.7413	0937	✓	
49	108.3490	1013	108.3493	0938	✓	
50	96.5247	1014	96.5244	0939	✓	

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
8-21-14	0945	CW	-	66	49
8-22-14	0910	CW	-	70	48
		CW	-		

Checked by : CW
Date : 8-22-14
Time : 1100

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : F118 **RUN :** 2 **DATE :** 12-25-14 **Page :** 1 **of** 1

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
41	12-26	1000	CJ	105.5245	12-27	1225	CJ	105.5231	12-28	0910	CJ	105.5229	12-29	1120	CJ
42	12-26	1000	CJ	104.8893	12-27	1226	CJ	104.8876	12-28	0911	CJ	104.8880	12-29	1121	CJ
43	12-26	1000	CJ	107.3939	12-27	1227	CJ	107.3920	12-28	0912	CJ	107.3921	12-29	1122	CJ
44	12-26	1000	CJ	107.8449	12-27	1225	CJ	107.8433	12-28	0913	CJ	107.8434	12-29	1123	CJ
45	12-26	1000	CJ	94.9786	12-27	1229	CJ	94.9769	12-28	0914	CJ	94.9771	12-29	1124	CJ

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
141E	1225	1915	CJ	.5855	12-26	0929	KM	.5854	12-27	1239	CJ				
141B	1225	1915	CJ	.3705	12-26	0930	KM	.3707	12-27	1240	CJ				

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	12-26-14	0928	KM	72	46
2	12-27-14	1220	CJ	73	47
3	12-28-14	0930	CJ	69	47
4	12-29-14	1110	CJ	71	45
5					

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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 10-18-14 Through	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9997	10.0000	1.0000	.1000	CLP	10-18	1610	77	49
100.0002	10.0003	.9999	.1000	CLP	10-20	1100	74	47
100.0003	10.0000	1.0001	.0999	CLP	10-20	1410	75	48
100.0001	10.0003	1.0000	.0999	KM	10-22	1000	78	49
99.9999	10.0000	1.0000	.1000	CLP	10-23	0900	72	46
99.9997	9.9999	1.0000	.1000	CLP	10-24	1330	68	47
100.0000	10.0001	1.0001	.1000	CLP	10-25	1530	68	47
100.0000	10.0000	1.0000	.0998	KM	11-26	1005	73	47
99.9999	10.0001	1.0000	.0999	KM	11-27	1000	73	47
100.0003	10.0002	.9998	.0999	KM	11-28	1005	77	49
99.9995	10.0002	1.0000	.0999	CLP	11-29	0945	68	47
100.0000	10.0002	1.0000	.1000	CLP	11-30	1200	72	42
100.0000	9.9998	1.0000	.0998	CLP	12-1	1500	75	41
100.0000	10.0001	1.0000	.0999	CLP	12-3	1200	77	45
100.0000	10.0001	.9999	.0999	CLP	12-4	1130	74	47
99.9998	10.0001	.9999	.0997	CLP	12-4	1330	72	46
100.0001	10.0000	.9999	.1000	CLP	12-11	0930	70	48
100.0000	10.0000	1.0000	.0999	KM	12-12	1045	77	49
100.0000	10.0000	.9999	.0999	KM	12-13	1110	68	47
100.0000	10.0001	.9999	.0998	CLP	12-14	0940	66	49
100.0000	10.0000	.9999	.0997	CLP	12-15	1000	65	44
100.0003	9.9999	1.0001	.0999	CLP	12-15	1330	68	47
100.0000	10.0002	1.0000	.1000	KM	12-25	1345	74	47
100.0000	9.9999	1.0000	.1000	KM	12-26	0915	69	47
99.9995	9.9999	1.0000	.1000	CLP	12-27	1220	73	47
99.9995	9.9999	1.0000	.1000	CLP	12-28	0900	69	47
99.9996	9.9999	.9999	.0996	CLP	12-28	1110	71	45
100.0000	9.9999	1.0000	.1000	CLP	12-29	1000	66	43
99.9997	10.0000	.9999	.0997	CLP	12-29	1205	66	45
100.0000	10.0001	1.0002	.1000	CLP	1-1-15	1100	65	40
100.0000	10.0000	1.0000	.0999	CLP	1-2-15	1300	66	41
100.0000	10.0001	.9999	.0998	CLP	1-2-15	1530	67	42
100.0002	10.0001	.9999	.0998	CLP	1-4-15	1245	68	47
100.0003	10.0001	1.0002	.1000	CLP	1-4-15	1515	69	44

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 4-27-14 Through 10-17-14	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9996	9.9999	1.0000	.0999	CAP	4-27	1730	68	47
100.0000	10.0000	1.0000	.0999	CA	5-21	0945	76	49
100.0000	9.9997	1.0000	.1002	CA	5-22	0930	78	48
100.0005	10.0000	.9999	.0999	CAP	5-23	0740	77	46
100.0000	9.9999	1.0000	.1000	CA	5-24	1330	74	47
99.9996	9.9999	1.0000	.1000	CAP	5-25	1100	72	46
100.0001	10.0000	1.0001	.0998	CA	5-26	1115	73	47
100.0000	10.0000	1.0000	.0999	CAP	5-27	1115	78	46
100.0004	10.0000	1.0001	.0999	CA	5-27	1330	74	47
100.0000	9.9999	.9999	.1000	CA	7-3	0915	76	46
100.0000	10.0000	1.0000	.0999	CAP	7-4	0900	77	42
100.0000	10.0001	.9999	.0998	CA	7-5	1230	77	49
100.0000	10.0001	1.0000	.0998	CA	7-6	1510	76	48
100.0000	10.0000	1.0000	.0999	CA	7-7	0820	70	48
100.0000	10.0001	.9999	.0999	CA	7-9	0715	74	47
99.9995	9.9999	.9999	.0999	CA	7-10	0945	75	44
100.0000	9.9999	.9999	.1000	CA	7-10	1300	73	47
100.0001	10.0001	1.0001	.0998	CA	7-14	1230	74	47
100.0000	9.9999	1.0000	.1000	CA	715	0710	72	46
100.0000	10.0000	1.0000	.0998	CA	8-21	0945	66	49
100.9998	10.0000	1.0000	.0998	KM	8-26	0920	69	47
100.0003	10.0000	1.0000	.1000	KM	9-11	0910	70	48
100.0000	10.0001	1.0001	.1000	KM	9-12	0905	72	42
100.0000	9.9999	.9999	.0999	KM	9-13	1000	73	47
100.0005	10.0001	1.0000	.1000	CAP	9-14	1015	68	47
100.0005	10.0000	1.0000	.0999	CAP	9-15	1030	68	47
99.9999	10.0000	.9999	.1000	KM	9-16	1010	77	49
99.9996	10.0000	1.0001	.1000	KM	9-16	1315	78	46
100.0000	10.0001	1.0000	.0999	KM	9-17	1010	70	48
100.0000	10.0000	1.0000	.1000	KM	9-19	0915	76	49
100.0000	10.0000	.9999	.0998	CAP	9-20	1000	71	49
100.0000	10.0001	1.0001	.0999	CA	9-22	1000	72	46
100.0005	10.0000	.9999	.0999	CA	9-22	1330	74	47
100.0000	10.0000	1.0000	.0998	KM	9-24	1120	78	46
100.0001	9.9999	1.0000	.1000	KM	9-25	1005	76	49
99.9998	9.9999	1.0000	.0999	KM	9-26	1105	76	49
100.0000	10.0001	.9999	.0999	KM	9-30	1120	78	49
99.9998	9.9999	.9999	.1000	KM	10-16	0945	76	49
100.0000	10.0001	1.0000	.1000	KM	10-17	0920	72	46

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 1-12-14 Through 4-22-14	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9995	10.0000	1.0001	.0999	CAP	1-12-14	1300	70	48
99.9995	9.9999	1.0000	.0997	CAP	1-13-14	1215	69	47
100.0000	9.9999	1.0001	.0999	CAP	1-23-14	0915	70	48
100.0000	9.9999	1.0000	.0999	CAP	1-31-14	1500	65	48
100.0000	9.9999	1.0000	.0999	CAP	2-4-14	1200	76	32
99.9997	9.9999	1.0001	.0999	CAP	2-5-14	1600	65	40
100.0000	9.9997	.9999	.1000	CAP	2-6-14	1600	65	36
100.0003	10.0000	1.0000	.0998	CAP	2-7-14	1530	65	40
100.0005	10.0001	1.0000	.0999	CAP	2-10-14	1115	65	48
100.0000	10.0000	1.0000	.0998	CAP	2-12-14	1315	70	48
100.0003	10.0002	1.0000	.0998	CAP	2-13-14	1130	75	48
99.9997	10.0001	1.0000	.1000	CAP	2-14-14	1500	66	49
99.9998	10.0001	1.0000	.0999	CAP	2-15-14	1015	69	44
100.0000	10.0001	1.0000	.0999	CAP	2-16-14	1500	68	47
100.0000	9.9999	1.0000	.0997	CAP	2-17-14	1530	74	44
99.9997	9.9998	1.0000	.1000	CAP	2-18-14	1130	65	48
100.0000	10.0000	1.0000	.1000	CAP	2-19-14	1130	70	41
100.0000	10.0000	1.0000	.0998	CAP	2-21-14	1445	72	42
100.0003	10.0002	.9999	.0997	CAP	2-23-14	1445	69	47
100.0006	10.0002	1.0001	.0999	CAP	2-25-14	1230	68	49
99.9999	10.0000	1.0000	.1000	CAP	2-26-14	1020	70	48
100.0005	10.0001	1.0001	.1000	CAP	2-27-14	1600	70	48
99.9996	9.9999	1.0000	.0998	CAP	3-1-14	1200	68	47
100.0000	10.0001	1.0000	.0999	CAP	3-2-14	1500	65	48
100.0000	10.0000	1.0000	.0999	CAP	3-3-14	1300	77	49
100.0000	10.0001	1.0000	.0999	CAP	3-4-14	1500	69	47
100.0000	10.0000	1.0000	.0999	CAP	3-5-14	1700	66	49
100.0000	9.9999	1.0001	.0999	CAP	3-19-14	1300	69	47
100.0000	10.0001	1.0000	.0999	CAP	3-21-14	1600	70	48
99.9995	10.0000	1.0000	.0999	CAP	3-23-14	1600	71	49
100.0000	10.0001	1.0000	.0998	CAP	3-24-14	1510	70	45
100.0004	10.0000	.9999	.0999	CAP	3-26-14	1645	70	48
99.9996	9.9999	1.0000	.1001	CAP	3-27-14	1145	66	49
99.9999	10.0002	1.0000	.0998	CAP	3-29-14	1200	65	48
100.0004	10.0000	.9999	.0998	CAP	4-22-14	1000	73	47
100.0000	10.0001	.9999	.0999	CAP	4-24-14	1030	72	49
99.9995	9.9999	.9999	.0998	CAP	4-25-14	1140	75	48
100.0000	9.9998	1.0000	.0999	CAP	4-26-14	1600	72	46
99.9995	9.9998	.9999	.0999	CAP	4-27-14	1130	65	48

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 3-6-13 Through 1-11-14	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	9.9999	1.0000	.0999	CP	3-6-13	1100	65	48
100.0000	10.0001	1.0000	.1000	CP	3-7-13	1700	68	47
99.9998	10.0002	1.0001	.1000	CP	3-9-13	1500	67	46
100.0001	10.0000	1.0000	.1000	CP	3-11-13	1540	75	41
100.0000	10.0002	1.0000	.0999	CP	3-12-13	1520	76	45
100.0000	9.9999	.9998	.0998	CP	3-19-13	1400	67	46
100.0000	10.0000	1.0000	.0998	CP	3-20-13	1600	74	47
100.0000	10.0001	1.0000	.1000	CP	6-18-13	1430	78	49
100.0000	10.0001	1.0000	.0998	CP	6-19-13	0900	76	49
99.9995	10.0000	.9998	.0998	CP	6-20-13	0820	66	49
99.9996	9.9999	1.0000	.0999	CP	6-21-13	1330	74	47
100.0003	9.9999	1.0000	.0998	CP	6-22-13	0930	76	49
99.9995	9.9999	.9999	.1000	CP	6-23-13	1500	74	47
100.0001	10.0001	1.0000	.0998	CP	6-24-13	1230	70	48
100.0000	10.0000	1.0000	.0999	CP	6-25-13	1400	70	48
99.9993	9.9999	1.0000	.0998	CP	6-26-13	1900	64	48
100.0000	9.9996	1.0001	.0998	CP	7-12-13	1500	72	47
100.0000	9.9999	1.0000	.0998	CP	7-14-13	1400	77	49
100.0005	10.0002	1.0000	.1000	CP	7-15-13	1600	78	48
100.0000	9.9997	1.0000	.1001	CP	7-16-13	1530	78	46
100.0003	10.0000	.9999	.0998	CP	7-17-13	0730	74	47
100.0003	9.9999	1.0000	.1000	CP	7-18-13	1600	78	46
100.0000	9.9999	.9999	.0999	CP	7-19-13	1415	72	46
100.0000	10.0001	.9999	.1001	CP	7-20-13	0800	74	47
100.0000	10.0000	1.0000	.0999	CP	7-21-13	1300	68	47
100.0000	10.0000	1.0000	.0998	CP	7-22-13	1300	70	48
100.0003	9.9998	1.0001	.1000	CP	7-23-13	1230	72	46
100.0000	9.9999	1.0000	.0999	CP	11-15-13	1530	72	46
100.0001	10.0001	.9999	.0999	CP	11-16-13	1035	72	46
99.9997	9.9999	1.0000	.0999	CP	11-17-13	1000	72	46
99.9997	10.0000	.9999	.0998	CP	11-18-13	1600	72	46
100.0000	10.0000	1.0000	.0999	CP	11-20-13	1100	66	49
100.0000	9.9999	1.0001	.0999	CP	11-21-13	1000	70	41
100.0000	9.9999	1.0000	.0998	CP	11-22-13	1730	67	46
100.0000	10.0000	.9998	.0999	CP	11-25-13	1500	70	44
100.0001	10.0000	.9999	.0999	CP	11-26-13	1600	68	47
100.0000	10.0002	.9997	.1001	CP	1-7-14	1630	72	47
99.9997	10.0000	1.0001	.0999	CP	1-9-14	1230	76	42
100.0002	10.0001	.9999	.1000	CP	1-11-14	1800	70	48

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 10-10-12 Through 3-6-2013	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9997	10.0000	1.0000	.0999	CR	10-10-12	1615	75	48
100.0000	10.0001	1.0001	.0999	CR	10-12-12	1230	77	46
99.9997	10.0000	.9999	.0999	CR	10-13-12	0830	77	49
100.0005	10.0000	.9999	.0999	CR	10-14-12	1030	78	46
100.0005	10.0002	.9999	.0998	CR	10-15-12	1000	78	48
100.0001	10.0002	1.0000	.1000	CR	10-16-12	1600	78	49
99.9996	9.9999	.9999	.1000	CR	10-17-12	0900	69	47
100.0000	9.9999	1.0006	.1000	CR	10-18-12	1330	78	37
100.0002	10.0000	.9999	.0999	CR	10-19-12	1130	78	46
100.0001	10.0001	.9999	.0999	CR	10-20-12	1400	78	48
99.9999	10.0001	.9998	.0999	CR	10-21-12	1800	65	45
100.0000	10.0001	1.0001	.0999	CR	10-21-12	1900	65	48
100.0000	9.9998	1.0000	.0998	CR	10-24-12	1750	70	48
100.0001	10.0000	1.0000	.0999	CR	10-28-12	1745	73	47
100.0000	10.0000	1.0000	.0999	CR	11-5-12	1030	74	47
99.9998	10.0000	1.0000	.0999	CR	11-6-12	1000	73	47
100.0000	10.0001	1.0000	.0999	CR	11-7-12	1030	73	47
100.0000	10.0000	1.0000	.1000	CR	11-8-12	0930	66	45
100.0000	9.9999	.9999	.0999	CR	11-12-12	1030	72	42
100.0000	10.0000	1.0000	.1000	CR	11-13-12	1000	71	44
100.0000	10.0000	1.0000	.0999	CR	11-29-12	0910	74	47
100.0000	10.0000	1.0000	.1000	CR	12-1-12	1800	66	49
100.0000	9.9999	1.0001	.0999	CR	12-2-12	1130	67	46
100.0000	10.0000	.9999	.0999	CR	12-3-12	0915	72	46
100.0004	10.0000	1.0000	.1001	CR	12-4-12	1700	69	47
99.9997	9.9999	.9999	.0999	CR	12-5-12	1045	74	44
99.9999	10.0000	1.0000	.0998	CR	12-6-12	1400	66	49
100.0000	9.9999	.9999	.0998	CR	12-7-12	1730	65	48
100.0002	10.0001	1.0000	.1000	CR	12-9-12	1400	66	49
100.0002	10.0001	.9999	.1000	CR	12-10-12	1500	66	49
100.0000	9.9999	1.0001	.0999	CR	12-21-13	1020	78	44
100.0000	9.9998	1.0001	.0999	CR	12-23-13	1900	72	46
99.9995	10.0001	1.0000	.0999	CR	12-24-13	1700	72	46
100.0000	9.9999	.9999	.1000	CR	12-25-13	1000	73	43
100.0000	9.9998	1.0000	.0999	CR	12-26-13	1600	66	49
100.0000	10.0002	1.0000	.0999	CR	12-27-13	0915	67	46
100.0000	10.0001	1.0000	.0999	CR	12-28-13	1530	76	42
100.0000	10.0001	1.0000	.0999	CR	3-2-13	1600	73	47
100.0000	9.9999	.9999	.0998	CR	3-4-13	1900	71	41

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 1-14-2017 Through 9-17-12	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	10.0000	1.0000	.0999	CR	1-14-12	1300	70	48
100.0002	10.0001	1.0001	.1000	CR	1-15-12	1330	68	47
99.9997	10.0000	1.0001	.1000	CR	1-17-12	1030	73	47
99.9997	10.0001	1.0000	.1000	CR	1-18-12	0915	74	44
99.9999	10.0002	1.0001	.1001	CR	1-19-12	1015	70	44
100.0001	10.0001	1.0001	.0998	CR	1-25-12	1600	72	46
99.9999	9.9998	1.0001	.1000	CR	1-26-12	1500	70	48
99.9995	9.9999	1.0000	.0999	CR	1-28-12	1400	70	41
100.0000	10.0000	1.0000	.0999	CR	2-4-12	1500	73	60
100.0000	10.0003	.9999	.0999	CR	2-6-12	1200	69	44
100.0000	10.0000	.9999	.0998	CR	2-7-12	1030	67	42
100.0000	9.9999	1.0001	.0999	CR	2-10-12	1630	78	49
100.0000	10.0001	1.0000	.1000	CR	2-11-12	1430	72	46
99.9997	10.0002	1.0000	.1001	CR	2-12-12	1530	73	47
100.0000	10.0000	.9999	.0999	CR	2-13-12	1100	78	46
99.9995	10.0000	.9999	.0999	CR	2-14-12	1000	76	45
100.0000	9.9999	.9999	.1000	CR	2-15-12	1120	70	44
99.9999	10.0000	1.0000	.0999	CR	2-17-12	1415	73	47
99.9999	10.0000	1.0000	.0998	CR	2-19-12	1600	70	44
99.9997	9.9999	1.0000	.0999	CR	2-20-12	1200	70	48
100.0004	10.0001	1.0000	.1000	CR	2-23-12	1000	73	47
100.0000	9.9997	1.0000	.0999	CR	2-24-12	1015	78	46
100.0000	10.0000	1.0000	.1001	CR	2-25-12	1715	65	48
100.0000	9.9996	1.0000	.0999	CR	2-27-12	1000	70	44
100.0000	10.0000	1.0001	.1002	CR	2-28-12	1125	75	41
99.9997	10.0000	1.0000	.1000	CR	2-29-12	1110	68	43
99.9995	9.9999	.9999	.0997	CR	3-1-12	1330	68	47
99.9996	10.0000	1.0000	.0998	CR	3-2-12	1430	71	45
99.9995	9.9999	1.0000	.0999	CR	3-3-12	1430	72	42
99.9999	10.0000	.9999	.0999	CR	9-2-12	0945	77	46
100.0000	10.0000	1.0000	.1000	CR	9-3-12	1030	71	49
100.0002	9.9999	1.0000	.0998	CR	9-4-12	1000	77	49
100.0000	10.0000	1.0000	.0999	CR	9-5-12	0945	78	46
100.0000	10.0002	1.0000	.0999	CR	9-6-12	1130	76	49
99.9997	10.0001	1.0002	.0999	CR	9-7-12	1400	76	49
100.0000	10.0001	1.0000	.0999	CR	9-8-12	1200	71	49
100.0000	10.0002	1.0000	.1001	CR	9-15-12	1410	78	48
100.0000	10.0000	1.0000	.1000	CR	9-16-12	1700	78	48
100.0000	10.0000	.9999	.0999	CR	9-17-12	1330	75	48

BLANK PROCESSING DATA SHEET # 5

UNIT : F 118 RUN : 2 DATE : 12-25-14

BLANKS DONE : 9-8-12

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	108.9013	106.3080	106.9659
TARE WEIGHT	108.9005	106.3061	106.9637
NET WEIGHT	.0008	.0019	.0022

TARE BEAKERS INTO DESC : TIME : 1015 DATE : 8-31-12

DATE : 9-2 BY : CP DATE : 9-3 BY : CP DATE : ____ BY : ____

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9002	1016	108.9005	1046		
B	106.3058	1017	106.3061	1047		
C	106.9641	1018	106.9637	1048		

FINAL BEAKERS INTO DESC : TIME : ____ DATE : ____

DATE : 9-6 BY : CP DATE : 9-7 BY CP DATE : ____ BY : ____

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9016	1148	108.9013	1415		
B	106.3077	1149	106.3080	1416		
C	106.9661	1150	106.9659	1417		

TARE QC

DATE	TIME	BY	WB	DB	%
9-2	0945	CP	S	77	46
9-3	1030	CP	S	71	49

FINAL QC

DATE	TIME	BY	WB	DB	%
9-6	1130	CP	S	76	49
9-7	1400	CP	S	76	49

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT: F118 RUN: 2 DATE: 12-25-14

BLANK CALCULATIONS

Acetone: .0008 g ÷ 200 ml = .000004 g/ml

Dicholoromethane: .0019 g ÷ 75 ml = .000025 g/ml

Distilled Water: .0022 g ÷ 200 ml = .000011 g/ml

FRONT HALF CATCH

FILTERS: .0784 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0784 g

BEAKERS: .0429 (Total Catch) g - 60 (ml Acetone) (.0002 .000004 g) (Blank Value / ml Acetone) = .0427 g

TOTAL FRONT HALF CATCH : .1211 g

BACK HALF CATCH

FILTERS: .0427 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0427 g

BEAKERS:

Acetone: .2257 (Total Catch) g - 125 (ml Acetone) (.0005 .000004 g) (Blank Value / ml Acetone) = .2252 g

Extract: .0446 (Total Catch) g - 75 (ml Dichloromethane) (.0019 .000025 g) (Blank Value / Dichloromethane) = .0427 g

Water: .1077 (Total Catch) g - 300 (ml Water) (.0033 .000011 g) (Blank Value / Water) = .1044 g

TOTAL BACK HALF CATCH : .4150 g

TOTAL CATCH : .5361 g

% FRONT HALF : 22.6 %

CALCULATIONS DATA SHEET # 7

UNIT : JOTUL F118 RUN : 2 DATE : 12-25-2014

1) $Vm(std) = \dfrac{(61.805\ Vm)(17.64)(.903\ mcf)\left(30.10\ "Hg + \frac{.143\ "H_2O}{13.6}\right)}{(547\ TmA)} = \dfrac{59.4537}{000.0000}$ dscf

2) $Vw(std) = (.04707)(94.2\ ml\ H_2O) = \dfrac{4.4340}{00.0000}$ scf

3) $Asw = \dfrac{(4.4340\ scf)}{(4.4340\ scf + 59.4537\ dscf)} = \dfrac{.0694}{.0000}$ Bws × 100 = $\dfrac{6.9403}{00.0000}$ % H_2O

4) $Cs = \dfrac{(.5361\ g.)}{(59.4537\ dscf)}(15.43) = \dfrac{.1391}{0.0000}$ gr / dscf

5) Estimated g / hr = $\dfrac{(.5361\ g.)}{(59.4537\ dscf)}\left(\dfrac{8.161}{00.0000}\ dscfm\right)(60) = \dfrac{4.4153}{00.0000}$ g / hr

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

TEST DATA SHEET # 8

UNIT: JOTUL F118 RUN: 2 DATE: 12-25-14

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

Wet Bulb / Dry Bulb

Pre : WB: 66 DB: 83 = 38 % RH 1.5 % H_2O

Post : WB: 62 DB: 79 = 37.6 % RH 1.3 % H_2O

Average: 37.5 % RH 1.4 % 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: 9.0 + 7.9 + 9.8 Total: 26.7

Kindling & Preburn Fuel Weight (wood only) (lbs): **Total**: 27.8

Coal Bed Wt Range (lbs): 2.3 - 1.9 **Scale**: 2.3 - 1.9

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

Lower : .20 × fuel weight : Always round UP to nearest tenth **Actual Coal Bed Weight**: 2.1

Maximum Coal Bed Removal (lbs): ((2.3 (Upper) + 1.9 (Lower)) ÷ 2) .25 = .5 (round down to nearest tenth)

Test Fuel (.75" × 1.5" × 5" spacers) = 16 pcs

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" × 4"	18	4	9.3	100
4" × 4"	—	—	—	—

Test Fuel Weight: 9.3 lbs

Estimated Dry Burn Rate:

$$\frac{9.3 - (9.3 \times .16926)}{2.2046} \times \frac{60}{\frac{230}{\text{TIME}}} = .914 \text{ kg / hr}$$

Estimated BTU's/hr: 19,140 × $\frac{63}{100}$ × $\frac{.914}{\text{DBR}}$ = 11021.2 BTU's/hr

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

WOOD STOVE OPERATING DATA PAGE #9

Unit : JOTUL F118 Run : 2 Date : 12-25-2014

FIRE STARTED: 1020

WARM UP AND PREBURN:

PRIMARY AIR : Set wide open for all warm-up / preburn fuel charges. Then set to 1010' 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 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 1010'.

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

FAN:

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

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

Fan speed set at N/A

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 8 or 16 inches.

1st warm up / pre-burn fuel charge (9.0 lbs.) added at 1025

2nd warm up / pre-burn fuel charge (7.9 lbs.) added at 1123

3rd warm up / pre-burn fuel charge (9.8 lbs.) added at 1215

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 F118 Run : 2 Date : 12-25-2014

Room Temperature : 76 °F Temperature Correction Set? : (Yes) No

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

Time Test Fuel moisture reading taken : 1220

pc #	Dimen.	Use	TOP	BOTTOM	SIDE	Avg Corrected
1	2"×4"×8'	K	14.5	14.5	14.9	14.633
2						
3						
4	2"×4"×8'	P	22.6	22.7	22.4	22.6
5	2"×4"×8'	P	20.2	20.1	20.1	20.1
6	2"×4"×8'	P	18.9	19.1	18.5	18.8
7	2"×4"×8'	P				(61.5)
8	2"×4"×8'	P				
9						
10						
11						
12	2"×4"×18"	T	17.9	18.2	18.2	18.1
13	"	T	19.8	19.7	19.7	19.7
14	"	T	20.1	20.6	20.9	20.5
15	"	T	22.8	23.2	23.5	23.2
16						(81.5)
17						
18						
19						
20	Spacers	T	21.9	23.6	22.2	22.567

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	14.633 %	20.500 %	20.375 %
Wet Moisture % :	12.765 %	17.012 %	16.926 %

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: 2.1 DATE: 12-25-2014

UNIT: JOTUL F118 RUN: 2 PAGE: 1 OF 2

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
0 1445	11.4	9.3	—	.100	2.5	.710	17.9	.039	.38	-.031	400
5 1450	11.3	9.2	.1	.096	2.4	.724	18.1	.027	.26	-.033	300
10	11.0	8.9	.3	.222	5.5	.604	15.1	.018	.17	-.036	375
15 1500	10.6	8.5	.4	.287	7.2	.529	13.3	.036	.35	-.044	350
20	10.2	8.1	.4	.253	6.3	.568	14.2	.030	.29	-.040	350
25 1510	9.9	7.8	.3	.282	7.0	.547	13.7	.013	.12	-.043	325
30	9.4	7.3	.5	.328	8.2	.498	12.5	.015	.14	-.046	325
35 1520	8.9	6.8	.5	.384	9.6	.440	11.0	.020	.19	-.047	325
40	8.4	6.3	.5	.423	10.6	.397	9.9	.029	.28	-.050	350
45 1530	8.0	5.9	.4	.366	9.1	.463	11.6	.013	.12	-.049	325
50	7.6	5.5	.4	.373	9.3	.456	11.4	.010	.09	-.049	325
55 1540	7.2	5.1	.4	.346	8.6	.477	11.9	.028	.27	-.046	350
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.514	*****
60	6.9	4.8	.3	.296	7.4	.520	13.0	.039	.38	-.045	375
65 1550	6.6	4.5	.3	.324	8.1	.498	12.5	.024	.23	-.045	375
70	6.3	4.2	.3	.312	7.8	.511	12.8	.021	.20	-.045	375
75 1600	6.0	3.9	.3	.309	7.7	.512	12.8	.030	.29	-.044	375
80	5.8	3.7	.2	.305	7.6	.514	12.9	.034	.33	-.043	375
85 1610	5.5	3.4	.3	.283	7.1	.526	13.2	.054	.53	-.040	400
90	5.3	3.2	.2	.257	6.4	.548	13.7	.068	.68	-.040	425
95 1620	5.1	3.0	.2	.246	6.1	.561	14.1	.065	.65	-.039	425
100	4.9	2.8	.2	.262	6.5	.547	13.7	.061	.61	-.038	425
105 1630	4.7	2.6	.2	.232	5.8	.569	14.2	.076	.76	-.038	425
110	4.5	2.4	.2	.210	5.2	.590	14.8	.082	.82	-.036	450
115 1640	4.3	2.2	.2	.216	5.4	.583	14.6	.080	.80	-.035	450
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.488	*****
120	4.1	2.0	.2	.143	3.5	.571	14.3	.300	3.01	-.035	625
125 1650	3.9	1.8	.2	.140	3.5	.579	14.5	.280	2.81	-.033	600
130	3.8	1.7	.1	.145	3.6	.574	14.4	.281	2.82	-.033	525
135 1700	3.6	1.5	.2	.201	5.0	.591	14.8	.100	1.00	-.032	475
140	3.5	1.4	.1	.205	5.1	.588	14.7	.097	.97	-.032	475
145 1710	3.4	1.3	.1	.221	5.5	.580	14.5	.078	.78	-.031	475
150	3.3	1.2	.1	.203	5.0	.594	14.9	.092	.92	-.030	475
155 1720	3.2	1.1	.1	.203	5.0	.593	14.8	.096	.96	-.030	475
160	3.1	1.0	.1	.200	5.0	.591	14.8	.101	1.01	-.030	475
165 1730	3.0	.9	.1	.182	4.5	.613	15.4	.095	.95	-.030	475
170	2.9	.8	.1	.183	4.5	.609	15.2	.106	1.06	-.030	475
175 1740	2.8	.7	.1	.180	4.5	.605	15.1	.116	1.16	-.028	475
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.374	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-1.376	*****

GAS DATA SHEET #12

WEIGHT: 2.1 DATE: 12-25-2014

UNIT: JOTUL F118 RUN: 2 PAGE: 2 OF 2

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
180	2.7	.6	.1	.179	4.4	.604	15.1	.127	1.27	-.028	475
185 1750	2.7	.6	Ø	.170	4.2	.614	15.4	.124	1.24	-.029	475
190	2.6	.5	.1	.160	4.0	.618	15.5	.132	1.32	-.028	475
195 1800	2.5	.4	.1	.159	3.9	.626	15.7	.123	1.23	-.028	500
200	2.4	.3	.1	.141	3.5	.638	16.0	.134	1.34	-.028	475
205 1810	2.4	.3	Ø	.141	3.5	.640	16.0	.129	1.29	-.028	500
210	2.3	.2	.1	.132	3.3	.643	16.1	.139	1.39	-.028	500
215 1820	2.3	.2	Ø	.134	3.3	.643	16.1	.139	1.39	-.027	475
220	2.2	.1	-.1	.119	2.9	.640	16.0	.188	1.89	-.027	500
225 1830	2.2	.1	Ø	.104	2.6	.651	16.3	.188	1.89	-.027	500
230 1835	2.1	Ø	.1	.125	3.1	.664	16.6	.107	1.07	-.026	500
235											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.304	*****
240											
245											
250											
255											
260											
265											
270											
275											
280											
285											
290											
295											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****		*****
300											
305											
310											
315											
320											
325											
330											
335											
340											
345											
350											
355											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****		*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-1.680	*****

AVG -.036

1-47

PREBURN DATA SHEET #13

UNIT: JOTUL F118 RUN: 2 DATE: 12-25-2014 PAGE: 1 of 1

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
0/1345	3.2	-	296	331	489	306	374	386			80	.045	PREBURN START: # 9 UP
5/50	3.1	.1	291	332	469	304	280	384			81	.044	COAL BED SCALE RANGE:
10/55	3.0	.1	286	330	455	300	272	383			82	.044	2.3 → 1.9
15/1400	2.9	.1	278	323	443	293	270	383			82	.041	PRIMARY AIR: .010"
20/05	2.8	.1	285	321	437	288	268	383			81	.042	SECONDARY AIR: N/A
25/10	2.6	.2	275	317	431	286	272	387			80	.040	FAN: N/A
30/15	2.5	.1	260	310	423	282	264	390			81	.039	PUMPS ON AT:
35/20	2.4	.1	250	302	415	277	258	391			81	.038	CHECK WB/DB: N/A
40/25	2.3	.1	242	293	404	274	249	391			81	.037	
45/30	2.3	0	235	285	393	267	240	389			80	.036	
50/35	2.2	.1	231	278	382	263	235	386			80	.036	
55/40	2.2	0	216	270	371	257	228	384			80	.034	
*****	****	***	****	*****	*****	****	*****	*****	*****	*****	*****	****	
60/1445	2.1	.1											
65/50													
70													
75													
80													
85													
90													

Unit:Jotul Black Bear

Temperature Data Sheet #14

Run-2
12-25-14

Time	Stack	Top	Left Side	Back	Right Side	Bottom	Firebox	Secondary	Ambient	Furnace	Sample Box	Bucket	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	195	258	357	251	224	380	#######	#######	80	1427	247	49	N/A	33	33
5	197	242	325	240	206	369	#######	#######	79	1407	247	39		33	33
10	221	250	298	232	193	354	#######	#######	78	1386	248	40		33	33
15	261	275	278	221	179	337	#######	#######	77	1368	247	41		33	33
20	254	302	269	212	173	319	#######	#######	77	1352	246	42		33	33
25	259	305	264	204	168	304	#######	#######	77	1340	246	42		33	34
30	287	337	266	198	167	294	#######	#######	77	1328	245	42		33	35
35	304	363	271	194	169	288	#######	#######	76	1318	245	41		34	35
40	320	402	282	189	174	286	#######	#######	77	1310	245	41		34	36
45	313	418	296	189	178	285	#######	#######	77	1304	244	41		35	36
50	310	419	307	187	186	286	#######	#######	78	1299	244	41		35	37
55	296	413	319	188	194	288	#######	#######	78	1294	244	41		35	37
60	280	395	331	191	203	290	#######	#######	77	1290	243	42		36	38
65	282	388	336	194	207	292	#######	#######	77	1286	243	42		36	38
70	275	380	348	196	210	294	#######	#######	78	1283	243	42		36	38
75	269	371	356	199	216	299	#######	#######	78	1281	243	43		37	38
80	262	362	364	199	224	305	#######	#######	78	1279	243	43		37	38
85	252	352	372	200	228	311	#######	#######	78	1277	243	43		37	38
90	240	339	377	204	232	316	#######	#######	77	1275	243	44		37	38
95	233	327	379	206	234	320	#######	#######	78	1275	243	44		37	38
100	234	320	380	209	234	324	#######	#######	80	1275	244	43		37	38
105	229	314	379	212	234	328	#######	#######	78	1273	244	44		37	38
110	221	304	381	213	237	332	#######	#######	78	1272	243	44		37	38
115	218	297	380	216	236	335	#######	#######	77	1272	244	44		37	38
120	205	287	376	217	233	338	#######	#######	78	1272	244	44		37	38
125	198	276	369	216	229	341	#######	#######	77	1271	245	45		37	38
130	194	266	363	217	223	345	#######	#######	77	1268	245	47		37	38
135	194	258	366	217	222	353	#######	#######	77	1267	244	47		37	38
140	193	252	375	219	223	363	#######	#######	77	1265	242	46		37	38
145	193	249	387	222	226	376	#######	#######	77	1265	240	47		37	38
150	190	245	396	225	229	388	#######	#######	76	1265	238	47		37	37
155	189	242	400	230	236	399	#######	#######	75	1265	236	46		37	37
160	188	239	398	233	237	409	#######	#######	76	1266	235	45		37	37
165	185	236	395	237	242	414	#######	#######	75	1266	234	45		37	37
170	183	233	389	239	242	420	#######	#######	75	1266	233	45		36	37

Unit:Jotul Black Bear

Temperature Data Sheet #14

Run-2
12-25-14

175	182	230	383	241	239	427	########	#######	75	1266	233	45	36	37
180	181	228	379	242	237	432	########	#######	75	1267	236	45	36	36
185	180	225	376	242	235	436	########	#######	75	1268	237	46	36	36
190	178	222	369	243	229	439	########	#######	75	1269	238	46	36	36
195	176	220	363	241	229	440	########	#######	74	1269	238	46	35	36
200	173	217	353	242	222	436	########	#######	75	1270	240	46	35	36
205	171	214	345	239	219	435	########	#######	74	1270	240	46	35	35
210	169	211	337	239	212	438	########	#######	73	1271	241	46	35	35
215	169	209	331	236	209	443	########	#######	72	1271	241	46	35	35
220	167	206	325	234	204	446	########	#######	72	1271	241	46	34	35
225	164	203	316	231	199	439	########	#######	72	1272	241	46	34	35
230	163	200	309	229	195	437	########	#######	72	1273	242	47	34	34

Unit:Jotul Black Bear

Run-2
12-25-14

TEMPERATURE DATA SHEET #14A

		TEST TIME	230		
STACK	221	TOP AVG	287	LT SIDE AVG	347
BACK AVG	219	RT SIDE AVG	214	BOTTOM AVG	360
FIREBOX AVG	########	SEC/CAT AVG	########	AMBIENT AVG	76

END	274.2	
START	293.8	
	-19.6	DELTA T

CIRCLE: LOSE / GAIN

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 12-23-14 Analyte : CO_2 (15-1)

Unit : F 118 Run # : 2

Zero Cyl. # : XC3AAM173 Conc. : 0.00 % CO_2 Cyl. Press. : 1980 PSI

Certified by : AIR LIQUIDE Date : 2-14-13

Span Cyl. # : 487905 Conc. : 12.20 % CO_2 Cyl. Press. : 1340 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % CO_2

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

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

PRE RUN Audit : by : [signature] Time : 1300 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	-.052	-.052	-.209
SPAN	48.8	.488	12.20	48.8	.488	12.195	-.005	-.019

POST RUN Audit : by : [signature] Time : 1900 Temp : 73 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.2	.000	-.052	-.052	-.209
SPAN	48.8	.488	12.20	48.6	.486	12.145	-.055	-.220

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

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

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

ZERO / SPAN CHECK DATA SHEET #15-2

Date : 12-25-14 Analyte : O_2 (15-2)

Unit : F118 Run # : 2

Zero Cyl. # : TC3AAM173 Conc. : 0.00 % O_2 Cyl. Press. : 1980 PSI

Certified by : AIR LIQUIDE Date : 2-14-13

Span Cyl. # : 487905 Conc. : 12.60 % O_2 Cyl. Press. : 1340 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 : CJ Dastrup Time : 1300 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	-.020	-.020	-.081
SPAN	12.60	.504	12.6	12.6	.504	12.613	.013	.054

POST RUN Audit : by : CJ Dastrup Time : 1900 Temp : 73 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-.020	-.020	-.081
SPAN	12.60	.504	12.6	12.5	.501	12.538	-.062	-.247

± 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 : 12-25-14 Analyte : CO (15-3)

Unit : F118 Run # : 2

Zero Cyl. # : IC3AAM173 Conc. : 0.00 % CO Cyl. Press. : 1980 PSI

Certified by : AIR LIQUIDE Date : 2-14-13

Span Cyl. # : CA487905 Conc. : 4.90 % CO Cyl. Press. : 1340 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 10.0 % CO

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

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

PRE RUN Audit : by : [signature] Time : 1300 Temp : 76 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	000	,000	-.011	-.011	-.106
SPAN	49.0	.490	4.90	49.0	,490	4.931	,031	,313

POST RUN Audit : by : [signature] Time : 1900 Temp : 73 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	,000	-.011	-.011	-.106
SPAN	49.0	.490	4.90	48.9	,489	4.921	,021	,214

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

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

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

ZERO / SPAN CHECK DATA SHEET #15-4

Date : 12-25-14 Analyte : SO_2 (15-4)

Unit : F118 Run # : 2

Zero Cyl. # : TC3AAM173 Conc. : 0.00 ppm SO_2 Cyl. Press. : 1980 PSI

Certified by : AIR LIQUIDE Date : 2-14-13

Span Cyl. # : CC82089 Conc. : 1250 ppm SO_2 Cyl. Press. : 1580 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 : Clp Workman Time : 1300 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	.000	1.305	1.305	.052
SPAN	50.0	.500	1250	50.0	.500	1248.0	-2.000	-.080

POST RUN Audit : by : Clp Workman Time : 1900 Temp : 72 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	-.002	-3.682	-3.682	-.147
SPAN	50.0	.500	1250	50.1	.501	1250.5	.500	.020

± 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 F118 RUN: 2 DATE: 12-25-2014

Thermocouple Check:

T/C # 1	——— °F	T/C # 13	53.5 °F
T/C # 2	——— °F	T/C # 14	52.6 °F
T/C # 3	53.7 °F	T/C # 15	53.5 °F
T/C # 4	50.7 °F	T/C # 16	43.1 °F
T/C # 5	50.4 °F	T/C # 17	43.8 °F
T/C # 6	50.2 °F	T/C # 18	56.3 °F
T/C # 7	50.2 °F	T/C # 19	52.3 °F
T/C # 8	50.2 °F	T/C # 20	——— °F
T/C # 9	——— °F	T/C # 21	——— °F
T/C # 10	——— °F	T/C # 22	——— °F
T/C # 11	49.8 °F	T/C # 23	——— °F
T/C # 12	56.7 °F	T/C # 24	——— °F

Thermocouple Readout:

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

ZERO 1.1 °F Adj. to 0.0 °F ZERO .4 °F Difference .020 %

SPAN 2000.0 °F Adj. to 2000.0 °F SPAN 1999.6 °F Difference -.020 %

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 200.4 °F	400	= 400.1 °F
600	= 600.1 °F	800	= 799.9 °F	1000	= 999.9 °F
1200	= 1199.8 °F	1400	= 1399.5 °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: 12.2 − 2.2 = 10

Post: 12.1 − 2.1 = 10

Stack Cleaned Prior to Test Run: YES _____ NO X

COMPUTER INPUT DATA SHEET #1

Client: JOTUL U.S.A. Inc.

Address: 55 Hutchenson

Gorham, ME 04038

Phone: (207) 797-5912 Fax: (207) 772-0523

Run No.: 3 Date of Test: 12-26-2014 Burn Rate: 1.956

Model No.: JOTUL F118 Black Bear ☐ min ☐ min-1.25 ☐ fan

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

Dry Gas Meter Y Factor: .903 (0.000) (Data Sheet #2) Post Leak Rate: .00 cfm (.000) (Data Sheet #2) Time: 120 min. (000) (Data Sheet #2)

Dry Gas Meter Volume: 33.725 cf (00.000) (Data Sheet #2)

Stack Flow: 12.483 dscfm (00.000) (Data Sheet #2) Δ H: .124 in. H_2O (.000) (Data Sheet #2)

Maximum Vac.: 2.0 (0.0) (Data Sheet #2) Barometric Pressure: 30.30 in. Hg (00.00) (Data Sheet #2)

H_2O Captured: 53.1 g (00.0) (Data Sheet #3)

Front Half Catch % Of Total: 41.6 % (00.0) (Data Sheet #6) Total Particulate Catch: .2840 g (0.0000) (Data Sheet #6)

Flue Gas Moisture: 7.7855 % (00.000) (Data Sheet #7)

Particulate Emission: .1480 gr/dscf (0.0000) (Data Sheet #7)

Relative Humidity: 38 % RH (00.0) (Data Sheet #8) Ambient Moisture: 1.45 % H_2O (0.00) (Data Sheet #8)

Preburn Fuel Wt.: 27.4 lbs. (00.0) (Data Sheet #8) Coal Bed Wt.: 2.0 lbs. (00.0) (Data sheet #8) Test Fuel Wt.: 9.4 lbs. (00.0) (Data sheet #8)

Heat Output (EPA Default): 21174.2 BTU/hr (00,000.0) (Data Sheet #8)

Kindling Fuel % Moisture (wet): 13.019 % (00.000) (Data Sheet #10) Pretest Fuel % Moisture (wet): 16.897 % (00.000) (Data Sheet #10)

Test Fuel % Moisture (dry): 21.425 % (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove]) Test Fuel % Moisture (wet): 17.645 %

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

Stack Static Pressure: -.043 in. H_2O (+/- .000) (Data Sheet #12)

Average Ambient Temperature: 81 °F (00) (Data Sheet #14) Stove Temperature Change: -11.4 °F (+/- 000.0) (Data Sheet #14)

TEST START 1415

END 1615

METER TEMP 550

7.44

TABLE 1 ----- RAW DATA

CLIENT : Jotul TEST No. : 3

MODEL: F118 Black Bear DATE: 20-Dec-14

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	196.000	0.150	90	0.74	4.10	250
5	197.500	0.120	90	0.16	2.40	275
10	198.903	0.150	90	0.16	3.40	250
15	200.446	0.150	90	0.30	2.00	250
20	201.990	0.120	90	0.36	1.90	275
25	203.393	0.120	90	0.24	1.90	275
30	204.796	0.150	90	0.61	2.50	250
35	206.339	0.150	90	0.65	4.00	250
40	207.882	0.030	90	2.78	11.30	550
45	208.584	0.070	90	1.37	10.90	350
50	209.687	0.120	90	0.84	11.80	275
55	211.090	0.070	90	1.16	12.20	350
60	212.193	0.100	90	0.82	13.70	300
65	213.479	0.180	90	0.16	11.30	225
70	215.194	0.180	90	0.17	8.30	225
75	216.908	0.150	90	0.66	6.10	250
80	218.451	0.150	90	0.64	6.10	250
85	219.995	0.150	90	0.90	5.10	250
90	221.538	0.120	90	1.01	4.90	275
95	222.941	0.120	90	1.12	4.70	275
100	224.344	0.120	90	1.03	4.60	275
105	225.747	0.120	90	1.17	4.30	275
110	227.150	0.100	90	1.20	4.20	300
115	228.437	0.100	90	1.13	4.30	300
120	229.723	0.100	90	1.44	4.00	300

TABLE 2---RAW DATA

CLIENT : Jotul TEST No. 3

MODEL: F118 Black Bear DATE: 20-Dec-14

METER CAL. FACTOR (Y) -------	0.903		Wt. WOOD BURNED(LB) -------	9.4	Lbs
BAROMETRIC PRESS.(Pb) -------	30.3	in Hg	WET,FUEL MOISTURE % -------	17.645	%
LEAK RATE POST (Lp) -------	0.000	cfm	Wt. PART. COLLECTED -------	0.284	g
WATER VOL. (V1c) -------	53.1	Ml	METER VOLUME Vm -------	33.725	mcf
TEST TIME (MIN) ------	120	min	HC MOLE FRACTION -------	0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT : Jotul TEST No. 3

MODEL: F118 Black Bear DATE: 20-Dec-14

****

AVG DELTA H	-------	0.12	in H2O	AVG PRCNT CO	-------	0.83	%
AVG METER TEMP. Tm	-------	90	deg F	AVG PRCNT CO2	-------	6.00	%
AVG PPM SO2	-------	284	PPM	AVG BAL CO2/CO	-------	7.20	%

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul TEST No. 3

MODEL: F118 Black Bear DATE: 20-Dec-14

STD SAMPLE VOL. Vm(std) d) ------	29.62	dscf	STACK GAS FLOW Qsd -------	775.843 12.93	dscf/Hr & dscf/min
VOL. WATER VAPOR Vw(s td) -----	2.499	scf	PARTICULATE CONCTRT. C s ------	0.0096	g/dscf
PRCNT MSTR Bws -------	7.78	%	PARTC.EMISS. RATE E -------	7.44	g/Hr
BURN RATE BR -------	1.76	Kg/Hr	MOLES OF GAS PER Lb WOOD Nt ----	0.52	Lb-mole/Lb
CO EMISSION RATE -------	216.37 123.22	g/Hr & g/Kgdry fuel	PART.EMISS. RATE ------	4.24	g/Kgdry fuel

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Jotul TEST No. : 3

MODEL: F118 Black Bear DATE: 20-Dec-14

TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR		PROPRTN RATE VAR. AVERAGE	
5	329.4	97		100	
10	338.9	100			
15	338.8	100			
20	339.0	100			
25	338.9	100			
30	338.9	100			
35	338.8	100			
40	338.8	100			
45	339.0	100			
50	339.0	100			
55	338.9	100			
60	339.0	100			
65	338.8	100			
70	339.0	100			
75	338.8	100			
80	338.8	100			
85	339.0	100			
90	338.8	100			
95	338.9	100			
100	338.9	100			
105	338.9	100			
110	338.9	100			
115	339.1	100			
120	338.8	100			

METER BOX DATA SHEET PAGE # 2

Page: 1 of 2

UNIT: JOTUL F118 RUN: 3 DATE: 12-26-2014

Meter Box: 5H Y Factor: .903

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: 46 : 1 BP: 30.30

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1415	196.000	—	13.741	.15	90	250	90	20
5	20	197.500	—	12.492	.12	90	275	90	20
10	25	198.903	198.903	13.741	.15	90	250	90	20
15	30	200.446	200.446	13.741	.15	90	250	90	20
20	35	201.990	201.990	12.492	.12	90	275	90	20
25	40	203.393	203.393	12.492	.12	90	275	90	20
30	45	204.796	204.796	13.741	.15	90	250	90	20
35	50	206.339	206.339	13.741	.15	90	250	90	20
40	55	207.882	207.882	6.216	.63	90	550	90	20
45	1500	208.584	208.584	9.815	.07	90	350	90	20
50	05	209.687	209.687	12.492	.12	90	275	90	20
55	10	211.090	211.090	9.815	.07	90	350	90	20
ROTO PRESS:		18	TOTALS:	144.549	1.40	1080	BP.:	30.30	
60	1515	212.193	212.193	11.451	.10	90	300	90	20
65	20	213.479	213.479	15.268	.18	90	225	90	20
70	25	215.194	215.194	15.268	.18	90	225	90	20
75	30	216.908	216.908	13.741	.15	90	250	90	20
80	35	218.451	218.451	13.741	.15	90	250	90	20
85	40	219.995	219.995	13.741	.15	90	250	90	20
90	45	221.538	221.538	12.492	.12	90	275	90	20
95	50	222.941	222.941	12.492	.12	90	275	90	20
100	55	224.344	224.344	12.492	.12	90	275	90	20
105	1600	225.747	225.747	12.492	.12	90	275	90	20
110	05	227.150	227.150	11.451	.10	90	300	90	20
115	10	228.437	228.437	11.451	.10	90	300	90	20
			TOTALS:	156.080	1.59	1080	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	300.629	2.99	2160	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 2 of 2

UNIT: Jotul F118 RUN: 3 DATE: 12-26-14

Meter Box: SH." Y Factor: .903

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: 1500

ROTO: PRESS: 118 SAMPLING RATIO: 46 : 1 BP: 30.30

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1615	229.723	229.723	11.451	.10	90	300	90	20
125	20								
130	25								
135	30								
140	35								
145	40								
150									
155									
160									
165									
170									
175									
ROTO PRESS:			TOTALS:				BP.:		
180									
185									
190									
195									
200									
205									
210									
215									
220									
225									
230				312.080		2250			
235					3.09				
			TOTALS:				MAX VACC =		2.0
TOTAL Cu Ft		33.725	TOTALS:	12.483	.124	90	AVG. BP:		3030

1/25

550

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : F118 RUN : 3 DATE : 12-26-14

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

SCALE	WEIGHT
295.0 g	295.0
590.0 g	590.2
885.0 g	885.4

IMPINGER	# 1	# 2	# 3	# 4
FINAL WT	652.9	588.5	486.4	879.5
INITIAL WT	611.4	587.3	486.1	869.4
NET WT GRAMS	41.5	1.2	.3	10.1

TOTAL CATCH : 53.1 GRAMS H_2O

FRONT HALF

FILTER #	143F	
FINAL WT g	.6018	
INITIAL WT g	.5151	
NET WT g	.0867	

BEAKER #	46
DESC.	ACETONE
FINAL WT g	106.0730
INITIAL WT g	106.0413
NET WT g	.0317
VOL. DESC. ml	100

BACK HALF

FILTER #	143B	
FINAL WT g	.3815	
INITIAL WT g	.3244	
NET WT g	.0571	

BEAKER #	47	48	49	50	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	107.0973	97.7550	108.3615	96.5456	
INITIAL WT g	107.0306	97.7413	108.3493	96.5244	
NET WT g	.0667	.0137	.0122	.0212	(.0334)
VOL. DESC ml	150	75	100	115	(215)

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 8-21-14 Time : 0942 By : KM

Manufacturer S & S Grade : # 25 Glass Front Size : 11 cm Lot No. : 6775627

Back Size: 8.2 cm Lot No. : 9465841

	DATE: 8-22-14	BY: KM	DATE: 8-26-14	BY: KM	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
141F	.5072	1025	.5070	0930	✓	
142F	.5136	1026	.5137	0931	✓	
143F	.5151	1027	.5151	0932	✓ ← R-3	
144F	.5153	1028	.5153	0933	✓	
145F	.5077	1029	.5078	0934	✓	
146F	.5164	1030	.5165	0935	✓	
147F	.5128	1031	.5128	0936	✓	
148F	.5154	1032	.5152	0937	✓	
149F	.5100	1033	.5101	0938	✓	
150F	.5136	1034	.5136	0939	✓	
141B	.3280	1035	.3280	0940	✓	
142B	.3235	1036	.3235	0941	✓	
143B	.3243	1037	.3244	0942	✓ ← R-3	
144B	.3247	1038	.3248	0943	✓	
145B	.3277	1039	.3278	0944	✓	
146B	.3287	1040	.3287	0945	✓	
147B	.3248	1041	.3249	0946	✓	
148B	.3260	1042	.3258	0947	✓	
149B	.3288	1043	.3289	0948	✓	
150B	.3251	1044	.3252	0949	✓	

Checked by: G. Wachter Date: 9-10-14 Time: 1035

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
8-22-14	1024	KM	64	78	46
8-26-14	0928	KM	62	70	47

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 7-7-14 Time : 0900 By : CW

	DATE: 8-21-14	BY: MM	DATE: 8-22-14	BY: KM	DATE:	BY:
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
26	101.0196	0950	101.0199	0915	✓	
27	106.3608	0951	106.3609	0916	✓	
28	105.7304	0952	105.7302	0917	✓	
29	104.4385	0953	104.4386	0918	✓	
30	107.3442	0954	107.3444	0919	✓	
31	95.5359	0955	95.5359	0920	✓	
32	107.8528	0956	107.8530	0921	✓	
33	101.1583	0957	101.1582	0922	✓	
34	106.4505	0958	106.4506	0923	✓	
35	96.5371	0959	96.5367	0924	✓	
36	94.4467	1000	94.4466	0925	✓	
37	106.5936	1001	106.5933	0926	✓	
38	96.2408	1002	96.2407	0927	✓	
39	97.1276	1003	97.1278	0928	✓	
40	106.4604	1004	106.4601	0929	✓	
41	105.4799	1005	105.4800	0930	✓	
42	104.6623	1006	104.6623	0931	✓	
43	107.3478	1007	107.3475	0932	✓	
44	107.7836	1008	107.7837	0933	✓	
45	94.9295	1009	94.9291	0934	✓	
46	106.0414	1010	106.0413	0935	✓	
47	107.0306	1011	107.0306	0936	✓	
48	97.7411	1012	97.7413	0937	✓ R-3	
49	108.3490	1013	108.3493	0938	✓	
50	96.5247	1014	96.5244	0939	✓	

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH	
8-21-14	0940	CW	-	66	49	Checked by : CW
8-22-14	0910	CW	-	70	48	Date : 8-22-14
		CW	-			Time : 1100

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : F118 **RUN :** 3 **DATE :** 12-26-14 **Page :** 1 **of** 1

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
46	12-27	0800	CJ	106.0729	12-28	0917	CJ	106.0730	12-29	1126	CJ				
47	12-27	0800	CJ	107.0969	12-28	0918	CJ	107.0973	12-29	1127	CJ				
48	12-27	0800	CJ	97.7545	12-28	0919	CJ	97.7550	12-29	1124	CJ				
49	12-27	0800	CJ	108.3611	12-28	0919	CJ	108.3615	12-29	1129	CJ				
50	12-27	0800	CJ	96.5457	12-28	0920	CJ	96.5456	12-29	1130	CJ				

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
1431F	12.26	1700	CJ	.6023	12-27	1241	CJ	.6018	12-29	0915	CJ				
1430	12.26	1700	CJ	.3818	12-27	1242	CJ	.3815	12-29	0916	CJ				

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	12-27-14	1220	CJ	73	47
2	12-28-14	0940	CJ	69	47
3	12-28-14	1110	CJ	71	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 10-18-14 Through	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9997	10.0000	1.0000	.1000	CLP	10-18	1610	77	49
100.0002	10.0003	.9999	.1000	CLP	10-20	1100	74	47
100.0003	10.0000	1.0001	.0999	CLP	10-20	1410	75	48
100.0001	10.0003	1.0000	.0999	KLM	10-22	1000	78	49
99.9999	10.0000	1.0000	.1000	CLP	10-23	0900	72	46
99.9997	9.9999	1.0000	.1000	CLP	10-24	1330	68	47
100.0000	10.0001	1.0001	.1000	CLP	10-25	1530	68	47
100.0000	10.0000	1.0000	.0998	KLM	11-26	1005	73	47
99.9999	10.0001	1.0000	.0999	KLM	11-27	1000	73	47
100.0003	10.0002	.9998	.0999	KLM	11-28	1005	77	49
99.9995	10.0002	1.0000	.0999	CLP	11-29	0945	68	47
100.0000	10.0002	1.0000	.1000	CLP	11-30	1200	72	42
100.0000	9.9998	1.0000	.0998	CLP	12-1	1500	75	41
100.0000	10.0001	1.0000	.0999	CLP	12-3	1200	77	45
100.0000	10.0001	.9999	.0999	CLP	12-4	1130	74	47
99.9998	10.0001	.9999	.0997	CLP	12-4	1330	72	46
100.0001	10.0000	.9999	.1000	CLP	12-11	0930	70	48
100.0000	10.0000	1.0000	.0999	KLM	12-12	1045	77	49
100.0000	10.0000	.9999	.0999	KLM	12-13	1110	68	47
100.0000	10.0001	.9999	.0998	CLP	12-14	0945	66	49
100.0000	10.0000	.9999	.0997	CLP	12-15	1000	65	44
100.0003	9.9999	1.0001	.0999	CLP	12-15	1330	68	47
100.0000	10.0002	1.0000	.1000	KLM	12-25	1345	74	47
100.0000	9.9999	1.0000	.1000	KLM	12-26	0915	69	47
99.9995	9.9999	1.0000	.1000	CLP	12-27	1220	73	47
99.9995	9.9999	1.0000	.1000	CLP	12-28	0900	69	47
99.9996	9.9999	.9999	.0996	CLP	12-28	1110	71	45
100.0000	9.9999	1.0000	.1000	CLP	12-29	1000	66	43
99.9997	10.0000	.9999	.0997	CLP	12-29	1205	66	43
100.0000	10.0001	1.0002	.1000	CLP	1-1-15	1100	65	40
100.0000	10.0000	1.0000	.0999	CLP	1-2-15	1300	66	41
100.0000	10.0001	.9999	.0998	CLP	1-2-15	1530	67	42
100.0002	10.0001	.9999	.0998	CLP	1-4-15	1245	68	47
100.0003	10.0001	1.0002	.1000	CLP	1-4-15	1515	69	44

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 4-27-14 Through 10-17-14	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9996	9.9999	1.0000	.0999	Clp	4-27	1730	68	47
100.0000	10.0000	1.0000	.0999	Clp	5-21	0945	76	49
100.0000	9.9997	1.0000	.1002	Clp	5-22	0930	78	48
100.0005	10.0000	.9999	.0999	Clp	5-23	0740	77	46
100.0000	9.9999	1.0000	.1000	Clp	5-24	1330	74	47
99.9996	9.9999	1.0000	.1000	Clp	5-25	1100	72	46
100.0001	10.0000	1.0001	.0998	Clp	5-26	1115	73	47
100.0000	10.0000	1.0000	.0999	Clp	5-27	1115	78	46
100.0004	10.0000	1.0001	.0999	Clp	5-27	1330	74	47
100.0000	9.9999	.9999	.1000	Clp	7-3	0915	76	46
100.0000	10.0000	1.0000	.0999	Clp	7-4	0900	77	42
100.0000	10.0001	.9999	.0998	Clp	7-5	1230	77	49
100.0000	10.0001	1.0000	.0998	Clp	7-6	1510	76	48
100.0000	10.0000	1.0000	.0999	Clp	7-7	0820	70	48
100.0000	10.0001	.9999	.0999	Clp	7-9	0715	74	47
99.9995	9.9999	.9999	.0999	Clp	7-10	0945	75	44
100.0000	9.9999	.9999	.1000	Clp	7-10	1300	73	47
100.0001	10.0001	1.0001	.0998	Clp	7-14	1230	74	47
100.0000	9.9999	1.0000	.1000	Clp	7-15	0710	72	46
100.0000	10.0000	1.0000	.0998	Clp	8-21	0945	66	49
100.9998	10.0000	1.0000	.0998	KM	9-26	0920	69	47
100.0003	10.0000	1.0000	.1000	KM	9-11	0910	70	48
100.0000	10.0001	1.0001	.1000	KM	9-12	0905	72	42
100.0000	9.9999	.9999	.0999	KM	9-13	1000	73	47
100.0005	10.0001	1.0000	.1000	Clp	9-14	1015	68	42
100.0005	10.0000	1.0000	.0999	Clp	9-15	1030	68	47
99.9999	10.0000	.9999	.1000	KM	9-16	1010	77	49
99.9996	10.0000	1.0001	.1000	KM	9-16	1315	78	46
100.0000	10.0001	1.0000	.0999	KM	9-17	1010	70	48
100.0000	10.0000	1.0000	.1000	KM	9-19	0915	76	49
100.0000	10.0000	.9999	.0998	Clp	9-20	1000	71	49
100.0000	10.0001	1.0001	.0999	Clp	9-22	1000	72	46
100.0005	10.0000	.9999	.0999	Clp	9-22	1330	74	47
100.0000	10.0000	1.0000	.0998	KM	9-24	1120	78	46
100.0001	9.9999	1.0000	.1000	KM	9-25	1005	76	49
99.9998	9.9999	1.0000	.0999	KM	9-26	1105	76	49
100.0000	10.0001	.9999	.0999	KM	9-30	1120	78	49
99.9998	9.9999	.9999	.1000	KM	10-16	0945	76	49
100.0000	10.0001	1.0000	.1000	KM	10-17	0920	72	46

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 1-12-14 Through 4-27-14	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9995	10.0000	1.0001	.0999	CLp	1-12-14	1300	70	48
99.9995	9.9999	1.0000	.0997	CLp	1-13-14	1215	69	47
100.0000	9.9999	1.0001	.0999	CLp	1-23-14	0915	70	48
100.0000	9.9999	1.0000	.0999	CLp	1-31-14	1500	65	48
100.0000	9.9999	1.0000	.0999	CLp	2-4-14	1200	76	32
99.9997	9.9999	1.0001	.0999	CLp	2-5-14	1600	65	40
100.0000	9.9997	.9999	.1000	CLp	2-6-14	1600	65	36
100.0003	10.0000	1.0000	.0998	CLp	2-7-14	1530	65	40
100.0005	10.0001	1.0000	.0999	CLp	2-10-14	1115	65	48
100.0000	10.0000	1.0000	.0998	CLp	2-12-14	1315	70	48
100.0003	10.0002	1.0000	.0998	CLp	2-13-14	1130	75	48
99.9997	10.0001	1.0000	.1000	CLp	2-14-14	1500	66	49
99.9998	10.0001	1.0000	.0999	CLp	2-15-14	1015	69	44
100.0000	10.0001	1.0000	.0999	CLp	2-16-14	1500	68	43
100.0000	9.9999	1.0000	.0997	CLp	2-17-14	1530	74	44
99.9997	9.9998	1.0000	.1000	CLp	2-18-14	1130	65	48
100.0000	10.0000	1.0000	.1000	CLp	2-19-14	1130	70	41
100.0000	10.0000	1.0000	.0998	CLp	2-21-14	1445	72	42
100.0003	10.0002	.9999	.0997	CLp	2-23-14	1445	69	47
100.0006	10.0002	1.0001	.0999	CLp	2-25-14	1930	68	49
99.9999	10.0000	1.0000	.1000	CLp	2-26-14	1020	70	48
100.0005	10.0001	1.0001	.1000	CLp	2-27-14	1600	70	48
99.9996	9.9999	1.0000	.0998	CLp	3-1-14	1200	68	47
100.0000	10.0001	1.0000	.0999	CLp	3-2-14	1500	65	48
100.0000	10.0000	1.0000	.0999	CLp	3-3-14	1300	77	49
100.0000	10.0001	1.0000	.0999	CLp	3-4-14	1500	69	47
100.0000	10.0000	1.0000	.0999	CLp	3-5-14	1700	66	49
100.0000	9.9999	1.0001	.0999	CLp	3-19-14	1300	69	47
100.0000	10.0001	1.0000	.0999	CLp	3-21-14	1600	70	48
99.9995	10.0000	1.0000	.0999	CLp	3-23-14	1600	71	49
100.0000	10.0001	1.0000	.0998	CLp	3-24-14	1510	70	45
100.0004	10.0000	.9999	.0999	CLp	3-26-14	1645	70	48
99.9996	9.9999	1.0000	.1001	CLp	3-27-14	1145	66	49
99.9999	10.0002	1.0000	.0998	CLp	3-29-14	1200	65	48
100.0004	10.0000	.9999	.0998	CLp	4-22-14	1000	73	47
100.0000	10.0001	.9999	.0999	CLp	4-24-14	1030	76	49
99.9995	9.9999	.9999	.0998	CLp	4-25-14	1140	75	48
100.0000	9.9998	1.0000	.0999	CLp	4-26-14	1600	72	46
99.9995	9.9998	.9999	.0999	CLp	4-27-14	1130	65	48

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 3-6-13 Through 1-11-14	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	9.9999	1.0000	.0999	CP	3-6-13	1100	65	48
100.0000	10.0001	1.0000	.1000	CP	3-7-13	1700	68	47
99.9998	10.0002	1.0001	.1000	CP	3-9-13	1500	67	46
100.0001	10.0000	1.0000	.1000	CP	3-11-13	1540	75	41
100.0000	10.0002	1.0000	.0999	CP	3-12-13	1520	76	45
100.0000	9.9999	.9998	.0998	CP	3-19-13	1400	67	46
100.0000	10.0000	1.0000	.0998	CP	3-20-13	1600	74	47
100.0000	10.0001	1.0000	.1000	CP	6-18-13	1430	78	49
100.0000	10.0001	1.0000	.0998	CP	6-19-13	0900	76	49
99.9995	10.0000	.9998	.0998	CP	6-20-13	0820	66	49
99.9996	9.9999	1.0000	.0999	CP	6-21-13	1330	74	47
100.0003	9.9999	1.0000	.0998	CP	6-22-13	0930	76	49
99.9995	9.9999	.9999	.1000	CP	6-23-13	1500	74	47
100.0001	10.0001	1.0000	.0998	CP	6-24-13	1230	70	48
100.0000	10.0000	1.0000	.0999	CP	6-25-13	1400	70	48
99.9993	9.9999	1.0000	.0998	CP	6-26-13	1900	65	48
100.0000	9.9996	1.0001	.0998	CP	7-12-13	1500	72	47
100.0000	9.9999	1.0000	.0998	CP	7-14-13	1400	77	49
100.0005	10.0002	1.0000	.1000	CP	7-15-13	1600	78	48
100.0000	9.9997	1.0000	.1001	CP	7-16-13	1530	78	46
100.0003	10.0000	.9999	.0998	CP	7-17-13	0730	74	47
100.0003	9.9999	1.0000	.1000	CP	7-18-13	1600	78	46
100.0000	9.9999	.9999	.0998	CP	7-19-13	1415	72	46
100.0000	10.0001	.9999	.1001	CP	7-20-13	0800	74	47
100.0000	10.0000	1.0000	.0999	CP	7-21-13	1300	68	47
100.0000	10.0000	1.0000	.0998	CP	7-22-13	1300	70	48
100.0003	9.9998	1.0001	.1000	CP	7-23-13	1230	72	46
100.0000	9.9999	1.0000	.0999	CP	11-15-13	1530	72	46
100.0001	10.0001	.9999	.0999	CP	11-16-13	1035	72	46
99.9997	9.9999	1.0000	.0999	CP	11-17-13	1000	72	46
99.9997	10.0000	.9999	.0998	CP	11-18-13	1600	72	46
100.0000	10.0000	1.0000	.0999	CP	11-20-13	1100	66	49
100.0000	9.9999	1.0001	.0999	CP	11-21-13	1000	70	41
100.0000	9.9999	1.0000	.0998	CP	11-22-13	1730	67	46
100.0000	10.0000	.9998	.0999	CP	11-25-13	1500	70	44
100.0001	10.0000	.9999	.0999	CP	11-26-13	1600	68	47
100.0000	10.0002	.9997	.1001	CP	1-9-14	1630	72	47
99.9997	10.0000	1.0001	.0999	CP	1-9-14	1230	76	42
100.0002	10.0001	.9999	.1000	CP	1-11-14	1800	70	48

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 10-10-12 Through 3-6-2013	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9997	10.0000	1.0000	.0999	CR	10-10-12	1615	75	48
100.0000	10.0001	1.0001	.0999	CR	10-12-12	1230	77	46
99.9997	10.0000	.9999	.0999	CR	10-13-12	0830	77	49
100.0005	10.0000	.9999	.0999	CR	10-14-12	1030	78	46
100.0005	10.0002	.9999	.0998	CR	10-15-12	1000	78	48
100.0001	10.0002	1.0000	.1000	CR	10-16-12	1600	78	49
99.9996	9.9999	.9999	.1000	CR	10-17-12	0900	69	47
100.0000	9.9999	1.0006	.1000	CR	10-18-12	1330	78	37
100.0002	10.0000	.9999	.0999	CR	10-19-12	1130	78	46
100.0001	10.0001	.9999	.0999	CR	10-20-12	1400	78	48
99.9999	10.0001	.9998	.0999	CR	10-22-12	1800	65	45
100.0000	10.0001	1.0001	.0999	CR	10-24-12	1900	65	48
100.0000	9.9998	1.0000	.0998	CR	10-26-12	1750	70	48
100.0001	10.0000	1.0000	.0999	CR	10-29-12	1745	73	47
100.0000	10.0000	1.0000	.0999	CR	11-5-12	1030	74	47
99.9998	10.0000	1.0000	.0999	CR	11-6-12	1000	73	47
100.0000	10.0001	1.0000	.0999	CR	11-7-12	1030	73	47
100.0000	10.0000	1.0000	.1000	CR	11-8-12	0930	66	45
100.0000	9.9999	.9999	.0999	CR	11-12-12	1030	72	42
100.0000	10.0000	1.0000	.1000	CR	11-13-12	1000	71	45
100.0000	10.0000	1.0000	.0999	CR	11-29-12	0910	74	47
100.0000	10.0000	1.0000	.1000	CR	12-1-12	1800	66	49
100.0000	9.9999	1.0001	.0999	CR	12-2-12	1130	67	46
100.0000	10.0000	.9999	.0999	CR	12-3-12	0915	72	46
100.0004	10.0000	1.0000	.1001	CR	12-4-12	1700	69	47
99.9997	9.9999	.9999	.0999	CR	12-5-12	1045	74	44
99.9999	10.0000	1.0000	.0998	CR	12-6-12	1400	66	49
100.0000	9.9999	.9999	.0998	CR	12-7-12	1730	65	48
100.0002	10.0001	1.0000	.1000	CR	12-9-12	1460	66	49
100.0002	10.0001	.9999	.1000	CR	12-10-12	1500	66	49
100.0000	9.9999	1.0001	.0999	CR	12-21-13	1020	78	44
100.0000	9.9998	1.0001	.0999	CR	12-23-13	1900	72	46
99.9995	10.0001	1.0000	.0999	CR	12-24-13	1700	72	46
100.0000	9.9999	.9999	.1000	CR	12-25-13	1000	73	43
100.0000	9.9998	1.0000	.0999	CR	12-26-13	1600	66	49
100.0000	10.0002	1.0000	.0999	CR	12-27-13	0915	67	46
100.0000	10.0001	1.0000	.0999	CR	12-28-13	1530	76	42
100.0000	10.0001	1.0000	.0999	CR	3-2-13	1600	73	47
100.0000	9.9999	.9999	.0998	CR	3-4-13	1900	71	41

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 1-14-2012 Through 9-17-12	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	10.0000	1.0000	.0999	CA	1-14-12	1310	70	48
100.0002	10.0001	1.0001	.1000	CA	1-15-12	1330	68	47
99.9997	10.0000	1.0001	.1000	CA	1-17-12	1030	73	47
99.9997	10.0001	1.0000	.1000	CA	1-18-12	0915	74	44
99.9999	10.0002	1.0001	.1001	CA	1-19-12	1015	70	44
100.0001	10.0001	1.0001	.0998	CA	1-25-12	1600	72	46
99.9999	9.9998	1.0001	.1000	CA	1-26-12	1500	70	48
99.9995	9.9999	1.0000	.0999	CA	1-28-12	1400	70	41
100.0000	10.0000	1.0000	.0999	CA	2-4-12	1500	73	60
100.0000	10.0003	.9999	.0999	CA	2-6-12	1200	69	44
100.0000	10.0000	.9999	.0998	CA	2-7-12	1030	67	42
100.0000	9.9999	1.0001	.0999	CA	2-10-12	1630	78	49
100.0000	10.0001	1.0000	.1000	CA	2-11-12	1630	72	46
99.9997	10.0002	1.0000	.1001	CA	2-12-12	1530	73	47
100.0000	10.0000	.9999	.0999	CA	2-13-12	1100	78	46
99.9995	10.0000	.9999	.0999	CA	2-14-12	1000	76	45
100.0000	9.9999	.9999	.1000	CA	2-15-12	1120	70	44
99.9999	10.0000	1.0000	.0999	CA	2-17-12	1415	73	47
99.9999	10.0000	1.0000	.0998	CA	2-19-12	1600	70	44
99.9997	9.9999	1.0000	.0999	CA	2-20-12	1200	70	48
100.0004	10.0001	1.0000	.1000	CA	2-23-12	1000	73	47
100.0000	9.9997	1.0000	.0999	CA	2-24-12	1015	78	46
100.0000	10.0000	1.0000	.1001	CA	2-25-12	1715	65	48
100.0000	9.9996	1.0000	.0999	CA	2-27-12	1000	70	44
100.0000	10.0000	1.0001	.1002	CA	2-28-12	1125	75	41
99.9997	10.0000	1.0000	.1000	CA	2-29-12	1110	68	43
99.9995	9.9999	.9999	.0997	CA	3-1-12	1330	68	47
99.9996	10.0000	1.0000	.0998	CA	3-2-12	1430	71	45
99.9995	9.9999	1.0000	.0999	CA	3-3-12	1430	72	42
99.9999	10.0000	.9999	.0999	CA	9-2-12	0945	77	46
100.0000	10.0000	1.0000	.1000	CA	9-3-12	1030	71	49
100.0002	9.9999	1.0000	.0998	CA	9-4-12	1000	77	49
100.0000	10.0000	1.0000	.0999	CA	9-5-12	0945	78	46
100.0000	10.0002	1.0000	.0999	CA	9-6-12	1130	76	49
99.9997	10.0001	1.0002	.0999	CA	9-7-12	1400	76	49
100.0000	10.0001	1.0000	.0999	CA	9-8-12	1200	71	49
100.0000	10.0002	1.0000	.1001	CA	9-15-12	1410	78	48
100.0000	10.0000	1.0000	.1000	CA	9-16-12	1100	78	48
100.0000	10.0000	.9999	.0999	CA	9-17-12	1330	75	48

BLANK PROCESSING DATA SHEET # 5

UNIT : F 118 RUN : 3 DATE : 12-26-14

BLANKS DONE : 9-8-12

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	108.9013	106.3080	106.9659
TARE WEIGHT	108.9005	106.3061	106.9637
NET WEIGHT	.0008	.0019	.0022

TARE BEAKERS INTO DESC : TIME : 1015 DATE : 8-31-12

DATE : 9-2 BY : cp DATE : 9-3 BY : cp DATE : BY :

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9007	1016	108.9005	1046		
B	106.3058	1017	106.3061	1047		
C	106.9641	1018	106.9637	1048		

FINAL BEAKERS INTO DESC : TIME : DATE :

DATE : 9-6 BY : cp DATE : 9-7 BY cp DATE : BY :

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9016	1148	108.9013	1415		
B	106.3077	1149	106.3080	1416		
C	106.9661	1150	106.9659	1417		

TARE QC

DATE	TIME	BY	WB	DB	%
9-2	0945	cp	S	77	46
9-3	1030	cp	S	71	49

FINAL QC

DATE	TIME	BY	WB	DB	%
9-6	1130	cp	S	76	49
9-7	1400	cp	S	76	49

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT: F118 RUN: 3 DATE: 12-26-14

BLANK CALCULATIONS

Acetone :	.0008	g ÷	200	ml =	.000004	g/ml
Dicholoromethane :	.0019	g ÷	75	ml =	.000025	g/ml
Distilled Water :	.0022	g ÷	200	ml =	.000011	g/ml

FRONT HALF CATCH

FILTERS : .0867 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0867 g

BEAKERS : .0317 (Total Catch) g - 160 (ml Acetone) (.000004 g) (Blank Value / ml Acetone) = .0313 g

TOTAL FRONT HALF CATCH : .1180 g

BACK HALF CATCH

FILTERS : .0571 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0571 g

BEAKERS :

Acetone : .0667 (Total Catch) g - 150 (ml Acetone) (.000004 g) (Blank Value / ml Acetone) = .0661 g

Extract : .0137 (Total Catch) g - 75 (ml Dichloromethane) (.000025 g) (Blank Value / Dichloromethane) = .0118 g

Water : .0334 (Total Catch) g - 215 (ml Water) (.000011 g) (Blank Value / Water) = .0310 g

TOTAL BACK HALF CATCH : .1660 g

TOTAL CATCH : .2840 g

% FRONT HALF : 41.6 %

CALCULATIONS DATA SHEET # 7

UNIT: JOTUL F118 RUN: 3 DATE: 12-26-2014

1) $Vm(std) = \dfrac{(33.725\ Vm)(17.64)(.903\ mcf)\left(30.30\ "Hg + \frac{.124\ "H_2O}{13.6}\right)}{(550\ TmA)} = \dfrac{29.6039}{000.0000}$ dscf

2) $Vw(std) = (.04707)(53.1\ ml\ H_2O) = \dfrac{2.4994}{00.0000}$ scf

3) $Asw = \dfrac{(2.4994\ scf)}{(2.4994\ scf + 29.6039\ dscf)} = \dfrac{.0779}{.0000}$ Bws × 100 = $\dfrac{7.7855}{00.0000}$ % H_2O

4) $Cs = \dfrac{(.2840\ g.)}{(29.6039\ dscf)}(15.43) = \dfrac{.1480}{0.0000}$ gr / dscf

5) Estimated g / hr = $\dfrac{(.2840\ g.)}{(29.6039\ dscf)}\left(\dfrac{12.483}{00.0000}\ dscfm\right)(60) = \dfrac{7.1852}{00.0000}$ g / hr

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

TEST DATA SHEET # 8

UNIT: JOTUL F118 RUN: 3 DATE: 12-26-14

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

Wet Bulb / Dry Bulb

Pre : WB: 67 DB: 85 = 38 % RH 1.6 % H_2O

Post : WB: 63 DB: 80 = 38 % RH 1.3 % H_2O

Average: 38 % 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: 1.5

Preburn Fuel Weight: 9.1 + 7.4 + 9.4 Total: 25.9

Kindling & Preburn Fuel Weight (wood only) (lbs): **Total**: 27.4

Coal Bed Wt Range (lbs): 2.3 - 1.9 **Scale**: 2.3 - 1.9

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

Lower : .20 x fuel weight : Always round UP to nearest tenth **Actual Coal Bed Weight**: 2.0

Maximum Coal Bed Removal (lbs): ((2.3 (Upper) + 1.9 (Lower)) ÷ 2) .25 = .5 (round down to nearest tenth)

Test Fuel (.75" x 1.5" x 5" spacers) = 16 pcs

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" x 4"	18	4	9.4	100.0
4" x 4"	—	—	—	—

Test Fuel Weight: 9.4 lbs

Estimated Dry Burn Rate:

$$\frac{9.4 - (9.4 \times .17645)}{2.2046} \times \frac{60}{\underset{\text{TIME}}{120}} = 1.756 \text{ kg / hr}$$

Estimated BTU's/hr: 19,140 x $\frac{63}{100}$ x $\frac{1.756}{\text{DBR}}$ = 21174.2 BTU's/hr

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

WOOD STOVE OPERATING DATA PAGE #9

Unit : JOTUL F118 Run : 3 Date : 12-26-2014

FIRE STARTED: 1210

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 35 sec.

TEST:

DOOR wide open during loading 0 min. 55 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 during preburn

ON / OFF first ALL minutes of test

ON / OFF balance of test run

Fan speed set at N/A

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 8 or 16 inches.

1st warm up / pre-burn fuel charge (9.1 lbs.) added at 1214

2nd warm up / pre-burn fuel charge (7.4 lbs.) added at 1322

3rd warm up / pre-burn fuel charge (9.4 lbs.) added at 1420

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 F118 Run : 3 Date : 12-26-2014

Room Temperature : 72 °F Temperature Correction Set? : (Yes) No

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

Time Test Fuel moisture reading taken : 1225

pc #	Dimen.	Use	TOP	BOTTOM	SIDE	Avg Corrected
1	2"×4"×8'	K	15.1	14.9	14.9	14.967
2						
3						
4	2"×4"×8'	P	19.6	19.4	19.4	19.5
5	2"×4"×8'	P	21.9	22.6	22.6	23.4
6	2"×4"×8'	P	18.1	18.2	18.0	18.1
7	2"×4"×8'	P				61.0
8	2"×4"×8'	P				
9						
10						
11						
12	2" 4" × 18"	T	20.2	20.4	20.5	20.4
13	"	T	21.7	21.8	21.8	21.8
14	"	T	21.5	21.7	21.7	21.6
15	"	T	21.8	21.9	21.9	21.9
16						85.7
17						
18						
19						
20	Spacers	T	22.6	23.5	23.4	23.167

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	14.967 %	20.333 %	21.425 %
Wet Moisture % :	13.019 %	16.897 %	17.645 %

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: 2.0 DATE: 12-26-2014

UNIT: JOTUL F118 RUN: 3 PAGE: 1 OF 1

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
0 1415	11.4	9.4	—	.167	4.1	.638	16.0	.074	.74	-.038	250
5 1420	11.7	9.2	.2	.098	2.4	.728	18.2	.017	.16	-.037	275
10	10.9	8.9	.3	.137	3.4	.689	17.2	.017	.16	-.040	250
15 1430	10.6	8.6	.3	.083	2.0	.739	18.5	.031	.30	-.035	250
20	9.8	7.8	.8	.079	1.9	.740	18.5	.037	.36	-.035	275
25 1440	9.3	7.3	.5	.077	1.9	.745	18.7	.025	.24	-.038	275
30	9.0	7.0	.3	.103	2.5	.707	17.7	.061	.61	-.040	250
35 1450	8.5	6.5	.5	.162	4.0	.645	16.2	.065	.65	-.038	250
40	8.0	6.0	.5	.454	11.3	.269	6.7	.277	2.78	-.050	550
45 1500	6.7	4.7	1.3	.438	10.9	.341	8.5	.137	1.37	-.054	350
50	5.9	3.9	.8	.474	11.8	.326	8.2	.084	.84	-.055	275
55 1510	4.9	2.9	1.0	.490	12.2	.298	7.4	.116	1.16	-.055	350
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.515	*****
60	4.6	2.6	.3	.547	13.7	.251	6.3	.082	.82	-.055	300
65 1520	4.3	2.3	.3	.451	11.3	.373	9.3	.017	.16	-.055	225
70	4.0	2.0	.3	.334	8.3	.493	12.3	.018	.17	-.050	225
75 1530	3.8	1.8	.2	.247	6.1	.561	14.0	.066	.66	-.048	250
80	3.6	1.6	.2	.246	6.1	.562	14.1	.064	.64	-.045	250
85 1540	3.3	1.3	.3	.204	5.1	.591	14.8	.090	.90	-.045	250
90	3.1	1.1	.2	.198	4.9	.595	14.9	.101	1.01	-.041	275
95 1550	2.9	.9	.2	.191	4.7	.598	15.0	.112	1.12	-.040	275
100	2.7	.7	.2	.184	4.6	.606	15.2	.103	1.03	-.040	275
105 1600	2.5	.5	.2	.173	4.3	.612	15.3	.117	1.17	-.040	275
110	2.3	.3	.2	.170	4.2	.615	15.4	.120	1.20	-.039	300
115 1610	2.2	.2	.1	.173	4.3	.614	15.4	.113	1.13	-.037	300
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.535	*****
120 1615	2.0	ø	.2	.161	4.0	.614	15.4	.144	1.44	-.037	300
125											
130											
135											
140											
145											
150											
155											
160											
165											
170											
175											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****		*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.087	*****

AVG: -.043

PREBURN DATA SHEET #13

UNIT: JOTUL F118 RUN: 3 DATE: 12-26-2014 PAGE: 1 of 1

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
0 1315	3.7	-	423	498	502	322	362	416			85	.055	PREBURN START: # 1,7 UP
5 1320	3.3	.4	384	494	522	325	368	420			85	.053	COAL BED SCALE RANGE:
10	3.0	.3	353	468	539	329	384	425			85	.050	2.3 - 1.9
15 1330	2.9	.1	321	436	536	333	376	427			87	.047	PRIMARY AIR: 5/32"
20	2.7	.2	301	405	523	337	365	429			87	.045	SECONDARY AIR: N/A
25 1340	2.6	.1	289	380	505	337	338	425			87	.045	FAN: N/A
30	2.5	.1	277	362	496	332	323	423			87	.043	PUMPS ON AT:
35 1350	2.3	.2	267	346	482	331	313	423			87	.040	CHECK WB/DB: N/A
40	2.2	.1	258	333	464	326	302	422			85	.040	
45 1400	2.2	Ø	250	321	447	322	288	418			86	.040	
50	2.1	.1	248	310	433	316	281	412			86	.040	
55 1410	2.0	.1	243	301	422	310	277	407			85	.039	
*****	****	***	****	*****	*****	****	*****	*****	*****	*****	*****	****	
60 1415	2.0	Ø	233	290	409	304	266	404			85	.038	
65													
70													
75													
80													
85													
90													

Unit:Jotul F118 Black Bear

Temperature Data Sheet #14

Run-3
12-26-14

Time	Stack	Top	Left Side	Back	Right Side	Bottom	Firebox	Secondary	Ambient	Furnace	Sample Box	Bucket	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	233	290	409	304	266	404	#######	#######	85	1268	228	64	N/A	31	31
5	219	273	371	290	247	394	#######	#######	84	1270	229	52		31	31
10	237	271	333	274	226	380	#######	#######	83	1269	230	51		31	31
15	212	264	304	261	203	363	#######	#######	82	1268	231	49		31	31
20	202	252	281	246	192	344	#######	#######	82	1266	232	48		31	31
25	325	283	271	235	183	324	#######	#######	81	1264	234	46		31	31
30	241	290	281	227	192	309	#######	#######	81	1262	236	45		31	32
35	226	272	274	222	186	300	#######	#######	81	1264	237	45		31	32
40	297	283	302	220	188	294	#######	#######	82	1264	238	45		31	33
45	337	327	391	224	229	297	#######	#######	82	1261	238	46		32	34
50	368	374	451	233	271	308	#######	#######	82	1259	239	46		32	35
55	386	420	492	251	304	321	#######	#######	83	1258	240	46		33	36
60	429	476	524	268	333	337	#######	#######	83	1258	242	47		34	38
65	403	502	542	293	350	351	#######	#######	84	1260	243	47		34	39
70	351	473	547	315	347	365	#######	#######	85	1265	245	47		35	39
75	313	437	535	330	339	377	#######	#######	85	1270	244	47		36	38
80	294	406	510	334	326	387	#######	#######	88	1271	243	48		36	38
85	278	380	478	329	295	395	#######	#######	82	1272	243	48		37	37
90	265	357	454	324	282	402	#######	#######	81	1273	245	48		37	37
95	256	339	440	320	273	407	#######	#######	79	1275	246	48		38	37
100	250	323	429	313	263	412	#######	#######	78	1276	248	49		38	37
105	242	310	420	308	258	413	#######	#######	77	1277	245	49		38	37
110	236	298	409	301	249	414	#######	#######	76	1278	243	49		39	36
115	231	288	402	295	244	416	#######	#######	75	1279	241	49		39	36
120	225	279	390	290	240	416	#######	#######	75	1280	240	50		39	36

Unit:Jotul F118 Black Bear

Run-3
12-26-14

TEMPERATURE DATA SHEET #14A

		TEST TIME	120		
STACK	282	TOP AVG	339	LT SIDE AVG	410
BACK AVG	280	RT SIDE AVG	259	BOTTOM AVG	365
FIREBOX AVG	########	SEC/CAT AVG	########	AMBIENT AVG	81

END	323.2	
START	334.6	
	-11.4	DELTA T

CIRCLE: LOSE / GAIN

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 12-26-14 Analyte : CO_2 (15-1)

Unit : F 118 Run # : 3

Zero Cyl. # : FC3AAM173 Conc. : 0.00 % CO_2 Cyl. Press. : 1980 PSI

Certified by : AIR LIQUIDE Date : 2-14-13

Span Cyl. # : 487905 Conc. : 12.20 % CO_2 Cyl. Press. : 1340 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % CO_2

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

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

PRE RUN Audit : by : [signature] Time : 1332 Temp : 73 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-.052	-.052	-.209
SPAN	48.8	.488	12.20	48.8	.488	12.195	-.005	-.019

POST RUN Audit : by : [signature] Time : 1630 Temp : 75 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.2	.002	-.002	-.002	-.008
SPAN	48.8	.488	12.20	48.7	.487	12.170	-.030	-.120

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

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

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

ZERO / SPAN CHECK DATA SHEET #15-2

Date : 12-26-14 Analyte : O_2 (15-2)

Unit : F118 Run # : 3

Zero Cyl. # : TC3AAM173 Conc. : 0.00 % O_2 Cyl. Press. : 1980 PSI

Certified by : AIR LIQUIDE Date : 2-14-13

Span Cyl. # : 487905 Conc. : 12.60 % O_2 Cyl. Press. : 1340 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 : CJ Dunlap Time : 1330 Temp : 73 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-.020	-.020	-.081
SPAN	12.60	.504	12.6	12.6	.504	12.613	.013	.054

POST RUN Audit : by : CJ Dunlap Time : 1630 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	-.020	-.020	-.081
SPAN	12.60	.504	12.6	12.6	.505	12.638	.038	.154

± 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 : 12-2L-14 Analyte : CO (15-3)

Unit : F 118 Run # : 3

Zero Cyl. # : IC3AAM173 Conc. : 0.00 % CO Cyl. Press. : 1980 PSI

Certified by : AIR LIQUIDE Date : 2-14-13

Span Cyl. # : CA487905 Conc. : 4.90 % CO Cyl. Press. : 1340 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 : Clp Dartmouth Time : 1330 Temp : 73 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	000	,000	-.011	-.011	-.106
SPAN	49.0	.490	4.90	49.0	,490	4.931	,031	,313

POST RUN Audit : by : Clp Dartmouth Time : 1630 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	-,001	-,001	-,005
SPAN	49.0	.490	4.90	49.0	,490	4.931	,031	,315

± 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 : 12-26-14 Analyte : SO_2 (15-4)

Unit : F118 Run # : 3

Zero Cyl. # : IC3AAM173 Conc. : 0.00 ppm SO_2 Cyl. Press. : 1980 PSI

Certified by : AIR LIQUIDE Date : 2-14-13

Span Cyl. # : CC82089 Conc. : 1250 ppm SO_2 Cyl. Press. : 1580 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 2500 ppm SO_2

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

PRE RUN Audit : by : Cp Wortmann Time : 1330 Temp : 73 ° F

AUDIT RESULTS

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

POST RUN Audit : by : Cp Wortmann Time : 1130 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	-.003	-6.175	-6.175	-.247
SPAN	50.0	.500	1250	50.2	.502	1253.0	3.000	.120

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

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

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

QUALITY CHECKS DATA SHEET # 16

UNIT: JOTUL F118 RUN: 3 DATE: 12-26-2014

Thermocouple Check:

T/C # 1	——— °F	T/C # 13	57.9 °F
T/C # 2	——— °F	T/C # 14	57.0 °F
T/C # 3	57.6 °F	T/C # 15	57.9 °F
T/C # 4	54.0 °F	T/C # 16	36.8 °F
T/C # 5	53.4 °F	T/C # 17	37.8 °F
T/C # 6	53.2 °F	T/C # 18	60.5 °F
T/C # 7	52.3 °F	T/C # 19	58.6 °F
T/C # 8	53.5 °F	T/C # 20	——— °F
T/C # 9	——— °F	T/C # 21	——— °F
T/C # 10	——— °F	T/C # 22	——— °F
T/C # 11	51.4 °F	T/C # 23	——— °F
T/C # 12	63.9 °F	T/C # 24	——— °F

Thermocouple Readout:

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

ZERO -.2 °F Adj. to 0.0 °F ZERO .1 °F Difference .005 %

SPAN 2000.0 °F Adj. to 2000.0 °F SPAN 2000.3 °F Difference .015 %

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 200.2 °F	400	= 399.9 °F
600	= 599.9 °F	800	= 799.8 °F	1000	= 999.8 °F
1200	= 1199.7 °F	1400	= 1399.5 °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: 12.0 − 2.0 = 10

Post: 12.0 − 2.0 = 10

Stack Cleaned Prior to Test Run: YES ——— NO X

COMPUTER INPUT DATA SHEET #1

Client: JOTUL U.S.A. Inc.

Address: 55 Hutchenson

Gorham, ME 04038

Phone: (207) 797-5912 Fax: (207) 772-0523 1.30

Run No.: 5 Date of Test: 12-31-2014 Burn Rate: 1,688

Model No.: JOTUL F118 Black Bear ☐ min ☐ min-1.25 ☐ fan

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

Dry Gas Meter Y Factor: .903 (0.000) (Data Sheet #2) Post Leak Rate: .000 cfm (.000) (Data Sheet #2) Time: 125 min. (000) (Data Sheet #2)

Dry Gas Meter Volume: 32.934 cf (00.000) (Data Sheet #2)

Stack Flow: 10.455 dscfm (00.000) (Data Sheet #2) Δ H: .120 in. H_2O (.000) (Data Sheet #2)

Maximum Vac.: 2.0 (0.0) (Data Sheet #2) Barometric Pressure: 30.50 in. Hg (00.00) (Data Sheet #2)

H_2O Captured: 47.2 g (00.0) (Data Sheet #3)

Front Half Catch % Of Total: 57.1 % (00.0) (Data Sheet #6) Total Particulate Catch: .0665 g (0.0000) (Data Sheet #6)

Flue Gas Moisture: 6.9131 % (00.000) (Data Sheet #7)

Particulate Emission: .0343 gr/dscf (0.0000) (Data Sheet #7)

Relative Humidity: 21.0 % RH (00.0) (Data Sheet #8) Ambient Moisture: .55 % H_2O (0.00) (Data Sheet #8)

Preburn Fuel Wt.: 25.9 lbs. (00.0) (Data Sheet #8) Coal Bed Wt.: 2.3 lbs. (00.0) (Data sheet #8) Test Fuel Wt.: 9.4 lbs. (00.0) (Data sheet #8)

Heat Output (EPA Default): 20354.2 BTU/hr (00,000.0) (Data Sheet #8)

Kindling Fuel % Moisture (wet): 13.068 % (00.000) (Data Sheet #10) Pretest Fuel % Moisture (wet): 17.035 % (00.000) (Data Sheet #10)

Test Fuel % Moisture (dry): 21.225 % Test Fuel % Moisture (wet): 17.509 % (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove])

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

Stack Static Pressure: -.049 in. H_2O (+/- .000) (Data Sheet #12)

Average Ambient Temperature: 70 °F (00) (Data Sheet #14) Stove Temperature Change: ~29.0 °F (+/- 000.0) (Data Sheet #14)

TEST START 1400

END 1605

METER TEMP 535

TABLE 1 ----- RAW DATA

CLIENT : Jotul TEST No. : 5

MODEL: F118 Black Bear DATE: 31-Dec-14

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	260.500	0.150	75	0.64	5.40	300
5	262.000	0.150	75	0.52	14.20	300
10	263.491	0.090	75	1.55	13.90	375
15	264.685	0.070	75	1.50	13.50	450
20	265.679	0.110	75	1.01	13.30	350
25	266.958	0.070	75	1.07	13.30	450
30	267.952	0.050	75	1.43	13.40	525
35	268.805	0.070	75	1.01	14.00	425
40	269.858	0.130	75	0.11	13.60	325
45	271.235	0.150	75	0.17	10.20	300
50	272.726	0.130	75	0.24	8.60	325
55	274.103	0.130	75	0.31	7.20	325
60	275.480	0.130	75	0.61	5.90	325
65	276.856	0.130	75	0.85	6.20	325
70	278.233	0.130	76	0.91	6.50	325
75	279.615	0.130	76	0.96	6.50	325
80	280.997	0.130	76	1.01	6.20	325
85	282.379	0.130	76	0.96	6.30	325
90	283.761	0.130	76	1.00	5.80	325
95	285.143	0.130	76	0.82	5.20	325
100	286.524	0.130	76	0.90	4.80	325
105	287.906	0.130	76	0.90	4.50	325
110	289.288	0.130	76	0.10	4.50	325
115	290.670	0.130	76	0.76	4.30	325
120	292.057	0.130	76	0.70	4.10	325
125	293.434	0.130	76	0.69	4.10	325

TABLE 2---RAW DATA

CLIENT : Jotul TEST No. 5

MODEL: F118 Black Bear DATE: 31-Dec-14

METER CAL. FACTOR (Y) -------	0.903		Wt. WOOD BURNED(LB) -------	9.4	Lbs
BAROMETRIC PRESS.(Pb) -------	30.5	in Hg	WET,FUEL MOISTURE % -------	17.509	%
LEAK RATE POST (Lp) -------	0.000	cfm	Wt. PART. COLLECTED -------	0.0665	g
WATER VOL. (V1c) -------	47.2	Ml	METER VOLUME Vm -------	32.934	mcf
TEST TIME (MIN) -------	125	min	HC MOLE FRACTION -------	0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT : Jotul TEST No. 5

MODEL: F118 Black Bear DATE: 31-Dec-14

AVG DELTA H	-------	0.12	in H2O	AVG PRCNT CO	-------	0.80	%
AVG METER TEMP. Tm	-------	75	deg F	AVG PRCNT CO2	-------	8.29	%
AVG PPM SO2	-------	346	PPM	AVG BAL CO2/CO	-------	10.40	%

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul TEST No. 5

MODEL: F118 Black Bear DATE: 31-Dec-14

STD SAMPLE VOL. Vm(std) d) ------	29.91	dscf	STACK GAS FLOW Qsd -------	584.323	dscf/Hr
				9.74	& dscf/min
VOL. WATER VAPOR Vw(s td) -----	2.222	scf	PARTICULATE CONCTRT. C s ------	0.0022	g/dscf
PRCNT MSTR Bws -------	6.92	%	PARTC.EMISS. RATE E -------	1.30	g/Hr
BURN RATE BR -------	1.69	Kg/Hr	MOLES OF GAS PER Lb WOOD Nt ----	0.41	Lb-mole/Lb
CO EMISSION RATE -------	156.02	g/Hr	PART.EMISS. RATE ------	0.77	g/Kgdry fuel
	92.43	& g/Kgdry fuel			

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Jotul TEST No. : 5

MODEL: F118 Black Bear DATE: 31-Dec-14

TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR		PROPRTN RATE VAR. AVERAGE	
5	409.0	100		100	
10	406.6	100			
15	406.9	100			
20	406.5	100			
25	406.8	100			
30	406.5	100			
35	406.9	100			
40	406.7	100			
45	406.8	100			
50	406.6	100			
55	406.8	100			
60	406.8	100			
65	406.5	100			
70	406.4	100			
75	407.5	100			
80	407.5	100			
85	407.5	100			
90	407.5	100			
95	407.5	100			
100	407.2	100			
105	407.5	100			
110	407.5	100			
115	407.5	100			
120	408.9	100			
125	406.0	100			

METER BOX DATA SHEET PAGE # 2

Page: 1 of 2

UNIT: F118 RUN: 5 DATE: 12-31-14

Meter Box: 5H Y Factor: .903

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

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

Inject SO^2 @ 100 cc/min. Nozzle: Probe @ 3/8 " od Initial Volume: 1.50

ROTO: PRESS: .18 SAMPLING RATIO: 40 : 1 BP: 30.50

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1400	260.500	—	11.850	.15	75	300	75	20
5	05	262.000	—	11.850	.15	75	300	75	20
10	10	263.491	263.491	9.480	.09	75	375	75	20
15	15	264.685	264.685	7.900	.07	75	450	75	20
20	20	265.679	265.679	10.157	.11	75	350	75	20
25	25	266.958	266.958	7.900	.07	75	450	75	20
30	30	267.957	267.952	6.771	.05	75	525	75	20
35	35	268.805	268.805	8.365	.07	75	425	75	20
40	40	269.858	269.858	10.938	.13	75	325	75	20
45	45	271.235	271.235	11.850	.15	75	300	75	20
50	50	272.726	272.726	10.938	.13	75	325	75	20
55	55	274.103	274.103	10.938	.13	75	325	75	20
ROTO PRESS: .18			TOTALS:	118.937	1.30	900	BP.: 30.50		
60	1500	275.480	275.480	10.938	.13	75	325	75	20
65	05	276.856	276.856	10.938	.13	75	325	75	20
70	10	278.233	278.233	10.918	.13	76	325	76	20
75	15	279.615	279.615	10.918	.13	76	325	76	20
80	20	280997	280.997	10.918	.13	76	325	76	20
85	25	282.379	282.379	10.918	.13	76	325	76	20
90	30	283.761	283.761	10.918	.13	76	325	76	20
95	35	285.143	285.143	10.918	.13	76	325	76	20
100	40	286.524	286.524	10.918	.13	76	325	76	20
105	45	287.906	287.906	10.918	.13	76	325	76	20
110	50	289.288	289.288	10.918	.13	76	325	76	20
115	55	290.670	290.670	10.918	.13	76	325	76	20
			TOTALS:	131.056	1.56	910	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	249.993	2.86	1810	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 2 of 2

UNIT: F118 RUN: 5 DATE: 12-31-14

Meter Box: 5H" Y Factor: .903

Leak checks: 15 " Hg @ .006 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: 40 : 1 BP: 30.50

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1600	292.057	292.057	10.918	.13	76	325	76	20
125	05	293.434	293.434	10.918	.13	76	325	76	20
130				(21.836)	(.26)	(152)			
135									
140									
145									
150									
155									
160									
165									
170									
175									
ROTO PRESS:			TOTALS:				BP.:		
180									
185									
190									
195									
200									
205									
210									
215									
220									
225									
230									
235				271.829	3.12	1962			
			TOTALS:			75	MAX VACC =		20
TOTAL Cu Ft		32.934	TOTALS:	(10.455)	(.120)	(535)	AVG. BP:		30.50

1.26

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : F118 RUN : 5 DATE : 12-31-14

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

SCALE	WEIGHT
295.0 g	295.1
590.0 g	590.3
885.0 g	885.4

IMPINGER	# 1	# 2	# 3	# 4
FINAL WT	655.9	602.1	486.5	892.9
INITIAL WT	619.8	599.2	484.9	886.3
NET WT GRAMS	36.1	2.9	1.6	6.6

TOTAL CATCH : 47.2 GRAMS H_2O

FRONT HALF

FILTER #	145F	
FINAL WT g	.5385	
INITIAL WT g	.5078	
NET WT g	.0307	

BEAKER #	56
DESC.	ACETONE
FINAL WT g	106.8686
INITIAL WT g	106.8596
NET WT g	.0090
VOL. DESC. ml	100

BACK HALF

FILTER #	145B	
FINAL WT g	.3315	
INITIAL WT g	.3278	
NET WT g	.0037	

BEAKER #	57	58	59	60	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	97.4156	96.8885	105.3479	98.1966	
INITIAL WT g	97.4016	96.8824	105.3439	98.1922	
NET WT g	.0140	.0061	.0040	.0044	(.0088)
VOL. DESC ml	125	75	150	125	(275)

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 8-21-14 Time : 0942 By : KM

Manufacturer S & S Grade : # 25 Glass Front Size : 11 cm Lot No. : 6775627

Back Size: 8.2 cm Lot No. : 9465841

	DATE: 8-22-14	BY: KM	DATE: 8-26-14	BY: KM	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
141F	.5072	1025	.5070	0930	✓	
142F	.5136	1026	.5137	0931	✓	
143F	.5151	1027	.5151	0932	✓	
144F	.5153	1028	.5153	0933	✓	
145F	.5077	1029	.5078	0934	✓ ← R.S	
146F	.5164	1030	.5165	0935	✓	
147F	.5128	1031	.5128	0936	✓	
148F	.5154	1032	.5152	0937	✓	
149F	.5100	1033	.5101	0938	✓	
150F	.5136	1034	.5136	0939	✓	
141B	.3280	1035	.3280	0940	✓	
142B	.3235	1036	.3235	0941	✓	
143B	.3243	1037	.3244	0942	✓	
144B	.3247	1038	.3248	0943	✓	
145B	.3277	1039	.3278	0944	← R.S	
146B	.3287	1040	.3287	0945	✓	
147B	.3248	1041	.3249	0946	✓	
148B	.3260	1042	.3258	0947	✓	
149B	.3288	1043	.3289	0948	✓	
150B	.3251	1044	.3252	0949	✓	

Checked by: [signature] Date: 9-10-14 Time: 1039

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
8-22-14	1024	KM	64	78	46
8-26-14	0928	KM	62	70	47

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 9-8-14 Time : 1400 By : Chp

	DATE: 9-10-14	BY: KM	DATE: 9-11-14	BY: KM	DATE:	BY:
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
51	104.8665	1016	104.8665	0916	✓	
52	107.4901	1017	107.4900	0917	✓	
53	105.7213	1018	105.7273	0918	✓	
54	107.2968	1019	107.2973	0919	✓	
55	93.4780	1020	93.4785	0920	✓	
56	106.8591	1021	106.8596	0921	✓	
57	97.4012	1022	97.4016	0922	✓	
58	96.8823	1023	96.8824	0923	✓ R-5	
59	105.3434	1024	105.3439	0924	✓	
60	98.1917	1025	98.1922	0925	✓	
61	99.3395	1026	99.3400	0926	✓	
62	97.8582	1027	97.8587	0927	✓	
63	93.2053	1028	93.2056	0928	✓	
64	104.7797	1029	104.7798	0929	✓	
65	98.4342	1030	98.4338	0930	✓	
66	96.5004	1031	96.5009	0931	✓	
67	106.2153	1032	106.2156	0932	✓	
68	94.1467	1033	94.1472	0933	✓	
69	108.9840	1034	108.9844	0934	✓	
70	107.4708	1035	107.4712	0935	✓	
71	104.1446	1036	104.1449	0936	✓	
72	103.8188	1037	103.8192	0937	✓	
73	104.3474	1038	104.3479	0938	✓	
74	107.5001	1039	107.5005	0939	✓	
75	96.4575	1040	107.4580	0940	✓	

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH	
9-10-14	1015	CW	-	70	48	Checked by: CW
9-11-14	0915	CW	-	70	48	Date : 9-11-14
		CW	-			Time : 1015

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : F118 **RUN :** 3 **DATE :** 12-31-14 **Page :** 1 **of** 1

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
56	1-1-15	1100	CP	106.8686	1-2-15	1305	CP	106.8680	1-2-15	1536	CP				
57	1-1-15	1100	CP	97.4155	1-2-15	1306	CP	97.4155	1-2-15	1537	CP				
58	1-1-15	1100	CP	96.8887	1-2-15	1301	CP	96.8885	1-2-15	1538	CP				
59	1-1-15	1100	CP	105.3480	1-2-15	1302	CP	105.3479	1-2-15	1539	CP				
60	1-1-15	1100	CP	98.1966	1-2-15	1300	CP	98.1966	1-2-15	1540	CP				

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
145F	12-31	1700	CP	.5381	1-1-15	1105	CP	.5385	1-2-15	1310	CP				
145B	12-31	1700	CP	.3315	1-1-15	1106	CP	.3315	1-2-15	1311	CP				

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	1-1-15	1100	CP	65	40
2	1-2-15	1300	CP	66	41
3	1-2-15	1530	CP	67	42
4					
5					

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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 10-18-14 Through	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9997	10.0000	1.0000	.1000	CLP	10-18	1610	77	49
100.0002	10.0003	.9999	.1000	CLP	10-20	1100	74	47
100.0003	10.0000	1.0001	.0999	CLP	10-20	1410	75	48
100.0001	10.0003	1.0000	.0999	KM	10-22	1000	78	49
99.9999	10.0000	1.0000	.1000	CLP	10-23	0900	72	46
99.9997	9.9999	1.0000	.1000	CLP	10-24	1330	68	47
100.0000	10.0001	1.0001	.1000	CLP	10-25	1530	68	47
100.0000	10.0000	1.0000	.0998	KM	11-26	1005	73	47
99.9999	10.0001	1.0000	.0999	KM	11-27	1000	73	47
100.0003	10.0002	.9998	.0999	KM	11-28	1005	77	49
99.9995	10.0002	1.0000	.0999	CLP	11-29	0945	68	47
100.0000	10.0002	1.0000	.1000	CLP	11-30	1200	72	42
100.0000	9.9998	1.0000	.0998	CLP	12-1	1500	75	41
100.0000	10.0001	1.0000	.0999	CLP	12-3	1200	77	45
100.0000	10.0001	.9999	.0999	CLP	12-4	1130	74	47
99.9998	10.0001	.9999	.0997	CLP	12-4	1330	72	46
100.0001	10.0000	.9999	.1000	CLP	12-11	0930	70	48
100.0000	10.0000	1.0000	.0999	KM	12-12	1045	77	49
100.0000	10.0000	.9999	.0999	KM	12-13	1110	68	47
100.0000	10.0001	.9999	.0998	CLP	12-14	0945	66	49
100.0000	10.0000	.9999	.0997	CLP	12-15	1000	65	44
100.0003	9.9999	1.0001	.0999	CLP	12-15	1330	68	47
100.0000	10.0002	1.0000	.1000	KM	12-25	1345	74	47
100.0000	9.9999	1.0000	.1000	KM	12-26	0915	69	47
99.9995	9.9999	1.0000	.1000	CLP	12-27	1220	73	47
99.9995	9.9999	1.0000	.1000	CLP	12-28	0900	69	41
99.9996	9.9999	.9999	.0996	CLP	12-28	1110	71	45
100.0000	9.9999	1.0000	.1000	CLP	12-29	1000	66	45
99.9997	10.0000	.9999	.0997	CLP	12-29	1205	66	45
100.0000	10.0001	1.0002	.1000	CLP	1-1-15	1100	65	40
100.0000	10.0000	1.0000	.0999	CLP	1-2-15	1300	66	41
100.0000	10.0001	.9999	.0998	CLP	1-2-15	1530	67	42
100.0002	10.0001	.9999	.0998	CLP	1-4-15	1240	68	47
100.0003	10.0001	1.0002	.1000	CLP	1-4-15	1515	69	44

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 4-27-14 Through 10-17-14	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9996	9.9999	1.0000	.0999	Chp	4-27	1730	68	47
100.0000	10.0000	1.0000	.0999	Ch	5-21	0945	76	49
100.0000	9.9997	1.0000	.1002	Ch	5-22	0930	78	48
100.0005	10.0000	.9999	.0999	Chp	5-23	0740	77	46
100.0000	9.9999	1.0000	.1000	Ch	5-24	1330	74	47
99.9996	9.9999	1.0000	.1000	Chp	5-25	1100	72	46
100.0001	10.0000	1.0001	.0998	Ch	5-26	1115	73	47
100.0000	10.0000	1.0000	.0999	Chp	5-27	1115	78	46
100.0004	10.0000	1.0001	.0999	Ch	5-27	1330	74	47
100.0000	9.9999	.9999	.1000	Ch	7-3	0915	76	46
100.0000	10.0000	1.0000	.0999	Chp	7-4	0900	77	42
100.0000	10.0001	.9999	.0998	Ch	7-5	1230	77	49
100.0000	10.0001	1.0000	.0998	Ch	7-6	1510	76	48
100.0000	10.0000	1.0000	.0999	Chp	7-7	0820	70	48
100.0000	10.0001	.9999	.0999	Ch	7-9	0715	74	47
99.9995	9.9999	.9999	.0999	Ch	7-10	0945	75	44
100.0000	9.9999	.9999	.1000	Ch	7-10	1300	73	47
100.0001	10.0001	1.0001	.0998	Ch	7-14	1230	74	47
100.0000	9.9999	1.0000	.1000	Ch	715	0710	72	46
100.0000	10.0000	1.0000	.0998	Ch	8-21	0945	66	49
100.9998	10.0000	1.0000	.0998	KM	8-26	0920	69	47
100.0003	10.0000	1.0000	.1000	KM	9-11	0910	70	48
100.0000	10.0001	1.0001	.1000	KM	9-12	0905	72	42
100.0000	9.9999	.9999	.0999	KM	9-13	1000	73	47
100.0005	10.0001	1.0000	.1000	Chp	9-14	1015	68	47
100.0005	10.0000	1.0000	.0999	Chp	9-15	1030	68	47
99.9999	10.0000	.9999	.1000	KM	9-16	1010	77	49
99.9996	10.0000	1.0001	.1000	KM	9-16	1315	78	46
100.0000	10.0001	1.0000	.0999	KM	9-17	1010	70	48
100.0000	10.0000	1.0000	.1000	KM	9-19	0915	76	49
100.0000	10.0000	.9999	.0998	Chp	9-20	1000	71	49
100.0000	10.0001	1.0001	.0999	Ch	9-22	1000	72	46
100.0005	10.0000	.9999	.0999	Ch	9-22	1330	74	47
100.0000	10.0000	1.0000	.0998	KM	9-24	1120	78	46
100.0001	9.9999	1.0000	.1000	KM	9-25	1005	76	49
99.9998	9.9999	1.0000	.0999	KM	9-26	1105	76	49
100.0000	10.0001	.9999	.0999	KM	9-30	1120	78	49
99.9998	9.9999	.9999	.1000	KM	10-16	0945	76	49
100.0000	10.0001	1.0000	.1000	KM	10-17	0920	72	46

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 1-12-14 Through 4-22-14	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9995	10.0000	1.0001	.0999	CLp	1-12-14	1300	70	48
99.9995	9.9999	1.0000	.0997	CLp	1-13-14	1215	69	47
100.0000	9.9999	1.0001	.0999	CLp	1-23-14	0915	70	48
100.0000	9.9999	1.0000	.0999	CLp	1-31-14	1500	65	48
100.0000	9.9999	1.0000	.0999	CLp	2-4-14	1200	76	32
99.9997	9.9999	1.0001	.0999	CLp	2-5-14	1600	65	40
100.0000	9.9997	.9999	.1000	CLp	2-6-14	1600	65	36
100.0003	10.0000	1.0000	.0998	CLp	2-7-14	1530	65	40
100.0005	10.0001	1.0000	.0999	CLp	2-10-14	1115	65	48
100.0000	10.0000	1.0000	.0998	CLp	2-12-14	1315	76	48
100.0003	10.0002	1.0000	.0998	CLp	2-13-14	1130	75	48
99.9997	10.0001	1.0000	.1000	CLp	2-14-14	1500	66	49
99.9998	10.0001	1.0000	.0999	CLp	2-15-14	1015	69	44
100.0000	10.0001	1.0000	.0999	CLp	2-16-14	1500	68	47
100.0000	9.9999	1.0000	.0997	CLp	2-17-14	1530	74	44
99.9997	9.9998	1.0000	.1000	CLp	2-18-14	1130	65	48
100.0000	10.0000	1.0000	.1000	CLp	2-19-14	1130	70	41
100.0000	10.0000	1.0000	.0998	CLp	2-21-14	1445	72	42
100.0003	10.0002	.9999	.0997	CLp	2-23-14	1445	69	47
100.0006	10.0002	1.0001	.0999	CLp	2-25-14	1330	68	47
99.9999	10.0000	1.0000	.1000	CLp	2-26-14	1020	70	48
100.0005	10.0001	1.0001	.1000	CLp	2-27-14	1600	70	48
99.9996	9.9999	1.0000	.0998	CLp	3-1-14	1200	68	47
100.0000	10.0001	1.0000	.0999	CLp	3-2-14	1500	65	48
100.0000	10.0000	1.0000	.0999	CLp	3-3-14	1300	77	49
100.0000	10.0001	1.0000	.0999	CLp	3-4-14	1500	69	47
100.0000	10.0000	1.0000	.0999	CLp	3-5-14	1700	66	49
100.0000	9.9999	1.0001	.0999	CLp	3-19-14	1300	69	47
100.0000	10.0001	1.0000	.0999	CLp	3-21-14	1600	70	48
99.9995	10.0000	1.0000	.0999	CLp	3-23-14	1600	71	49
100.0000	10.0001	1.0000	.0998	CLp	3-24-14	1510	70	45
100.0004	10.0000	.9999	.0999	CLp	3-26-14	1645	70	48
99.9996	9.9999	1.0000	.1001	CLp	3-27-14	1145	66	49
99.9999	10.0002	1.0000	.0998	CLp	3-29-14	1200	65	48
100.0004	10.0000	.9999	.0998	CLp	4-22-14	1000	73	47
100.0000	10.0001	.9999	.0999	CLp	4-24-14	1030	76	49
99.9995	9.9999	.9999	.0998	CLp	4-25-14	1140	75	48
100.0000	9.9998	1.0000	.0999	CLp	4-26-14	1600	72	46
99.9995	9.9998	.9999	.0999	CLp	4-27-14	1130	65	48

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 3-6-13 Through 1-11-14	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	9.9999	1.0000	.0999	CP	3-6-13	1100	65	48
100.0000	10.0001	1.0000	.1000	CP	3-7-13	1700	68	47
99.9998	10.0002	1.0001	.1000	CP	3-9-13	1500	67	46
100.0001	10.0000	1.0000	.1000	CP	3-11-13	1540	75	41
100.0000	10.0002	1.0000	.0999	CP	3-12-13	1520	76	45
100.0000	9.9999	.9998	.0998	CP	3-19-13	1400	67	46
100.0000	10.0000	1.0000	.0998	CP	3-20-13	1600	74	47
100.0000	10.0001	1.0000	.1000	CP	6-18-13	1430	78	49
100.0000	10.0001	1.0000	.0998	CP	6-19-13	0900	76	49
99.9995	10.0000	.9998	.0998	CP	6-20-13	0820	66	49
99.9996	9.9999	1.0000	.0999	CP	6-21-13	1330	74	47
100.0003	9.9999	1.0000	.0998	CP	6-22-13	0930	76	49
99.9995	9.9999	.9999	.1000	CP	6-23-13	1510	74	47
100.0001	10.0001	1.0000	.0998	CP	6-24-13	1230	70	48
100.0000	10.0000	1.0000	.0999	CP	6-25-13	1400	70	48
99.9993	9.9999	1.0000	.0998	CP	6-26-13	1900	65	48
100.0000	9.9996	1.0001	.0998	CP	7-12-13	1500	72	47
100.0000	9.9999	1.0000	.0998	CP	7-14-13	1400	77	49
100.0005	10.0002	1.0000	.1000	CP	7-15-13	1600	78	48
100.0000	9.9997	1.0000	.1001	CP	7-16-13	1530	78	46
100.0003	10.0000	.9999	.0998	CP	7-17-13	0730	74	47
100.0003	9.9999	1.0000	.1000	CP	7-18-13	1600	78	46
100.0000	9.9999	.9999	.0999	CP	7-19-13	1415	72	46
100.0000	10.0001	.9999	.1001	CP	7-20-13	0800	74	47
100.0000	10.0000	1.0000	.0999	CP	7-21-13	1300	68	47
100.0000	10.0000	1.0000	.0998	CP	7-22-13	1300	70	48
100.0003	9.9998	1.0001	.1000	CP	7-23-13	1230	72	46
100.0000	9.9999	1.0000	.0999	CP	11-15-13	1530	72	46
100.0001	10.0001	.9999	.0999	CP	11-16-13	1035	72	46
99.9997	9.9999	1.0000	.0999	CP	11-17-13	1000	72	46
99.9997	10.0000	.9999	.0998	CP	11-18-13	1400	72	46
100.0000	10.0000	1.0000	.0999	CP	11-20-13	1100	66	49
100.0000	9.9999	1.0001	.0999	CP	11-21-13	1000	70	41
100.0000	9.9999	1.0000	.0998	CP	11-22-13	1730	67	46
100.0000	10.0000	.9998	.0999	CP	11-25-13	1500	70	44
100.0001	10.0000	.9999	.0999	CP	11-26-13	1600	68	47
100.0000	10.0002	.9997	.1001	CP	1-7-14	1630	72	47
99.9997	10.0000	1.0001	.0999	CP	1-9-14	1230	76	42
100.0002	10.0001	.9999	.1000	CP	1-11-14	1800	70	48

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 10-10-12 Through 3-6-2013	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9997	10.0000	1.0000	.0999	CP	10-10-12	1615	75	48
100.0000	10.0001	1.0001	.0999	CP	10-12-12	1230	77	46
99.9997	10.0000	.9999	.0999	CP	10-13-12	0830	77	49
100.0005	10.0000	.9999	.0999	CP	10-14-12	1030	78	46
100.0005	10.0002	.9999	.0998	CP	10-15-12	1000	78	48
100.0001	10.0002	1.0000	.1000	CP	10-16-12	1600	78	49
99.9996	9.9999	.9999	.1000	CP	10-17-12	0900	69	47
100.0000	9.9999	1.0006	.1000	CP	10-18-12	1330	78	37
100.0002	10.0000	.9999	.0999	CP	10-19-12	1130	78	46
100.0001	10.0001	.9999	.0999	CP	10-20-12	1400	78	48
99.9999	10.0001	.9998	.0999	CP	10-21-12	1800	65	48
100.0000	10.0001	1.0001	.0999	CP	10-24-12	1900	65	48
100.0000	9.9998	1.0001	.0998	CP	10-26-12	1750	70	48
100.0001	10.0000	1.0000	.0999	CP	10-29-12	1745	73	47
100.0000	10.0000	1.0000	.0999	CP	11-5-12	1030	74	47
99.9998	10.0000	1.0000	.0999	CP	11-6-12	1000	73	47
100.0000	10.0001	1.0000	.0999	CP	11-7-12	1030	73	47
100.0000	10.0000	1.0000	.1000	CP	11-8-12	0930	66	45
100.0000	9.9999	.9999	.0999	CP	11-12-12	1030	72	42
100.0000	10.0000	1.0000	.1000	CP	11-13-12	1000	71	45
100.0000	10.0000	1.0000	.0999	CP	11-29-12	0910	74	47
100.0000	10.0000	1.0000	.1000	CP	12-1-12	1800	66	49
100.0000	9.9999	1.0001	.0999	CP	12-2-12	1130	67	46
100.0000	10.0000	.9999	.0999	CP	12-3-12	0915	72	46
100.0004	10.0000	1.0000	.1001	CP	12-4-12	1700	69	47
99.9997	9.9999	.9999	.0999	CP	12-5-12	1045	74	44
99.9999	10.0000	1.0000	.0998	CP	12-6-12	1400	66	49
100.0000	9.9999	.9999	.0998	CP	12-7-12	1730	65	48
100.0002	10.0001	1.0000	.1000	CP	12-9-12	1400	66	49
100.0002	10.0001	.9999	.1000	CP	12-10-12	1500	66	49
100.0000	9.9999	1.0001	.0999	CP	12-21-13	1020	78	44
100.0000	9.9998	1.0001	.0999	CP	12-23-13	1900	72	46
99.9995	10.0001	1.0000	.0999	CP	12-24-13	1700	72	46
100.0000	9.9999	.9999	.1000	CP	12-25-13	1000	73	43
100.0000	9.9998	1.0000	.0999	CP	12-26-13	1600	66	49
100.0000	10.0002	1.0000	.0999	CP	12-27-13	0915	67	46
100.0000	10.0001	1.0000	.0999	CP	12-28-13	1530	76	42
100.0000	10.0001	1.0000	.0999	CP	3-2-13	1600	73	47
100.0000	9.9999	.9999	.0998	CP	3-4-13	1900	71	41

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 1-14-2012 Through 9-17-12	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	10.0000	1.0000	.0999	CA	1-14-12	1300	70	48
100.0002	10.0001	1.0001	.1000	CA	1-15-12	1330	68	47
99.9997	10.0000	1.0001	.1000	CA	1-17-12	1030	73	47
99.9997	10.0001	1.0000	.1000	CA	1-18-12	0915	74	44
99.9999	10.0002	1.0001	.1001	CA	1-19-12	1015	70	44
100.0001	10.0001	1.0001	.0998	CA	1-25-12	1600	72	46
99.9999	9.9998	1.0001	.1000	CA	1-26-12	1500	70	48
99.9995	9.9999	1.0000	.0999	CA	1-28-12	1400	70	41
100.0000	10.0000	1.0000	.0999	CA	2-4-12	1500	73	60
100.0000	10.0003	.9999	.0999	CA	2-6-12	1200	69	44
100.0000	10.0000	.9999	.0998	CA	2-7-12	1030	67	42
100.0000	9.9999	1.0001	.0999	CA	2-10-12	1630	78	49
100.0000	10.0001	1.0000	.1000	CA	2-11-12	1630	72	46
99.9997	10.0002	1.0000	.1001	CA	2-12-12	1530	73	47
100.0000	10.0000	.9999	.0999	CA	2-13-12	1100	78	46
99.9995	10.0000	.9999	.0999	CA	2-14-12	1000	76	45
100.0000	9.9999	.9999	.1000	CA	2-15-12	1120	70	44
99.9999	10.0000	1.0000	.0999	CA	2-17-12	1415	73	47
99.9999	10.0000	1.0000	.0998	CA	2-19-12	1600	70	44
99.9997	9.9999	1.0000	.0999	CA	2-20-12	1200	70	48
100.0004	10.0001	1.0000	.1000	CA	2-23-12	1000	73	47
100.0000	9.9997	1.0000	.0999	CA	2-24-12	1015	78	46
100.0000	10.0000	1.0000	.1001	CA	2-25-12	1715	65	43
100.0000	9.9996	1.0000	.0999	CA	2-27-12	1000	70	44
100.0000	10.0000	1.0001	.1002	CA	2-28-12	1125	75	41
99.9997	10.0000	1.0000	.1000	CA	2-29-12	1110	68	43
99.9995	9.9999	.9999	.0997	CA	3-1-12	1330	68	47
99.9996	10.0000	1.0000	.0998	CA	3-2-12	1430	71	45
99.9995	9.9999	1.0000	.0999	CA	3-3-12	1430	72	42
99.9999	10.0000	.9999	.0999	CA	9-2-12	0945	77	46
100.0000	10.0000	1.0000	.1000	CA	9-3-12	1030	71	49
100.0002	9.9999	1.0000	.0998	CA	9-4-12	1000	77	49
100.0000	10.0000	1.0000	.0999	CA	9-5-12	0945	78	46
100.0000	10.0002	1.0000	.0999	CA	9-6-12	1130	76	49
99.9997	10.0001	1.0002	.0999	CA	9-7-12	1400	76	49
100.0000	10.0001	1.0000	.0999	CA	9-8-12	1200	71	49
100.0000	10.0002	1.0000	.1001	CA	9-15-12	1410	78	48
100.0000	10.0000	1.0000	.1000	CA	9-16-12	1700	78	48
100.0000	10.0000	.9999	.0999	CA	9-17-12	1330	75	48

BLANK PROCESSING DATA SHEET # 5

UNIT : F118 Black Bear RUN : 5 DATE : 12-31-14

BLANKS DONE : 9-8-12

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	108.9013	106.3080	106.9659
TARE WEIGHT	108.9005	106.3061	106.9637
NET WEIGHT	.0008	.0019	.0022

TARE BEAKERS INTO DESC : TIME : 1015 DATE : 8-31-12

DATE : 9-2 BY : CP DATE : 9-3 BY : CP DATE : BY :

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9002	1016	108.9005	1046		
B	106.3058	1017	106.3061	1047		
C	106.9641	1018	106.9637	1048		

FINAL BEAKERS INTO DESC : TIME : DATE :

DATE : 9-6 BY : CP DATE : 9-7 BY CP DATE : BY :

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9016	1148	108.9013	1415		
B	106.3077	1149	106.3080	1416		
C	106.9661	1150	106.9659	1417		

TARE QC

DATE	TIME	BY	WB	DB	%
9-2	0945	CP	5	77	46
9-3	1030	CP	5	71	49

FINAL QC

DATE	TIME	BY	WB	DB	%
9-6	1130	CP	5	76	49
9-7	1400	CP	5	76	49

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT: F118 Black Bag RUN: 5 DATE: 12-31-14

BLANK CALCULATIONS

Acetone: .0008 g ÷ 200 ml = .000004 g/ml

Dicholoromethane: .0019 g ÷ 75 ml = .000025 g/ml

Distilled Water: .0022 g ÷ 200 ml = .000011 g/ml

FRONT HALF CATCH

FILTERS: .0307 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0307 g

BEAKERS: .0090 (Total Catch) g - 100 (ml Acetone) (.0004 / .000004 g) (Blank Value / ml Acetone) = .0086 g

TOTAL FRONT HALF CATCH : .0393 g

BACK HALF CATCH

FILTERS: .0037 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0037 g

BEAKERS:

Acetone: .0140 (Total Catch) g - 125 (ml Acetone) (.0005 / .000004 g) (Blank Value / ml Acetone) = .0135 g

Extract: .0061 (Total Catch) g - 75 (ml Dichloromethane) (.0019 / .000025 g) (Blank Value / Dichloromethane) = .0042 g

Water: .0088 (Total Catch) g - 275 (ml Water) (.0030 / .000011 g) (Blank Value / Water) = .0058 g

TOTAL BACK HALF CATCH : .0272 g

TOTAL CATCH : .0665 g

% FRONT HALF : 59.10 %

CALCULATIONS DATA SHEET # 7

UNIT : JOTUL F118 RUN : 3 DATE : 12-26 -2014

1) $Vm(std) = \dfrac{(32.934 \text{ Vm})(17.64)(.903 \text{ mcf})\left(30.50 \text{ " Hg} + \dfrac{.120 \text{" } H_2O}{13.6}\right)}{(535 \text{ TmA})} = \dfrac{29.9159}{000.0000}$ dscf

2) $Vw(std) = (.04707)(47.2 \text{ ml } H_2O) = \dfrac{2.2217}{00.0000}$ scf

3) $Asw = \dfrac{(2.2217 \text{ scf})}{(2.2217 \text{ scf} + 29.9159 \text{ dscf})} = \dfrac{.0691}{.0000}$ Bws × 100 = $\dfrac{6.9131}{00.0000}$ % H_2O

4) $Cs = \dfrac{(.0665 \text{ g.})}{(29.9159 \text{ dscf})}(15.43) = \dfrac{.0343}{0.0000}$ gr / dscf

5) Estimated g / hr = $\dfrac{(.0665 \text{ g.})}{(29.9159 \text{ dscf})}\left(\dfrac{10.455}{00.0000} \text{ dscfm}\right)(60) = \dfrac{1.3944}{00.0000}$ 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 : F118 Black Bear RUN : 5 DATE : 12-3H4

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

Wet Bulb / Dry Bulb

Pre : WB : 50 DB : 71 = 24.0 % RH .50 % H_2O

Post : WB : 52 DB : 73 = 22.0 % RH .60 % H_2O

Average : 21.0 % RH .55 % H_2O

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

Kindling Weight (lbs) : Paper : 1.1 Wood : 1.6

Preburn Fuel Weight : 8.3 - 7.4 + 8.6 Total : 24.3

Kindling & Preburn Fuel Weight (wood only) (lbs) : **Total** : 25.9

Coal Bed Wt Range (lbs) : 2.3 - 1.9 **Scale** : 2.3 - 1.9

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

Lower : .20 x fuel weight : Always round UP to nearest tenth **Actual Coal Bed Weight** : 2.3

Maximum Coal Bed Removal (lbs) : ((2.3 (Upper) + 1.9 (Lower)) ÷ 2) .25 = .5 (round down to nearest tenth)

Test Fuel (.75" x 1.5" x 5" spacers) = 16 pcs

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" x 4"	18	4	9.4	100.0
4" x 4"	—	—	—	—

Test Fuel Weight : 9.4 lbs

Estimated Dry Burn Rate :

$$\frac{9.4 - (9.4 \times .17525)}{2.2046} \times \frac{60}{\frac{125}{\text{TIME}}} = 1.688 \text{ kg / hr}$$

Estimated BTU's/hr : 19,140 x $\frac{63}{100}$ x $\frac{1.688}{\text{DBR}}$ = 20354.2 BTU's/hr

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

WOOD STOVE OPERATING DATA PAGE #9

Unit : F114 Black Bear Run : 5 Date : 12-31-14

FIRE STARTED: 1010

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 25 sec.

TEST:

DOOR wide open during loading 00 min. 40 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 during preburn

ON / OFF first ALL minutes of test

ON / OFF balance of test run

Fan speed set at N/A

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 8 or 16 inches.

1st warm up / pre-burn fuel charge (8.3 lbs.) added at 1015

2nd warm up / pre-burn fuel charge (7.4 lbs.) added at 1115

3rd warm up / pre-burn fuel charge (8.6 lbs.) added at 1205

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 F118 Run : 5 Date : 12-31-2014

Room Temperature : 69 °F Temperature Correction Set? : (Yes) No

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

Time Test Fuel moisture reading taken : 1230

pc #	Dimen.	Use	TOP	BOTTOM	SIDE	Avg Corrected
1	2"×4"×8'	K	15.2	15.1	14.8	15.033
2						
3						
4	2"×4"×8'	P	22.6	23.0	23.0	22.9
5	2"×4"×8'	P	19.9	20.0	20.0	20.0
6	2"×4"×8'	P	18.1	18.7	19.2	18.7
7	2"×4"×8'	P				(61.6)
8	2"×4"×8'	P				
9						
10						
11						
12	2"×4"×18"	T	21.1	18.9	18.5	19.5
13	"	T	20.6	20.1	20.2	20.3
14	"	T	18.9	21.0	22.6	20.8
15	"	T	24.2	24.2	24.6	24.3
16						(84.9)
17						
18						
19						
20	Spacers	T	21.6	22.3	22.4	22.1

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	15.033 %	20.533 %	21.225 %
Wet Moisture % :	13.068 %	17.035 %	17.509 %

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: 2.3 DATE: 12-31-14

UNIT: T-118 Black Bear RUN: 5 PAGE: 1 OF 1

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
0 1400	11.7	9.4	—	.218	5.4	.590	14.8	.064	.64	-.043	300
5 05	11.4	9.1	.3	.568	14.2	.243	6.1	.105	.52	-.055	300
10 10	10.2	7.9	1.2	.556	13.9	.214	5.4	.153	1.53	-.059	375
15 15	9.1	6.8	1.1	.540	13.5	.232	5.8	.150	1.50	-.060	450
20 20	8.2	5.9	.9	.532	13.3	.260	6.5	.101	1.01	-.060	350
25	7.3	5.0	.9	.533	13.3	.257	6.4	.107	1.07	-.060	450
30 30	6.6	4.3	.7	.537	13.4	.239	6.0	.143	1.43	-.060	525
35	5.7	3.4	.9	.560	14.0	.232	5.8	.101	1.01	-.060	425
40 40	4.9	2.6	.8	.545	13.6	.284	7.1	.012	.11	-.060	325
45	4.4	2.1	.4	.407	10.2	.417	10.4	.018	.19	-.058	300
50 50	4.2	1.9	.2	.345	8.6	.478	12.0	.025	.24	-.055	325
55	4.0	1.7	.2	.289	7.2	.531	13.3	.032	.31	-.052	325
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.682	*****
60 1500	3.9	1.6	.1	.235	5.9	.571	14.3	.061	.61	-.049	325
65	3.7	1.4	.2	.248	6.2	.549	13.8	.085	.85	-.049	325
70 10	3.6	1.3	.1	.260	6.5	.535	13.4	.091	.91	-.045	325
75	3.4	1.1	.2	.259	6.5	.533	13.3	.096	.96	-.045	325
80 20	3.3	1.0	.1	.249	6.2	.543	13.6	.101	1.01	-.045	325
85	3.1	.8	.2	.252	6.3	.541	13.5	.096	.96	-.044	325
90 30	3.0	.7	.1	.234	5.8	.559	14.0	.100	1.00	-.043	325
95	2.9	.6	.1	.211	5.2	.590	14.8	.082	.82	-.042	325
100 40	2.8	.5	.1	.194	4.8	.603	15.1	.090	.90	-.041	325
105	2.7	.4	.1	.183	4.5	.615	15.4	.090	.90	-.041	325
110 50	2.6	.3	.1	.180	4.5	.611	15.3	.101	1.01	-.041	325
115	2.5	.2	.1	.174	4.3	.629	15.7	.076	.76	-.041	325
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.526	*****
120 1100	2.4	.1	.1	.166	4.1	.639	16.0	.070	.70	-.038	325
125	2.3	0	.1	.164	4.1	.640	16.0	.069	.69	-.038	325
130 10											
135										-.076	
140 20											
145											
150											
155											
160											
165											
170										-1.284	
175											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****		*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.049	*****

:26

PREBURN DATA SHEET #13

UNIT: F118 Black Bear RUN: 5 DATE: 12-31-14 PAGE: 1 of 1

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
0 1243	5.2	-	460	499	498	333	376	409			68	-.041	PREBURN START: # 2,9 UP
5 50	4.7	.5	420	486	498	335	353	405			68	-.058	COAL BED SCALE RANGE:
10 55	4.2	.5	406	421	501	331	396	404			69	-.057	2.3 → 1.9.
15 1300	4.0	.2	371	475	501	329	414	403			69	-.055	PRIMARY AIR: 5/32"
20 05	3.8	.2	342	447	506	327	436	405			69	-.052	SECONDARY AIR: N/A
25 10	3.5	.3	335	434	513	326	443	413			69	-.051	FAN: N/A
30 15	3.3	.2	327	426	520	325	454	420			70	-.050	PUMPS ON AT:
35 20	3.2	.1	286	370	498	324	439	425			70	-.047	CHECK WB/DB:
40 25	3.1	.1	288	372	486	322	430	423			70	-.046	
45 30	3.0	.1	278	355	485	316	412	430			70	-.045	
50 35	2.9	.1	273	341	489	312	403	439			70	-.045	
55 40	2.7	.2	269	330	495	307	403	457			70	-.044	
*****	****	***	****	*****	*****	****	*****	*****	*****	*****	*****	****	
60 1345	2.6	.1	265	323	495	305	398	471			70	-.043	
65 50	2.5	.1	261	313	482	305	388	478			67	-.043	
70 55	2.4	.1	244	313	454	296	385	458			68	-.043	
75 1400	23	.1	251	305	427	290	384	432			68	-.043	
80													
85													
90													

Unit:Jotul F118 Black Bear

Temperature Data Sheet #14

Run-5
12-31-14

Time	Stack	Top	Left Side	Back	Right Side	Bottom	Firebox	Secondary	Ambient	Furnace	Sample Box	Bucket	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	251	305	427	290	384	432	#######	#######	68	1367	231	52	N/A	35	33
5	341	308	382	279	352	413	#######	#######	68	1353	233	39		35	33
10	440	430	360	266	343	393	#######	#######	67	1336	235	39		35	33
15	444	486	393	260	371	376	#######	#######	68	1323	238	40		35	34
20	430	517	420	256	391	364	#######	#######	68	1313	240	41		35	35
25	419	534	449	254	415	355	#######	#######	68	1305	242	40		35	36
30	412	541	459	254	428	351	#######	#######	70	1298	243	39		36	37
35	416	544	472	255	437	349	#######	#######	71	1291	244	40		36	37
40	454	573	514	265	479	349	#######	#######	71	1287	246	40		37	38
45	427	560	554	279	505	354	#######	#######	72	1287	248	39		37	38
50	374	516	570	298	519	362	#######	#######	72	1288	248	40		38	38
55	338	472	565	312	521	372	#######	#######	73	1289	242	41		38	38
60	309	433	553	321	508	381	#######	#######	72	1291	238	41		38	38
65	292	401	527	324	486	388	#######	#######	72	1290	236	41		38	39
70	285	377	510	323	469	392	#######	#######	72	1288	235	42		38	39
75	279	359	505	322	461	396	#######	#######	72	1288	234	42		37	39
80	273	345	500	322	455	400	#######	#######	71	1288	234	42		37	39
85	268	334	491	321	451	403	#######	#######	71	1288	232	42		37	39
90	265	324	485	322	450	406	#######	#######	69	1285	232	42		37	38
95	261	316	475	319	441	409	#######	#######	69	1284	231	42		37	38
100	255	307	452	315	424	408	#######	#######	69	1282	230	43		36	38
105	247	298	436	310	404	405	#######	#######	69	1279	230	43		36	37
110	239	289	420	303	387	401	#######	#######	68	1275	230	43		36	37
115	233	281	409	296	376	398	#######	#######	69	1272	230	43		35	37
120	227	273	396	289	366	399	#######	#######	68	1271	231	43		35	37
125	222	265	386	283	359	401	#######	#######	68	1270	232	43		35	36

Unit:Jotul F118 Black Bear

Run-5
12-31-14

TEMPERATURE DATA SHEET #14A

		TEST TIME	125		
STACK	323	TOP AVG	400	LT SIDE AVG	466
BACK AVG	294	RT SIDE AVG	430	BOTTOM AVG	387
FIREBOX AVG	########	SEC/CAT AVG	########	AMBIENT AVG	70

END	338.8	
START	367.8	
	-29	DELTA T

CIRCLE: LOSE / GAIN

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 12-31-14 Analyte : CO_2 (15-1)

Unit : F 118 Run # : 5

Zero Cyl. # : ~~IC3AAM173~~ Conc. : 0.00 % CO_2 Cyl. Press. : 1980 PSI

Certified by : AIR LIQUIDE Date : 2-14-13

Span Cyl. # : 487905 Conc. : 12.20 % CO_2 Cyl. Press. : 1340 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % CO_2

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

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

PRE RUN Audit : by : [signature] Time : 1050 Temp : 69 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-.052	-.052	-.209
SPAN	48.8	.488	12.20	48.8	.488	12.195	-.005	-.019

POST RUN Audit : by : [signature] Time : 1130 Temp : 71 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.001	-.027	-.027	-.108
SPAN	48.8	.488	12.20	48.6	.486	12.145	-.055	-.220

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

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

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

ZERO / SPAN CHECK DATA SHEET #15-2

Date : 12-31-14 Analyte : O_2 (15-2)

Unit : F118 Run # : 5

Zero Cyl. # : IC3AAM173 Conc. : 0.00 % O_2 Cyl. Press. : 1980 PSI

Certified by : AIR LIQUIDE Date : 2-14-13

Span Cyl. # : 487905 Conc. : 12.60 % O_2 Cyl. Press. : 1340 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 : Cy Dearing Time : 1050 Temp : 69 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-.020	-.020	-.081
SPAN	12.60	.504	12.6	12.6	.504	12.613	.013	.054

POST RUN Audit : by : Cy Dearing Time : 1630 Temp : 71 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.002	.030	.030	.119
SPAN	12.60	.504	12.6	12.6	.505	12.638	.038	.154

± 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 : 12-31-14 Analyte : CO (15-3)

Unit : F118 Run # : 5

Zero Cyl. # : JC3AAM173 Conc. : 0.00 % CO Cyl. Press. : 1980 PSI

Certified by : AIR LIQUIDE Date : 2-14-13

Span Cyl. # : CA487905 Conc. : 4.90 % CO Cyl. Press. : 1340 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 : Clp Vartanian Time : 1050 Temp : 69 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	000	,000	-.011	-.011	-.106
SPAN	49.0	.490	4.90	49.0	,490	4.931	,031	,313

POST RUN Audit : by : Clp Vartanian Time : 1630 Temp : 71 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	,001	-.001	-.001	-.005
SPAN	49.0	.490	4.90	49.0	,490	4.931	,031	,315

± 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 : 12-13-14 Analyte : SO_2 (15-4)

Unit : F118 Run # : 5

Zero Cyl. # : TC3AAM173 Conc. : 0.00 ppm SO_2 Cyl. Press. : 1980 PSI

Certified by : AIR LIQUIDE Date : 2-14-13

Span Cyl. # : CC82089 Conc. : 1250 ppm SO_2 Cyl. Press. : 1580 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 : Clp Workman Time : 1050 Temp : 69 ° F

AUDIT RESULTS

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

POST RUN Audit : by : Clp Workman Time : 1632 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	1.305	1.305	.052
SPAN	50.0	.500	1250	50.3	.503	1255.5	5.500	.220

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

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

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

QUALITY CHECKS DATA SHEET # 16

UNIT : F118 Black Bear RUN : 5 DATE : 12-31-14

Thermocouple Check:

T/C # 1	— °F	T/C # 13	34.8 °F
T/C # 2	— °F	T/C # 14	35.2 °F
T/C # 3	34.9 °F	T/C # 15	34.6 °F
T/C # 4	34.9 °F	T/C # 16	42.4 °F
T/C # 5	34.9 °F	T/C # 17	42.4 °F
T/C # 6	35.2 °F	T/C # 18	36.1 °F
T/C # 7	35.2 °F	T/C # 19	— °F
T/C # 8	34.8 °F	T/C # 20	— °F
T/C # 9	— °F	T/C # 21	— °F
T/C # 10	— °F	T/C # 22	— °F
T/C # 11	34.6 °F	T/C # 23	— °F
T/C # 12	34.5 °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 .2 °F Difference .010 %

SPAN 1999.5 °F Adj. to 2000 °F SPAN 2000.7 °F Difference .035 %

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 200.1 °F	400	= 399.8 °F
600	= 599.7 °F	800	= 799.6 °F	1000	= 999.6 °F
1200	= 1199.5 °F	1400	= 1399.2 °F	1600	= 1599.2 °F
1800	= 1799.4 °F	2000	= 2000 °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 : 12.5 - 2.5 = 10.0

Post : 12.3 - 2.3 = 10.0

Stack Cleaned Prior to Test Run : YES ____ NO X

COMPUTER INPUT DATA SHEET #1

3.09

Client: JOTUL U.S.A. Inc.

Address: 55 Hutchinson
Gorham, ME 04038

Phone: (207) 797-5912 Fax: (207) 772-0523

Run No.: 4 Date of Test: 12-27-2014 Burn Rate: 1.784

Model No.: JOTUL F118 Black Bear ☐ min ☐ min-1.25 ☐ fan

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

Dry Gas Meter Y Factor: .903 (0.000) (Data Sheet #2) Post Leak Rate: .000 cfm (.000) (Data Sheet #2) Time: 115 min. (000) (Data Sheet #2)

Dry Gas Meter Volume: 30.201 cf (00.000) (Data Sheet #2)

Stack Flow: 11.973 dscfm (00.000) (Data Sheet #2) Δ H: .112 in. H_2O (.000) (Data Sheet #2)

Maximum Vac.: 2.0 (0.0) (Data Sheet #2) Barometric Pressure: 30.12 in. Hg (00.00) (Data Sheet #2)

H_2O Captured: 43.6 g (00.0) (Data Sheet #3)

Front Half Catch % Of Total: 33.0 % (00.0) (Data Sheet #6) Total Particulate Catch: .1185 g (0.0000) (Data Sheet #6)

Flue Gas Moisture: .64264 % (00.000) (Data Sheet #7)

Particulate Emission: .0612 gr/dscf (0.0000) (Data Sheet #7)

Relative Humidity: 49.5 % RH (00.0) (Data Sheet #8) Ambient Moisture: 1.45 % H_2O (0.00) (Data Sheet #8)

Preburn Fuel Wt.: 29.9 lbs. (00.0) (Data Sheet #8) Coal Bed Wt.: 2.3 lbs. (00.0) (Data sheet #8) Test Fuel Wt.: 9.2 lbs. (00.0) (Data sheet #8)

Heat Output (EPA Default): 21511.8 BTU/hr (00,000.0) (Data Sheet #8)

Kindling Fuel % Moisture (wet): 11.764 % (00.000) (Data Sheet #10) Pretest Fuel % Moisture (wet): 17.196 % (00.000) (Data Sheet #10)

Test Fuel % Moisture (dry): 22.025 % (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove]) Test Fuel % Moisture (wet): 18.050 %

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

Stack Static Pressure: -.046 in. H_2O (+/- .000) (Data Sheet #12)

Average Ambient Temperature: 75 °F (00) (Data Sheet #14) Stove Temperature Change: +.9 °F (+/- 000.0) (Data Sheet #14)

TEST START 1500
END 1655

METER TEMP 540

TABLE 1 ----- RAW DATA

CLIENT : Jotul TEST No. : 4

MODEL: F118 Black Bear DATE: 21-Dec-14

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	230.000	0.150	79	0.86	5.40	250
5	231.500	0.240	80	0.20	3.30	200
10	233.404	0.120	80	0.28	3.50	275
15	234.789	0.100	80	0.26	9.40	300
20	236.059	0.060	80	1.41	10.60	400
25	237.012	0.090	80	0.82	10.90	325
30	238.185	0.090	80	0.84	11.90	325
35	239.357	0.090	80	0.93	12.30	325
40	240.529	0.060	80	1.46	13.30	400
45	241.482	0.070	80	0.25	12.70	375
50	242.498	0.150	80	0.04	8.40	250
55	244.022	0.120	80	0.39	6.50	275
60	245.408	0.120	80	0.70	5.40	275
65	246.794	0.120	80	0.78	5.30	275
70	248.181	0.120	80	0.84	5.30	275
75	249.568	0.120	80	0.86	5.30	275
80	250.955	0.120	80	0.81	5.20	275
85	252.342	0.120	80	0.97	5.00	275
90	253.728	0.120	80	1.06	4.80	275
95	255.115	0.100	80	0.97	5.00	300
100	256.387	0.100	80	0.39	6.80	300
105	257.658	0.100	80	0.75	6.00	300
110	258.929	0.100	80	1.01	4.50	300
115	260.201	0.100	80	1.07	4.10	300

TABLE 2---RAW DATA

CLIENT : Jotul TEST No. 4

MODEL: F118 Black Bear DATE: 21-Dec-14

METER CAL. FACTOR (Y) -------	0.903		Wt. WOOD BURNED(LB) -------	9.2	Lbs
BAROMETRIC PRESS.(Pb) -------	30.12	in Hg	WET,FUEL MOISTURE % -------	18.05	%
LEAK RATE POST (Lp) -------	0.000	cfm	Wt. PART. COLLECTED -------	0.1185	g
WATER VOL. (V1c) -------	43.6	Ml	METER VOLUME Vm -------	30.201	mcf
TEST TIME (MIN) -------	115	min	HC MOLE FRACTION -------	0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT : Jotul TEST No. 4

MODEL: F118 Black Bear DATE: 21-Dec-14

****

AVG DELTA H	-------	0.11	in H2O	AVG PRCNT CO	-------	0.75	%
AVG METER TEMP. Tm	-------	80	deg F	AVG PRCNT CO2	-------	7.12	%
AVG PPM SO2	-------	297	PPM	AVG BAL CO2/CO	-------	9.52	%

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul TEST No. 4

MODEL: F118 Black Bear DATE: 21-Dec-14

STD SAMPLE VOL. Vm(std) d) ------	26.86	dscf	STACK GAS FLOW Qsd -------	699.350 11.66	dscf/Hr & dscf/min
VOL. WATER VAPOR Vw(s td) -----	2.052	scf	PARTICULATE CONCTRT. C s ------	0.0044	g/dscf
PRCNT MSTR Bws -------	7.10	%	PARTC.EMISS. RATE E -------	3.09	g/Hr
BURN RATE BR -------	1.78	Kg/Hr	MOLES OF GAS PER Lb WOOD Nt ----	0.46	Lb-mole/Lb
CO EMISSION RATE -------	175.16 & 98.18	g/Hr g/Kgdry fuel	PART.EMISS. RATE ------	1.73	g/Kgdry fuel

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Jotul TEST No. : 4

MODEL: F118 Black Bear DATE: 21-Dec-14

TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR	PROPRTN RATE VAR. AVERAGE
5	333.8	99	100
10	338.7	100	
15	338.7	100	
20	338.8	100	
25	338.9	100	
30	339.0	100	
35	338.7	100	
40	338.7	100	
45	338.9	100	
50	338.8	100	
55	338.8	100	
60	338.9	100	
65	338.9	100	
70	339.2	100	
75	339.2	100	
80	339.2	100	
85	339.2	100	
90	338.9	100	
95	339.2	100	
100	339.3	100	
105	339.1	100	
110	339.1	100	
115	339.3	100	

METER BOX DATA SHEET PAGE # 2

Page: 1 of 1

UNIT: JOTUL F118 RUN: 4 DATE: 12-27-2014

Meter Box: 5H Y Factor: .903

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: 46 : 1 BP: 30.13

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1500	230.000	—	13.943	.15	79	250	79	2.0
5	05	231.500	—	17.397	.24	80	200	80	2.0
10	10	233.404	233.404	12.652	.12	80	275	80	2.0
15	15	234.789	234.789	11.598	.10	80	300	80	2.0
20	20	236.059	236.059	8.698	.06	80	400	80	2.0
25	25	237.012	237.017	10.706	.09	80	325	80	2.0
30	30	238.185	238.185	10.706	.09	80	325	80	2.0
35	35	239.357	239.357	10.706	.09	80	325	80	2.0
40	40	240.529	240.529	8.698	.06	80	400	80	2.0
45	45	241.482	241.482	9.278	.07	80	375	80	2.0
50	50	242.498	242.498	13.917	.15	80	250	80	2.0
55	55	244.022	244.022	12.652	.12	80	275	80	2.0
ROTO PRESS:		.18	TOTALS:	140.951	1.34	959	BP.:	30.10	
60	1600	245.408	245.408	12.640	.12	80	275	80	2.0
65	05	246.794	246.794	12.640	.12	80	275	80	2.0
70	10	248.181	248.181	12.640	.12	80	275	80	2.0
75	15	249.568	249.568	12.640	.12	80	275	80	2.0
80	20	250.955	250.955	12.640	.12	80	275	80	2.0
85	25	252.342	252.342	12.640	.12	80	275	80	2.0
90	30	253.728	253.728	12.640	.12	80	275	80	2.0
95	35	255.115	255.115	11.586	.10	80	300	80	2.0
100	40	256.387	256.387	11.586	.10	80	300	80	2.0
105	45	257.658	257.658	11.586	.10	80	300	80	2.0
110	50	258.929	258.929	11.586	.10	80	300	80	2.0
115	55	260.201	260.201	11.586	.10	80	300	80	2.0
			TOTALS:	146.410	1.34	960	MAX VACC =		2.0
TOTAL Cu Ft.		30.201	TOTALS:	287.361	2.68	1919	AVG. BP:	30.12	

1.24

11.973 .112 80

540

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : F118 RUN : 4 DATE : 12-27-14

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

SCALE	WEIGHT
295.0 g	295.1
590.0 g	590.3
885.0 g	885.4

IMPINGER	# 1	# 2	# 3	# 4
FINAL WT	643.4	579.5	486.9	888.3
INITIAL WT	612.2	578.1	485.5	878.7
NET WT GRAMS	31.2	1.4	1.4	9.6

TOTAL CATCH : 43.6 GRAMS H_2O

FRONT HALF

FILTER #	144F	
FINAL WT g	.5365	
INITIAL WT g	.5153	
NET WT g	.0212	

BEAKER #	51
DESC.	ACETONE
FINAL WT g	104.8847
INITIAL WT g	104.8665
NET WT g	.0182
VOL. DESC. ml	65

BACK HALF

FILTER #	144B	
FINAL WT g	.3790	
INITIAL WT g	.3248	
NET WT g	.0542	

BEAKER #	52	53	54	55	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	107.5079	105.7295	107.3022	93.4835	
INITIAL WT g	107.4900	105.7273	107.2973	93.4785	
NET WT g	.0179	.0022	.0049	.0050	(.0099)
VOL. DESC ml	100	75	125	105	(230)

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 8-21-14 Time : 0942 By : KM

Manufacturer S & S Grade : # 25 Glass Front Size : 11 cm Lot No. : 6775627

Back Size: 8.2 cm Lot No. : 9465841

	DATE: 8-22-14	BY: KM	DATE: 8-26-14	BY: KM	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
141F	.5072	1025	.5070	0930	✓	
142F	.5136	1026	.5137	0931	✓	
143F	.5151	1027	.5151	0932	✓	
144F	.5153	1028	.5153	0933	← R-4	
145F	.5077	1029	.5078	0934	✓	
146F	.5164	1030	.5165	0935	✓	
147F	.5128	1031	.5128	0936	✓	
148F	.5154	1032	.5152	0937	✓	
149F	.5100	1033	.5101	0938	✓	
150F	.5136	1034	.5136	0939	✓	
141B	.3280	1035	.3280	0940	✓	
142B	.3235	1036	.3235	0941	✓	
143B	.3243	1037	.3244	0942	✓	
144B	.3247	1038	.3248	0943	← R-4	
145B	.3277	1039	.3278	0944	✓	
146B	.3287	1040	.3287	0945	✓	
147B	.3248	1041	.3249	0946	✓	
148B	.3260	1042	.3258	0947	✓	
149B	.3288	1043	.3289	0948	✓	
150B	.3251	1044	.3252	0949	✓	

Checked by: [signature] Date: 9-10-14 Time: 1039

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
8-22-14	1024	KM	64	78	46
8-26-14	0928	KM	62	70	47

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 9-8-14 Time : 1400 By : Chp

	DATE: 9-10-14	BY: KM	DATE: 9-11-14	BY: KM	DATE:	BY:
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
51	104.8665	1016	104.8665	0916	✓	
52	107.4901	1017	107.4900	0917	✓	
53	105.7213	1018	105.7273	0918	✓ R4	
54	107.2968	1019	107.2973	0919	✓	
55	93.4780	1020	93.4785	0920	✓	
56	106.8591	1021	106.8596	0921	✓	
57	97.4012	1022	97.4016	0922	✓	
58	96.8823	1023	96.8824	0923	✓	
59	105.3434	1024	105.3439	0924	✓	
60	98.1917	1025	98.1922	0925	✓	
61	99.3395	1026	99.3400	0926	✓	
62	97.8582	1027	97.8587	0927	✓	
63	93.2053	1028	93.2056	0928	✓	
64	104.7797	1029	104.7798	0929	✓	
65	98.4342	1030	98.4338	0930	✓	
66	96.5004	1031	96.5009	0931	✓	
67	106.2153	1032	106.2156	0932	✓	
68	94.1467	1033	94.1472	0933	✓	
69	108.9840	1034	108.9844	0934	✓	
70	107.4708	1035	107.4712	0935	✓	
71	104.1446	1036	104.1449	0936	✓	
72	103.8188	1037	103.8192	0937	✓	
73	104.3474	1038	104.3479	0938	✓	
74	107.5001	1039	107.5005	0939	✓	
75	96.4575	1040	107.4580	0940	✓	

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH	
9-10-14	1015	CW	-	70	48	Checked by CWachtman
9-11-14	0915	CW	-	70	48	Date : 9-11-14
		CW	-			Time : 1015

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : F118 **RUN :** 4 **DATE :** 12-27-14 **Page :** 1 of 1

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
51	12-28	0900	Clp	104.8850	12-29	1005	Clp	104.8847	12-29	1207	Clp				
52	12-28	0900	Clp	107.5077	12-29	1006	Clp	107.5079	12-29	1208	Clp				
53	12-28	0900	Clp	105.7291	12-29	1007	Clp	105.7295	12-29	1209	Clp				
54	12-28	0900	Clp	107.3018	12-29	1008	Clp	107.3022	12-29	1210	Clp				
55	12-28	0900	Clp	93.4832	12-29	1009	Clp	93.4835	12-29	1205	Clp				

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
144A	12-27	1500	Clp	.5366	12-28	0925	Clp	.5365	12-28	1132	Clp				
144B	12-27	1500	Clp	.3794	12-28	0926	Clp	.3790	12-28	1133	Clp				

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	12-28-14	0900	Clp	69	47
2	12-28-14	1110	Clp	71	45
3	12-29-14	1000	Clp	66	45
4	12-29-14	1205	Clp	66	43
5					

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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 10-18-14 Through	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9997	10.0000	1.0000	.1000	Clp	10-18	1610	77	49
100.0002	10.0003	.9999	.1000	Clp	10-20	1100	74	47
100.0003	10.0000	1.0001	.0999	Clp	10-20	1410	75	48
100.0001	10.0003	1.0000	.0999	KM	10-22	1000	78	49
99.9999	10.0000	1.0000	.1000	Clp	10-23	0900	72	46
99.9997	9.9999	1.0000	.1000	Clp	10-24	1330	68	47
100.0000	10.0001	1.0001	.1000	Clp	10-25	1530	68	47
100.0000	10.0000	1.0000	.0998	KM	11-26	1005	73	47
99.9999	10.0001	1.0000	.0999	KM	11-27	1000	73	47
100.0003	10.0002	.9998	.0999	KM	11-28	1005	77	49
99.9995	10.0002	1.0000	.0999	Clp	11-29	0945	68	47
100.0000	10.0002	1.0000	.1000	Clp	11-30	1200	72	42
100.0000	9.9998	1.0000	.0998	Clp	12-1	1500	75	41
100.0000	10.0001	1.0000	.0999	Clp	12-3	1200	77	45
100.0000	10.0001	.9999	.0999	Clp	12-4	1130	74	47
99.9998	10.0001	.9999	.0997	Clp	12-4	1330	72	46
100.0001	10.0000	.9999	.1000	Clp	12-11	0930	70	48
100.0000	10.0000	1.0000	.0999	KM	12-12	1045	77	49
100.0000	10.0000	.9999	.0999	KM	12-13	1110	68	47
100.0000	10.0001	.9999	.0998	Clp	12-14	0945	66	49
100.0000	10.0000	.9999	.0997	Clp	12-15	1000	65	44
100.0003	9.9999	1.0001	.0999	Clp	12-15	1330	68	47
100.0000	10.0002	1.0000	.1000	KM	12-25	1345	74	47
100.0000	9.9999	1.0000	.1000	KM	12-26	0915	69	47
99.9995	9.9999	1.0000	.1000	Clp	12-27	1220	73	47
99.9995	9.9999	1.0000	.1000	Clp	12-28	0900	69	47
99.9996	9.9999	.9999	.0996	Clp	12-28	1110	71	45
100.0000	9.9999	1.0000	.1000	Clp	12-29	1000	66	45
99.9997	10.0000	.9999	.0997	Clp	12-29	1205	66	45
100.0000	10.0001	1.0002	.1000	Clp	1-1-15	1100	65	40
100.0000	10.0000	1.0000	.0999	Clp	1-2-15	1300	66	41
100.0000	10.0001	.9999	.0998	Clp	1-2-15	1530	67	42
100.0002	10.0001	.9999	.0998	Clp	1-4-15	1245	68	47
100.0003	10.0001	1.0002	.1000	Clp	1-4-15	1515	69	44

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 4-27-14 Through 10-17-14	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9996	9.9999	1.0000	.0999	CM	4-27	1730	68	47
100.0000	10.0000	1.0000	.0999	CM	5-21	0945	76	49
100.0000	9.9997	1.0000	.1002	CM	5-22	0930	78	48
100.0005	10.0000	.9999	.0999	CM	5-23	0740	77	46
100.0000	9.9999	1.0000	.1000	CM	5-24	1330	74	47
99.9996	9.9999	1.0000	.1000	CM	5-25	1100	72	46
100.0001	10.0000	1.0001	.0998	CM	5-26	1115	73	47
100.0000	10.0000	1.0000	.0999	CM	5-27	1115	78	46
100.0004	10.0000	1.0001	.0999	CM	5-27	1330	74	47
100.0000	9.9999	.9999	.1000	CM	7-3	0915	76	46
100.0000	10.0000	1.0000	.0999	CM	7-4	0900	77	42
100.0000	10.0001	.9999	.0998	CM	7-5	1230	77	39
100.0000	10.0001	1.0000	.0998	CM	7-16	1510	76	48
100.0000	10.0000	1.0000	.0999	CM	7-7	0820	70	48
100.0000	10.0001	.9999	.0999	CM	7-9	0715	74	47
99.9995	9.9999	.9999	.0999	CM	7-10	0945	75	44
100.0000	9.9999	.9999	.1000	CM	7-10	1300	73	47
100.0001	10.0001	1.0001	.0998	CM	7-14	1230	74	47
100.0000	9.9999	1.0000	.1000	CM	7-15	0710	72	46
100.0000	10.0000	1.0000	.0998	CM	8-21	0945	66	49
100.9998	10.0000	1.0000	.0998	KM	8-26	0920	69	47
100.0003	10.0000	1.0000	.1000	KM	9-11	0910	70	48
100.0000	10.0001	1.0001	.1000	KM	9-12	0905	72	42
100.0000	9.9999	.9999	.0999	KM	9-13	1000	73	47
100.0005	10.0001	1.0000	.1000	CM	9-14	1015	68	47
100.0005	10.0000	1.0000	.0999	CM	9-15	1030	68	47
99.9999	10.0000	.9999	.1000	KM	9-16	1010	77	49
99.9996	10.0000	1.0001	.1000	KM	9-16	1315	78	46
100.0000	10.0001	1.0000	.0999	KM	9-17	1010	70	48
100.0000	10.0000	1.0000	.1000	KM	9-19	0915	76	49
100.0000	10.0000	.9999	.0998	CM	9-20	1000	71	49
100.0000	10.0001	1.0001	.0999	CM	9-22	1000	72	46
100.0005	10.0000	.9999	.0999	CM	9-22	1330	74	47
100.0000	10.0000	1.0000	.0998	KM	9-24	1120	78	46
100.0001	9.9999	1.0000	.1000	KM	9-25	1005	76	49
99.9998	9.9999	1.0000	.0999	KM	9-26	1105	76	49
100.0000	10.0001	.9999	.0999	KM	9-30	1120	78	49
99.9998	9.9999	.9999	.1000	KM	10-16	0945	76	49
100.0000	10.0001	1.0000	.1000	KM	10-17	0920	72	46

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 1-12-14 Through 4-22-14	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9995	10.0000	1.0001	.0999	CLp	1-12-14	1300	70	48
99.9995	9.9999	1.0000	.0997	CLp	1-13-14	1215	69	47
100.0000	9.9999	1.0001	.0999	CLp	1-23-14	0915	70	48
100.0000	9.9999	1.0000	.0999	CLp	1-31-14	1500	65	48
100.0000	9.9999	1.0000	.0999	CLp	2-4-14	1200	76	32
99.9997	9.9999	1.0001	.0999	CLp	2-5-14	1600	65	40
100.0000	9.9997	.9999	.1000	CLp	2-6-14	1600	65	36
100.0003	10.0000	1.0000	.0998	CLp	2-7-14	1530	65	40
100.0005	10.0001	1.0000	.0999	CLp	2-10-14	1115	65	48
100.0000	10.0000	1.0000	.0998	CLp	2-12-14	1315	76	48
100.0003	10.0002	1.0000	.0998	CLp	2-13-14	1130	75	48
99.9997	10.0001	1.0000	.1000	CLp	2-14-14	1500	66	49
99.9998	10.0001	1.0000	.0999	CLp	2-15-14	1015	69	44
100.0000	10.0001	1.0000	.0999	CLp	2-16-14	1500	68	47
100.0000	9.9999	1.0000	.0997	CLp	2-17-14	1530	74	44
99.9997	9.9998	1.0000	.1000	CLp	2-18-14	1130	65	48
100.0000	10.0000	1.0000	.1000	CLp	2-19-14	1130	70	41
100.0000	10.0000	1.0000	.0998	CLp	2-21-14	1445	72	42
100.0003	10.0002	.9999	.0997	CLp	2-23-14	1445	69	47
100.0006	10.0002	1.0001	.0999	CLp	2-25-14	1830	68	49
99.9999	10.0000	1.0000	.1000	CLp	2-26-14	1020	70	48
100.0005	10.0001	1.0001	.1000	CLp	2-27-14	1600	70	48
99.9996	9.9999	1.0000	.0998	CLp	3-1-14	1200	68	47
100.0000	10.0001	1.0000	.0999	CLp	3-2-14	1500	65	48
100.0000	10.0000	1.0000	.0999	CLp	3-3-14	1300	77	49
100.0000	10.0001	1.0000	.0999	CLp	3-4-14	1500	69	47
100.0000	10.0000	1.0000	.0999	CLp	3-5-14	1700	66	49
100.0000	9.9999	1.0001	.0999	CLp	3-19-14	1300	69	47
100.0000	10.0001	1.0000	.0999	CLp	3-21-14	1600	70	48
99.9995	10.0000	1.0000	.0999	CLp	3-23-14	1600	71	49
100.0000	10.0001	1.0000	.0998	CLp	3-24-14	1510	70	45
100.0004	10.0000	.9999	.0999	CLp	3-26-14	1645	70	48
99.9996	9.9999	1.0000	.1001	CLp	3-27-14	1145	66	49
99.9999	10.0002	1.0000	.0998	CLp	3-29-14	1200	65	48
100.0004	10.0000	.9999	.0998	CLp	4-22-14	1000	73	47
100.0000	10.0001	.9999	.0999	CLp	4-24-14	1080	76	49
99.9995	9.9999	.9999	.0998	CLp	4-25-14	1140	75	48
100.0000	9.9998	1.0000	.0999	CLp	4-26-14	1600	72	46
99.9995	9.9998	.9999	.0999	CLp	4-27-14	1130	65	48

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 3-6-13 Through 1-11-14	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	9.9999	1.0000	.0999	CP	3-6-13	1100	65	48
100.0000	10.0001	1.0000	.1000	CP	3-7-13	1700	68	47
99.9998	10.0002	1.0001	.1000	CP	3-9-13	1500	67	46
100.0001	10.0000	1.0000	.1000	CP	3-11-13	1540	75	41
100.0000	10.0002	1.0000	.0999	CP	3-12-13	1520	76	45
100.0000	9.9999	.9998	.0998	CP	3-19-13	1400	67	46
100.0000	10.0000	1.0000	.0998	CP	3-20-13	1600	74	47
100.0000	10.0001	1.0000	.1000	CP	6-18-13	1430	78	49
100.0000	10.0001	1.0000	.0998	CP	6-19-13	0900	76	49
99.9995	10.0000	.9998	.0998	CP	6-20-13	0820	66	49
99.9996	9.9999	1.0000	.0999	CP	6-21-13	1330	74	47
100.0003	9.9999	1.0000	.0998	CP	6-22-13	0930	76	49
99.9995	9.9999	.9999	.1000	CP	6-23-13	1500	74	47
100.0001	10.0001	1.0000	.0998	CP	6-24-13	1230	70	48
100.0000	10.0000	1.0000	.0999	CP	6-25-13	1400	70	48
99.9993	9.9999	1.0000	.0998	CP	6-26-13	1900	65	48
100.0000	9.9996	1.0001	.0998	CP	7-12-13	1500	72	47
100.0000	9.9999	1.0000	.0998	CP	7-14-13	1400	77	49
100.0005	10.0002	1.0000	.1000	CP	7-15-13	1400	78	48
100.0000	9.9997	1.0000	.1001	CP	7-16-13	1530	78	46
100.0003	10.0000	.9999	.0998	CP	7-17-13	0730	74	47
100.0003	9.9999	1.0000	.1000	CP	7-18-13	1600	78	46
100.0000	9.9999	.9999	.0998	CP	7-19-13	1415	72	46
100.0000	10.0001	.9999	.1001	CP	7-20-13	0800	74	47
100.0000	10.0000	1.0000	.0999	CP	7-21-13	1300	68	47
100.0000	10.0000	1.0000	.0998	CP	7-22-13	1300	70	48
100.0003	9.9998	1.0001	.1000	CP	7-23-13	1230	72	46
100.0000	9.9999	1.0000	.0999	CP	11-15-13	1530	72	46
100.0001	10.0001	.9999	.0999	CP	11-16-13	1035	72	46
99.9997	9.9999	1.0000	.0999	CP	11-17-13	1000	72	46
99.9997	10.0000	.9999	.0998	CP	11-18-13	1600	72	46
100.0000	10.0000	1.0000	.0999	CP	11-20-13	1100	66	49
100.0000	9.9999	1.0001	.0999	CP	11-21-13	1000	70	41
100.0000	9.9999	1.0000	.0998	CP	11-22-13	1730	67	46
100.0000	10.0000	.9998	.0999	CP	11-25-13	1500	70	44
100.0001	10.0000	.9999	.0999	CP	11-26-13	1600	68	47
100.0000	10.0002	.9997	.1001	CP	1-7-14	1630	72	47
99.9997	10.0000	1.0001	.0999	CP	1-9-14	1230	76	42
100.0002	10.0001	.9999	.1000	CP	1-11-14	1800	70	48

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 10-10-12 Through 3-6-2013	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9997	10.0000	1.0000	.0999	CR	10-10-12	1615	75	48
100.0000	10.0001	1.0001	.0999	CR	10-12-12	1230	77	46
99.9997	10.0000	.9999	.0999	CR	10-13-12	0830	77	49
100.0005	10.0000	.9999	.0999	CR	10-14-12	1030	78	46
100.0005	10.0002	.9999	.0998	CR	10-15-12	1000	78	48
100.0001	10.0002	1.0000	.1000	CR	10-16-12	1400	78	49
99.9996	9.9999	.9999	.1000	CR	10-17-12	0900	69	47
100.0000	9.9999	1.0006	.1000	CR	10-18-12	1330	78	37
100.0002	10.0002	.9999	.0999	CR	10-19-12	1130	78	46
100.0001	10.0001	.9999	.0999	CR	10-20-12	1400	78	48
99.9999	10.0001	.9998	.0999	CR	10-22-12	1800	65	45
100.0000	10.0001	1.0001	.0999	CR	10-24-12	1900	65	48
100.0000	9.9998	1.0000	.0998	CR	10-26-12	1750	70	48
100.0001	10.0000	1.0000	.0999	CR	10-28-12	1745	73	47
100.0000	10.0000	1.0000	.0999	CR	11-5-12	1037	74	47
99.9998	10.0000	1.0000	.0999	CR	11-6-12	1000	73	47
100.0000	10.0001	1.0000	.0999	CR	11-7-12	1030	73	47
100.0000	10.0000	1.0000	.1000	CR	11-8-12	0930	66	45
100.0000	9.9999	.9999	.0999	CR	11-12-12	1030	72	42
100.0000	10.0000	1.0000	.1000	CR	11-13-12	1000	71	45
100.0000	10.0000	1.0000	.0999	CR	11-27-12	0910	74	47
100.0000	10.0000	1.0000	.1000	CR	12-1-12	1800	66	49
100.0000	9.9999	1.0001	.0999	CR	12-2-12	1130	67	46
100.0000	10.0000	.9999	.0999	CR	12-3-12	0915	72	46
100.0004	10.0000	1.0000	.1001	CR	12-4-12	1700	69	47
99.9997	9.9999	.9999	.0999	CR	12-5-12	1045	74	44
99.9999	10.0000	1.0000	.0998	CR	12-6-12	1400	66	49
100.0000	9.9999	.9999	.0998	CR	12-7-12	1730	65	48
100.0002	10.0001	1.0000	.1000	CR	12-9-12	1400	66	49
100.0002	10.0001	.9999	.1000	CR	12-10-12	1500	66	49
100.0000	9.9999	1.0001	.0999	CR	12-21-13	1020	78	44
100.0000	9.9998	1.0001	.0999	CR	12-23-13	1900	72	46
99.9995	10.0001	1.0000	.0999	CR	12-24-13	1700	72	46
100.0000	9.9999	.9999	.1000	CR	12-25-13	1000	73	43
100.0000	9.9998	1.0000	.0999	CR	12-27-13	1600	64	49
100.0000	10.0002	1.0000	.0999	CR	12-27-13	0915	67	46
100.0000	10.0001	1.0000	.0999	CR	12-28-13	1530	76	42
100.0000	10.0001	1.0000	.0999	CR	3-2-13	1600	73	47
100.0000	9.9999	.9999	.0998	CR	3-4-13	1900	71	41

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 1-14-2012 Through 9-17-12	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	10.0000	1.0000	.0999	CA	1-14-12	1300	70	48
100.0002	10.0001	1.0001	.1000	AK	1-15-12	1330	68	47
99.9997	10.0000	1.0001	.1000	CA	1-17-12	1030	73	47
99.9997	10.0001	1.0000	.1000	CA	1-18-12	0915	74	44
99.9999	10.0002	1.0001	.1001	CA	1-19-12	1015	70	44
100.0001	10.0001	1.0001	.0998	CA	1-25-12	1600	72	46
99.9999	9.9998	1.0001	.1000	CA	1-26-12	1500	70	48
99.9995	9.9999	1.0000	.0999	CA	1-28-12	1400	70	41
100.0000	10.0000	1.0000	.0999	CA	2-4-12	1500	73	60
100.0000	10.0003	.9999	.0999	CA	2-6-12	1200	69	44
100.0000	10.0000	.9999	.0998	CA	2-7-12	1030	67	42
100.0000	9.9999	1.0001	.0999	CA	2-10-12	1630	78	49
100.0000	10.0001	1.0000	.1000	CA	2-11-12	1430	72	46
99.9997	10.0002	1.0000	.1001	CA	2-12-12	1530	73	47
100.0000	10.0000	.9999	.0999	CA	2-13-12	1100	78	46
99.9995	10.0000	.9999	.0999	CA	2-14-12	1000	76	45
100.0000	9.9999	.9999	.1000	CA	2-15-12	1120	70	44
99.9999	10.0000	1.0000	.0999	CA	2-17-12	1415	73	47
99.9999	10.0000	1.0000	.0998	CA	2-19-12	1600	70	44
99.9997	9.9999	1.0000	.0999	CA	2-20-12	1200	70	48
100.0004	10.0001	1.0000	.1000	CA	2-23-12	1000	73	47
100.0000	9.9997	1.0000	.0999	CA	2-24-12	1015	78	46
100.0000	10.0000	1.0000	.1001	CA	2-25-12	1715	65	49
100.0000	9.9996	1.0000	.0999	CA	2-27-12	1000	70	44
100.0000	10.0000	1.0001	.1002	CA	2-28-12	1125	75	41
99.9997	10.0000	1.0000	.1000	CA	2-29-12	1110	68	43
99.9995	9.9999	.9999	.0997	CA	3-1-12	1330	68	47
99.9996	10.0000	1.0000	.0998	CA	3-2-12	1430	71	45
99.9995	9.9999	1.0000	.0999	CA	3-3-12	1430	72	42
99.9999	10.0000	.9999	.0999	CA	9-2-12	0945	77	46
100.0000	10.0000	1.0000	.1000	CA	9-3-12	1030	71	49
100.0002	9.9999	1.0000	.0995	CA	9-4-12	1000	77	49
100.0000	10.0000	1.0000	.0999	CA	9-5-12	0945	78	46
100.0000	10.0002	1.0000	.0999	CA	9-6-12	1130	76	49
99.9997	10.0001	1.0002	.0999	CA	9-7-12	1400	76	49
100.0000	10.0001	1.0000	.0999	CA	9-8-12	1200	71	49
100.0000	10.0002	1.0000	.1001	CA	9-15-12	1410	78	48
100.0000	10.0000	1.0000	.1000	CA	9-16-12	1100	78	48
100.0000	10.0000	.9999	.0999	CA	9-17-12	1330	75	48

BLANK PROCESSING DATA SHEET # 5

UNIT : F118 RUN : 4 DATE : 12-27-14

BLANKS DONE : 9-8-12

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	108.9013	106.3080	106.9659
TARE WEIGHT	108.9005	106.3061	106.9637
NET WEIGHT	.0008	.0019	.0022

TARE BEAKERS INTO DESC : TIME : 1015 DATE : 8-31-12

DATE : 9-2 BY : CP DATE : 9-3 BY : CP DATE : BY :

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9002	1016	108.9005	1046		
B	106.3058	1017	106.3061	1047		
C	106.9641	1018	106.9637	1048		

FINAL BEAKERS INTO DESC : TIME : DATE :

DATE : 9-6 BY : CP DATE : 9-7 BY CP DATE : BY :

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9016	1148	108.9013	1415		
B	106.3077	1149	106.3080	1416		
C	106.9661	1150	106.9659	1417		

TARE QC

DATE	TIME	BY	WB	DB	%
9-2	0945	CP	S	77	46
9-3	1030	CP	S	71	49

FINAL QC

DATE	TIME	BY	WB	DB	%
9-6	1130	CP	S	76	49
9-7	1400	CP	S	76	49

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT : F118 RUN : 4 DATE : 12-27-14

BLANK CALCULATIONS

Acetone : .0008 g ÷ 200 ml = .000004 g/ml

Dicholoromethane : .0019 g ÷ 75 ml = .000025 g/ml

Distilled Water : .0022 g ÷ 200 ml = .000011 g/ml

FRONT HALF CATCH

FILTERS : .0212 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0212 g

BEAKERS : .0182 (Total Catch) g - 65 (ml Acetone) (.000004 g) (Blank Value / ml Acetone) = .0179 g

TOTAL FRONT HALF CATCH : .0391 g

BACK HALF CATCH

FILTERS : .0542 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0542 g

BEAKERS :

Acetone : .0179 (Total Catch) g - 100 (ml Acetone) (.000004 g) (Blank Value / ml Acetone) = .0175 g

Extract : .0022 (Total Catch) g - 75 (ml Dichloromethane) (.000025 g) (Blank Value / Dichloromethane) = .0003 g

Water : .0099 (Total Catch) g - 230 (ml Water) (.000011 g) (Blank Value / Water) = .0074 g

TOTAL BACK HALF CATCH : .0794 g

TOTAL CATCH : .1185 g

% FRONT HALF : 33.0 %

CALCULATIONS DATA SHEET # 7

UNIT : JOTUL F118 RUN : 4 DATE : 12-27-2014

1) Vm (std) = $\dfrac{(30.201 \text{ Vm})(17.64)(.903 \text{ mcf})\left(30.12 \text{ " Hg} + \dfrac{.112 \text{ " } H_2O}{13.6}\right)}{(540 \text{ TmA})} = \underset{000.0000}{29.8834}$ dscf

2) Vw (std) = (.04707) (43.6 ml H_2O) = $\underset{00.0000}{2.0523}$ scf

3) Asw = $\dfrac{(2.0523 \text{ scf})}{(2.0523 \text{ scf} + 29.8834 \text{ dscf})} = \underset{.0000}{.0643}$ Bws × 100 = $\underset{00.0000}{6.4264}$ % H_2O

4) Cs = $\dfrac{(.1185 \text{ g.})}{(29.8834 \text{ dscf})}$ (15.43) = $\underset{0.0000}{.0612}$ gr / dscf

5) Estimated g / hr = $\dfrac{(.1185 \text{ g.})}{(29.8834 \text{ dscf})}$ ($\underset{00.0000}{11.973}$ dscfm) (60) = $\underset{00.0000}{2.8487}$ g / hr

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

TEST DATA SHEET # 8

UNIT : JOTUL F118 RUN : 4 DATE : 12-27-14

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

Wet Bulb / Dry Bulb

Pre : WB : 62 DB : 75 = 47.0 % RH 1.3 % H_2O

Post : WB : 64 DB : 76 = 52.0 % RH 1.6 % H_2O

Average : 49.5 % 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 : 1.5

Preburn Fuel Weight : 10.0 + 7.3 + 3.5 + 7.6 Total : 28.4

Kindling & Preburn Fuel Weight (wood only) (lbs) : **Total** : 29.9

Coal Bed Wt Range (lbs) : 2.3 - 1.9 **Scale** : 2.3 - 1.9

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

Lower : .20 x fuel weight : Always round UP to nearest tenth **Actual Coal Bed Weight** : 2.3

Maximum Coal Bed Removal (lbs) : ((2.3 (Upper) + 1.9 (Lower)) ÷ 2) .25 = .5 (round down to nearest tenth)

Test Fuel (.75" x 1.5" x 5" spacers) = 16 pcs

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" x 4"	18	4	9.2	100.0
4" x 4"	—	—	—	—

Test Fuel Weight : 9.2 lbs

Estimated Dry Burn Rate :

$$\frac{9.2 - (9.2 \times .18050)}{2.2046} \times \frac{60}{\frac{115}{\text{TIME}}} = 1.784 \text{ kg / hr}$$

Estimated BTU's/hr : 19,140 x $\frac{63}{100}$ x $\frac{1.784}{\text{DBR}}$ = 21511.8 BTU's/hr

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

WOOD STOVE OPERATING DATA PAGE #9

Unit : JOTUL F118 Run : 4 Date : 12-27-2014

FIRE STARTED: 1115

WARM UP AND PREBURN:

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

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

CHARCOAL BED PREPARATION :

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

TEST:

DOOR wide open during loading 0 min. 50 sec.

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

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

FAN:

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

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

Fan speed set at N/A

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 8 or 16 inches.

1st warm up / pre-burn fuel charge (10.0 lbs.) added at 1120

2nd warm up / pre-burn fuel charge (7.3 lbs.) added at 1200

3rd warm up / pre-burn fuel charge (3.5 lbs.) added at 1238

4th warm up / pre-burn fuel charge (7.6 lbs.) added at 1321

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

TEST DATA SHEET #10

Unit : JOTUL F118 Run : 4 Date : 12-27-2014

Room Temperature : 72 °F Temperature Correction Set? : (Yes) No

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

Time Test Fuel moisture reading taken : 1300

pc #	Dimen.	Use	TOP	BOTTOM	SIDE	Avg Corrected
1	2"×4"×8'	K	13.2	13.4	13.4	13.333
2						
3						
4	2"×4"×8'	P	19.7	20.0	20.1	19.9
5	2"×4"×8'	P	22.6	21.9	21.8	22.1
6	2"×4"×8'	P	20.2	20.4	20.4	20.3
7	2"×4"×8'	P				62.3
8	2"×4"×8'	P				
9						
10						
11						
12	2"×4"×18"	T	22.6	22.7	22.8	22.7
13	"	T	20.2	20.4	20.5	20.4
14	"	T	23.0	22.8	22.7	22.8
15	"	T	21.9	22.2	22.4	22.2
16						88.1
17						
18						
19						
20	Spacers	T	22.6	21.9	22.6	22.367

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	13.333 %	20.767 %	22.025 %
Wet Moisture % :	11.764 %	17.196 %	18.050 %

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: 2.3 DATE: 12-27-2014

UNIT: JOTUL F118 RUN: 4 PAGE: 1 OF 1

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
0 1500	11.5	9.7	—	.218	5.4	.581	14.5	.086	.86	-.039	250
5	11.2	8.9	.3	.135	3.3	.691	17.3	.021	.20	-.036	200
10 10	10.8	8.5	.4	.140	3.5	.680	17.0	.029	.28	-.040	275
15	10.2	7.9	.6	.375	9.4	.445	11.1	.027	.26	-.046	300
20 20	9.1	6.8	1.1	.425	10.6	.351	8.8	.141	1.41	-.051	400
25	8.1	5.8	1.0	.438	10.9	.363	9.1	.082	.82	-.054	325
30 30	7.1	4.8	1.0	.478	11.9	.322	8.1	.084	.84	-.055	325
35	6.2	3.9	.9	.491	12.3	.303	7.6	.093	.93	-.055	325
40 40	5.3	3.0	.9	.533	13.3	.242	6.0	.146	1.46	-.056	400
45	4.5	2.2	.8	.506	12.7	.314	7.9	.026	.25	-.056	375
50 50	4.1	1.8	.4	.336	8.4	.494	12.4	.005	.04	-.052	250
55	3.9	1.6	.2	.267	6.5	.556	13.9	.040	.39	-.050	275
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.590	*****
60 1100	3.8	1.5	.1	.219	5.4	.587	14.7	.070	.70	-.046	275
65	3.7	1.4	.1	.214	5.3	.588	14.7	.078	.78	-.046	275
70 10	3.5	1.2	.2	.213	5.3	.586	14.7	.084	.84	-.045	275
75	3.4	1.1	.1	.216	5.3	.585	14.6	.086	.86	-.043	275
80 20	3.3	1.0	.1	.210	5.2	.591	14.8	.081	.81	-.042	275
85	3.1	.8	.2	.202	5.0	.592	14.8	.097	.97	-.041	275
90 30	3.0	.7	.2	.194	4.8	.597	14.9	.106	1.06	-.040	275
95	2.9	.6	.1	.199	5.0	.592	14.8	.097	.97	-.040	300
100 40	2.7	.4	.2	.271	6.8	.544	13.6	.040	.39	-.042	300
105	2.6	.3	.1	.240	6.0	.561	14.1	.075	.75	-.041	300
110 50	2.4	.1	.2	.182	4.5	.611	15.3	.101	1.01	-.040	300
115	2.3	0	.1	.163	4.1	.624	15.6	.107	1.07	-.039	300
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.505	*****
120											
125										-1.095	
130											
135											
140											
145											
150											
155											
160											
165											
170											
175											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****		*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.046	*****

1.24

PREBURN DATA SHEET #13

UNIT: JOTUL F118 RUN: 4 DATE: 12-27-2014 PAGE: 1 of 1

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
0 1330	9.0	-	398	381	355	296	215	401			72	-.051	PREBURN START: # 6.7 UP
5	8.1	.9	467	434	350	303	206	381			70.	-.054	COAL BED SCALE RANGE:
10 40	7.2	.9	467	458	377	324	324	366			70	-.054	2.3 → 1.9
15	6.4	.8	415	475	421	330	343	360			69	-.055	PRIMARY AIR: MAX
20 50	5.4	1.0	463	532	460	353	380	358			70	-.058	SECONDARY AIR: N/A
25	4.7	.7	487	578	488	362	414	363			72	-.060	FAN: N/A
30 1400	4.1	.6	487	610	514	365	452	371			72	-.060	PUMPS ON AT:
35	3.7	.4	452	600	543	363	461	379			73	-.056	CHECK WB/DB: N/A
40 10	3.4	.3	394	549	564	361	485	386			74	-.052	
45	3.3	.1	337	489	543	359	485	392			74	-.049	
50 20	3.2	.1	306	436	512	373	475	394			74	-.045	
55	3.1	.1	292	399	485	347	440	392			74	-.045	
*****	****	***	****	*****	*****	****	*****	*****	*****	*****	*****	****	
60 1430	3.0	.1	289	380	478	341	429	389			74	-.044	
65	2.8	.2	283	361	482	334	423	390			73	-.043	
70 40	2.7	.1	275	348	470	329	421	392			74	-.042	
75	2.6	.1	267	334	467	324	414	396			73	-.041	
80 50	2.5	.1	260	325	457	320	414	398			74	-.040	
85	2.4	.1	254	312	446	315	412	400			73	-.039	
90 1500	2.3	.1	250	301	436	310	405	401			74	-.039	

Unit:Jotul F118 Black Bear

Temperature Data Sheet #14

Run-4
12-27-14

Time	Stack	Top	Left Side	Back	Right Side	Bottom	Firebox	Secondary	Ambient	Furnace	Sample Box	Bucket	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	250	301	436	310	405	401	#######	#######	74	1348	233	52	N/A	36	36
5	231	280	387	299	361	395	#######	#######	75	1339	234	39		35	36
10	251	279	342	284	319	378	#######	#######	73	1328	234	41		35	36
15	310	296	323	271	295	358	#######	#######	73	1317	235	41		36	36
20	366	350	347	266	319	341	#######	#######	73	1306	236	42		36	37
25	387	395	386	267	380	329	#######	#######	72	1297	236	45		36	37
30	412	439	436	278	431	324	#######	#######	73	1290	238	46		36	37
35	425	474	483	294	466	326	#######	#######	74	1286	240	41		37	38
40	445	506	529	315	490	330	#######	#######	74	1283	241	41		37	38
45	448	533	563	337	510	333	#######	#######	75	1281	242	44		38	38
50	405	525	572	358	520	341	#######	#######	76	1281	243	44		38	38
55	355	481	562	371	516	353	#######	#######	78	1285	244	39		39	38
60	326	441	542	375	506	367	#######	#######	78	1288	245	43		39	38
65	307	408	520	375	485	378	#######	#######	77	1289	244	45		39	39
70	296	384	499	370	471	387	#######	#######	77	1289	244	45		39	39
75	287	364	486	365	461	395	#######	#######	76	1289	243	45		39	39
80	282	351	472	358	449	399	#######	#######	76	1288	243	45		39	39
85	272	338	456	349	437	400	#######	#######	76	1288	243	45		39	39
90	263	325	445	342	425	400	#######	#######	75	1288	243	45		39	39
95	260	315	441	336	418	401	#######	#######	75	1289	244	44		39	39
100	284	317	443	327	410	404	#######	#######	74	1291	243	45		39	39
105	277	316	443	318	405	407	#######	#######	74	1293	242	45		38	39
110	261	309	443	310	401	410	#######	#######	74	1294	241	45		38	39
115	249	300	441	307	398	412	#######	#######	75	1294	240	47		38	39

Unit:Jotul F118 Black Bear

Run-4
12-27-14

TEMPERATURE DATA SHEET #14A

		TEST TIME	115		
STACK	319	TOP AVG	376	LT SIDE AVG	458
BACK AVG	324	RT SIDE AVG	428	BOTTOM AVG	374
FIREBOX AVG	########	SEC/CAT AVG	########	AMBIENT AVG	75

END	371.5	
START	370.6	
	0.9	DELTA T

CIRCLE: LOSE / GAIN

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 12-27-14 Analyte : CO_2 (15-1)

Unit : F 118 Run # : 4

Zero Cyl. # : IC3AAM173 Conc. : 0.00 % CO_2 Cyl. Press. : 1980 PSI

Certified by : AIR LIQUIDE Date : 2-14-13

Span Cyl. # : 487905 Conc. : 12.20 % CO_2 Cyl. Press. : 1340 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % CO_2

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

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

PRE RUN Audit : by : Cp Watkins Time : 1345 Temp : 72 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-.052	-.052	-.209
SPAN	48.8	.488	12.20	48.8	.488	12.195	-.005	-.019

POST RUN Audit : by : Cp Watkins Time : 1745 Temp : 73 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.2	.002	-.002	-.002	-.008
SPAN	48.8	.488	12.20	48.5	.485	12.120	-.080	-.320

± 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 : 12-27-14 Analyte : O_2 (15-2)

Unit : F118 Run # : 4

Zero Cyl. # : TC3AAM173 Conc. : 0.00 % O_2 Cyl. Press. : 1980 PSI

Certified by : AIR LIQUIDE Date : 2-14-13

Span Cyl. # : 487905 Conc. : 12.60 % O_2 Cyl. Press. : 1340 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 : CJ Dowling Time : 1345 Temp : 72 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-.020	-.020	-.081
SPAN	12.60	.504	12.6	12.6	.504	12.613	.013	.054

POST RUN Audit : by : CJ Dowling Time : 1715 Temp : 73 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.001	.005	.005	.019
SPAN	12.60	.504	12.6	12.6	.503	12.588	-.012	-.047

± 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 : 12-27-14 Analyte : CO (15-3)

Unit : F118 Run # : 4

Zero Cyl. # : IC3AAM173 Conc. : 0.00 % CO Cyl. Press. : 1980 PSI

Certified by : AIR LIQUIDE Date : 2-14-13

Span Cyl. # : CA87905 Conc. : 4.90 % CO Cyl. Press. : 1340 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 : Clp Partners Time : 1345 Temp : 72 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	000	,000	-.011	-.011	-.106
SPAN	49.0	.490	4.90	49.0	,490	4.931	,031	,313

POST RUN Audit : by : Clp Partners Time : 1715 Temp : 73 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-.011	-.011	-.106
SPAN	49.0	.490	4.90	48.9	.489	4.921	.021	.214

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

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

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

ZERO / SPAN CHECK DATA SHEET #15-4

Date : 12-27-14 Analyte : SO_2 (15-4)

Unit : F118 Run # : 4

Zero Cyl. # : TC3AAM173 Conc. : 0.00 ppm SO_2 Cyl. Press. : 1980 PSI

Certified by : AIR LIQUIDE Date : 2-14-13

Span Cyl. # : CC82089 Conc. : 1250 ppm SO_2 Cyl. Press. : 1580 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 2500 ppm SO_2

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

PRE RUN Audit : by : Cp Westmoreland Time : 1345 Temp : 72 ° F

AUDIT RESULTS

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

POST RUN Audit : by : Cp Westmoreland Time : 1715 Temp : 73 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	-.003	-6.175	-6.175	-.247
SPAN	50.0	.500	1250	50.1	.501	1250.5	.500	.020

± 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 F118 RUN: 4 DATE: 12-27-2014

Thermocouple Check:

T/C # 1	—— °F	T/C # 13	58.6 °F
T/C # 2	—— °F	T/C # 14	58.6 °F
T/C # 3	59.0 °F	T/C # 15	58.8 °F
T/C # 4	55.9 °F	T/C # 16	49.0 °F
T/C # 5	55.4 °F	T/C # 17	45.6 °F
T/C # 6	55.3 °F	T/C # 18	59.1 °F
T/C # 7	55.1 °F	T/C # 19	57.0 °F
T/C # 8	55.1 °F	T/C # 20	—— °F
T/C # 9	—— °F	T/C # 21	—— °F
T/C # 10	—— °F	T/C # 22	—— °F
T/C # 11	54.6 °F	T/C # 23	—— °F
T/C # 12	69.8 °F	T/C # 24	—— °F

Thermocouple Readout:

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

ZERO 1.1 °F Adj. to 0.0 °F ZERO 0 °F Difference 0 %

SPAN 1999.9 °F Adj. to 2000.0 °F SPAN 2000.1 °F Difference .005 %

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 200.3 °F	400	= 400.0 °F
600	= 599.8 °F	800	= 799.9 °F	1000	= 999.8 °F
1200	= 1199.6 °F	1400	= 1399.5 °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: 12.4 — 2.4 = 10

Post: 12.3 — 2.3 = 10

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

Description	Value / Range	Qty	Material	Manufacture	Serial Number
Test Weight	1000 lb	5	Cast Iron	Rice Lake	OFT0, OFT1, OFT2, ~~OFSY, OFSZ~~
Test Weight	500 lb	12	Cast Iron	Rice Lake	T23-13 to T23-16, T23-20, T23-24, T23-26, T23-28 to T23-32
Test Weight	50 lb	30	Cast Iron	Rice Lake	877B, N1039, N1041, T23-1 to T23-10, T23-19 to T23-28, WA171-0, WA1712-0 to WA172-2, WA173-2, WA237, X694
Test Weight	25 lb	2	Cast Iron	Rice Lake	WA238, T23-11
Weight Set, 7 pc	10 lb - 8 oz	1	Stainless Steel	Rice Lake	WA177-7
Weight Set, 12 pc	5 kg - 200 g	1	Stainless Steel	Rice Lake	SK

The item(s) listed above have been found and/or left within the stated tolerances for the specification stated above, except as noted. The item(s) listed above have been compared to the Standards of the State of Washington, which are currently in control. These standards values are traceable to the National Institute of Standards and Technology (NIST) through NIST Test Numbers 822/264514-01 and Minnesota Metrology Laboratory Report Number 307 430. Calibration processes were monitored and found to be in control. The expanded uncertainty (k=2) for each item listed in this report is less than 1/3 of the appropriate tolerance. Results apply to items identified in this report only. This report may not be reproduced, except in full, unless permission for the publication of an abstract is obtained in writing from the calibrating organization issuing this report.

LABORATORY SERVICES DIVISION
WEIGHTS AND MEASURES PROGRAM

Dan Wright

DAN WRIGHT
STATE METROLOGIST

MAR 0 8 2002

NVLAP

NVLAP LAB CODE 200446-0

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: LOKT0137010004141006

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	10/6/14	3/10/14	6/2015

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
50	50.0001	50.0000
20	20.0000	20.0000
5	5.0000	5.0000
1	1.0000	1.0000
0.1	0.1000	0.1000

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Weight Set	R.L./Troemner	1MG-25KG	A45	8/28/14	8/2015	OR-12-267-C

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 ar location of calibration. Calibration data should be reviewed to insure that the instrument is performing to its required accuracy.

PT ID: LOKT01

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Lokee Testing Labs
13235 Prairie Circle East
Bonney Lake, WA 98390

Report Number: LOKT0137010004140310

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	3/10/14	9/19/13	10/2014

FUNCTIONAL CHECKS

ECCENTRICITY		LINEARITY		REPEATABILITY	
Test Wt:	Tol:	Test Wt:	Tol:	Test Wt:	Tol:
100	0.0003	50x2	0.0004	100	0.0001
As-Found:		As-Found:		As-Found:	
Pass: ☑	Fail: ☐	Pass: ☑	Fail: ☐	Pass: ☑	Fail: ☐
As-Left:		As-Left:		As-Left:	
Pass: ☑	Fail: ☐	Pass: ☑	Fail: ☐	Pass: ☑	Fail: ☐

CALIBRATION DATA

Standard	As-Found	As-Left
100	99.9998	100.0001
50	49.9999	50.0000
20	20.0000	20.0000
5	5.0000	5.0000
1	1.0000	1.0000
0.1	0.1000	0.1000

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Weight Set	R.L./Troemner	1MG-25KG	A45	8/28/14	8/2015	OR-12-267-C

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 ar location of calibration. Calibration data should be reviewed to insure that the instrument is performing to its required accuracy.

PT ID: LOKT01

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Lokee Testing Labs
13235 Prairie Circle East
Bonney Lake, WA 98390

Report Number: LOKT0137010004130919

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	9/19/13	12/4/12	3/2014

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	100.0003	99.9998
50	50.0001	49.9999
20	20.0000	20.0000
5	5.0000	5.0000
1	1.0000	1.0000
0.1	0.1000	0.1000

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Weight Set	R.L./Troemner	1MG-25KG	A45	9/13/12	9/2013	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.

~~Member: National Conference of Standards Laboratories and Weights & Measures~~

PT ID: LOKT01

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Lokee Testing Labs
13235 Prairie Circle East
Bonney Lake, WA 98390

Report Number: LOKT0137010004121204

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	12/4/12	6/12/12	6/2013

FUNCTIONAL CHECKS

ECCENTRICITY	LINEARITY	REPEATABILITY
Test Wt: 100	Test Wt: 50x2	Test Wt: 10
Tol: 0.0003	Tol: 0.0004	Tol: 0.0002
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	100.0004	99.9999
50	50.0002	50.0000
20	20.0000	20.0000
5	5.0000	5.0000
1	1.0000	1.0000
0.1	0.1000	0.1000

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Weight Set	R.L./Troemner	1MG-25KG	A45	9/13/12	9/2013	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.

Thermocouple Calibration Record Semi-Annual

Thermocouples Check against
Reference Thermometer serial number 9123454
Ice Water Bath 32.0
Boiling Water 212.0
Room Temperature 72
Barometric Pressure 30.32
DATE: 6-23-14

TC	Location	Ice Bath Temp	Boiling Water Temp
1	Wet Bulb	32.0	212.0
2	Dry Bulb	32.0	212.0
3	Stack	32.1	211.8
4	Stove Top	32.2	211.9
5	Left Side	32.1	211.8
6	Back	32.1	212.1
7	Right Side	32.2	211.9
8	Bottom	32.0	212.2
9	Firebox	32.3	211.6
10	Secondary/Cat	32.2	212.0
11	Ambient	32.0	212.2
12	Tube Furnace	32.5	212.4
13	Sample Box	32.1	211.8
14	Impinger Out	32.0	211.9
15	C. Gas Box	32.0	212.1
16	C. Gas Out	32.1	212.0
17	SO2 Out	32.0	212.1
18	Upper Ambient	32.1	212.0
19			
20			
21			
22			
23	Calibrator	32.0	212.0
24	Oven	32.0	211.8

Thermocouple Readout Semi-Annual Calibration Data Sheet

Date: 6.23.14
Ambient Temperature: 72
Technician: Chj

Thermocouple Number: T/C Readout
Barometric Pressure: 30.32
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	211.9	.047
250	Omega	250.0	249.9	.040
300	Omega	300.0	299.8	.067
400	Omega	400.0	399.8	.050
500	Omega	500.0	499.8	.160
600	Omega	600.0	599.7	.050
700	Omega	700.0	699.8	.029
800	Omega	800.0	799.8	.025
900	Omega	900.0	899.8	.022
1000	Omega	1000.0	999.9	.010
1200	Omega	1200.0	1199.9	.008
1400	Omega	1400.0	1399.9	.007
1600	Omega	1600.0	1599.9	.006
1800	Omega	1800.0	1800.0	Ø
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: 6-23-14

SO^2 INJECTION ROTAMETER FISHER SN 9123454

NIST Traceable

Actual	°C = °F	°F
0.0	32.0	32.0
22.8	73.0	73.0
37.0	98.6	98.6
50.1	122.2	122.1

DRY GAS METER THERMOCOUPLES

Actual	°C = °F	5H in	5H out	KK
0.0	32.0	32.1	32.1	
22.6	72.7	72.6	72.7	
36.8	98.2	98.2	98.3	
49.8	121.6	121.4	121.6	

SLING PSYCHROMETER

Actual	°C = °F	Wet Bulb	Dry Bulb
0.0	32.0	32.0	32.0
16.4	61.5	61.6	61.6
22.8	73.0	73.0	73.0
33.6	92.5	92.4	92.4

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.

APEX INSTRUMENTS METHOD 5 PRE-TEST CONSOLE CALIBRATION
USING CALIBRATED CRITICAL ORIFICES
5-POINT ENGLISH UNITS

Meter Console Information	
Console Model Number	
Console Serial Number	
DGM Model Number	
DGM Serial Number	

Calibration Conditions			
Date	Time	10-Sep-14	0:00
Barometric Pressure		30.3	in Hg
Theoretical Critical Vacuum[1]		14.3	in Hg
Calibration Technician		CW	

Factors/Conversions		
Std Temp	528	°R
Std Press	29.92	in Hg
K_1	17.647	oR/in Hg

[1]For valid test results, the Actual Vacuum should be 1 to 2 in. Hg greater than the Theoretical Critical Vacuum shown above.

[2]The Critical Orifice Coefficient, K', must be entered in English units, $(ft^3*°R^{1/2})/(in.Hg*min)$.

Calibration Data

Run Time	Metering Console					Critical Orifice				
Elapsed	DGM Orifice ΔH	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Serial Number	Coefficient	Amb Temp Initial	Amb Temp Final	Actual Vacuum
(Θ)	(P_m)	(V_{mi})	(V_{mf})	(t_{mi})	(t_{mf})		K'	(t_{amb})	(t_{amb})	
min	in H_2O	cubic feet	cubic feet	°F	°F		see above2	°F	°F	in Hg
16.1	0.3	453.000	458.500	73	75	gx-40	0.2333	74	73	20
9.8	0.7	458.500	463.500	75	79	gx-48	0.3392	73	77	18
7.8	1.1	463.500	468.500	79	83	gx-55	0.4457	77	79	17
5.9	1.2	468.500	473.500	83	84	gx-63	0.5870	79	81	16
4.3	1.4	473.500	478.500	84	87	gx-73	0.8091	81	82	13

Results

Standardized Data				Dry Gas Meter				
				Calibration Factor		Flowrate	ΔH @	
Dry Gas Meter		Critical Orifice		Value	Variation	Std & Corr	0.75 SCFM	Variation
($V_{m(std)}$)	($Q_{m(std)}$)	($Vcr_{(std)}$)	($Q_{cr(std)}$)	(Y)	(ΔY)	($Q_{m(std)(corr)}$)	(ΔH@)	(ΔΔH@)
cubic feet	cfm	cubic feet	cfm			cfm	in H2O	
5.506	0.342	4.923	0.306	0.894	-0.009	0.306	1.810	0.333
4.982	0.508	4.350	0.444	0.873	-0.030	0.444	1.996	0.519
4.950	0.639	4.508	0.582	0.911	0.008	0.582	1.734	0.257
4.929	0.835	4.511	0.765	0.915	0.012	0.765	1.142	-0.334
4.913	1.143	4.526	1.052	0.921	0.018	1.052	0.701	-0.775
				0.903	Y Average		1.477	ΔH@ Average

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is +-0.02.

I certify that the above Dry Gas Meter was calibrated in accordance with USEPA Methods, CFR 40 Part 60, using the Precision Wet Test Meter # 11AE6, which in turn was calibrated using the American Bell Prover # 3785, certificate # F107, which is traceable to the National Bureau of Standards (N.I.S.T.).

Signature _____ Date _____

APEX INSTRUMENTS
METHOD 5 CRITICAL ORIFICE SET CALIBRATION
Lokee Testing

Orifice Set	GX
Orifice Series	40-73
Meter Gamma	0.9974

Calibration Conditions	
Date Started	19-Dec-2011
Date Finished	19-Dec-2011
Calibration Technician	Eric Waters

Factors/Conversions		
Standard Temperature	293	K
Standard Pressure	760	mm Hg
K_1	0.3858	K/mm Hg

Calibration Data | **Reference Meter** | **Results: Critical Orifice**

Date	Orifice Number	Barometric Pressure	Theoretical Critical Vacuum[1]	Run Time Elapsed	DGM Orifice ΔH	Volume Initial	Volume Final	Volume Total	Standardized Volume	Outlet Temp Initial	Outlet Temp Final	Amb Temp Initial	Amb Temp Final	Actual Vacuum	Coefficient Metric Units	Coefficient English Units	% Variation from Avg	Standard Flow
				Θ	ΔH	$V_{m(i)}$	$V_{m(f)}$	V_m	V_{std}	$t_{m(i)}$	$t_{m(f)}$	$t_{amb(i)}$	$t_{amb(f)}$		K'	K'	<0.5%	Q'
		mm Hg	mm Hg	min	mm H_2O	m^3	m^3	m^3	m^3	°C	°C	°C	°C	mm Hg	see below[2]	see below[3]	%	Lpm
19-Dec-2011	GX-40	747.0	352.58	10	6.6	0.0530	0.1398	0.0868	0.0844	23	24	23	23	571.5	1.9388E-04	0.2333	0.00	8.4157
19-Dec-2011	GX-40	747.0	352.58	10	6.6	0.1398	0.2268	0.0870	0.0844	24	24	23	23	571.5	1.9400E-04	0.2335	0.06	8.4209
19-Dec-2011	GX-40	747.0	352.58	10	6.6	0.2268	0.3137	0.0869	0.0843	24	24	23	23	571.5	1.9377E-04	0.2332	-0.06	8.4112
														Average	1.9388E-04	0.2333		8.4160
19-Dec-2011	GX-48	747.0	352.58	10	15.0	0.3137	0.4399	0.1262	0.1226	24	24	23	23	546.1	2.8164E-04	0.3389	-0.08	12.2253
19-Dec-2011	GX-48	747.0	352.58	10	15.0	0.4399	0.5663	0.1264	0.1228	24	24	23	23	546.1	2.8209E-04	0.3395	0.08	12.2447
19-Dec-2011	GX-48	747.0	352.58	10	15.0	0.5663	0.6926	0.1263	0.1227	24	24	23	23	546.1	2.8186E-04	0.3392	0.00	12.2350
														Average	2.8186E-04	0.3392		12.2350
19-Dec-2011	GX-55	747.0	352.58	10	30.0	0.6926	0.8580	0.1654	0.1609	24	24	23	24	508	3.6998E-04	0.4452	-0.10	16.0463
19-Dec-2011	GX-55	747.0	352.58	10	30.0	0.8580	1.0236	0.1656	0.1611	24	24	24	24	508	3.7074E-04	0.4462	0.11	16.0657
19-Dec-2011	GX-55	747.0	352.58	10	30.0	1.0236	1.1890	0.1654	0.1609	24	24	24	24	508	3.7029E-04	0.4456	-0.01	16.0463
														Average	3.7034E-04	0.4457		16.0528
19-Dec-2011	GX-63	747.0	352.58	10	46.0	1.1890	1.4066	0.2176	0.2120	24	24	24	24	469.9	4.8792E-04	0.5872	0.03	21.1436
19-Dec-2011	GX-63	747.0	352.58	15	46.0	1.4066	1.7332	0.3266	0.3176	24	25	24	24	469.9	4.8740E-04	0.5866	-0.08	21.1210
19-Dec-2011	GX-63	747.0	352.58	10	46.0	1.7332	1.9516	0.2184	0.2121	25	25	24	24	469.9	4.8807E-04	0.5874	0.06	21.1502
														Average	4.8779E-04	0.5870		21.1383
19-Dec-2011	GX-73	747.0	352.58	10	88.0	1.9516	2.2504	0.2988	0.2913	25	25	24	24	419.1	6.7049E-04	0.8069	-0.28	29.0553
19-Dec-2011	GX-73	747.0	352.58	10	88.0	2.2504	2.5504	0.3000	0.2925	25	25	24	24	419.1	6.7318E-04	0.8101	0.12	29.1720
19-Dec-2011	GX-73	747.0	352.58	10	88.0	2.5504	2.8505	0.3001	0.2926	25	25	24	24	419.1	6.7341E-04	0.8104	0.16	29.1817
														Average	6.7236E-04	0.8091		29.1364

[1]For valid test results, the Actual Vacuum must be 25 mmHg greater than the Theoretical Critical Vacuum.

[2]The Critical Orifice Coefficient, K', in Metric units, $(m^3 * K^{1/2}) / (mm\ Hg * min)$.

[3]The Critical Orifice Coefficient, K', in English units, $(ft^3 * R^{1/2}) / (in\ Hg * min)$.

$$K' = \frac{K_1 V_m Y \left(P_{bar} + \frac{\Delta H}{13.6} \right) \sqrt{T_{amb}}}{P_{bar} T_m \Theta}$$

reference US EPA Method 5, Appendix A, section 7.2.2.2.6

I certify that the above Orifice Set was calibrated in accordance with US EPA Methods, CFR 40 Part 60, Appendix A, Method 5, Item 7.2.2 using the Precision Wet Test Meter # 11AE6, which in turn was calibrated using the American Bell Prover # 157, certified 05/26/2006 using Pi Tape S/N 20700139, which is traceable to the National Bureau of Standards (NIST).

Signature Eric Waters

Date 12/19/11

GX-40-73 Lokee Testing AIC53668 std 20111219

SO_2 ROTAMETER CALIBRATION

Last Cal. : 12-25-13 By : Chp Date : 6-23-14 By : Chp

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

Barometric Pressure : 30.32 " Hg Temperature : 72

RUN #	50 CC/MINUTE	100 CC/MINUTE	150 CC/MINUTE
	DIGICAL VOLUME	DIGICAL VOLUME	DIGICAL VOLUME
1	55.8	120.8	172.2
2	55.6	121.4	172.5
3	55.6	120.7	172.1
4	55.7	120.8	172.7
5	55.9	120.9	172.9
6	55.4	120.4	172.7
7	55.7	120.9	173.1
8	55.6	121.0	172.2
9	55.8	120.3	172.8
10	55.7	121.0	172.6
AVERAGE	55.7 cc/min	120.8 cc/min	172.6 cc/min

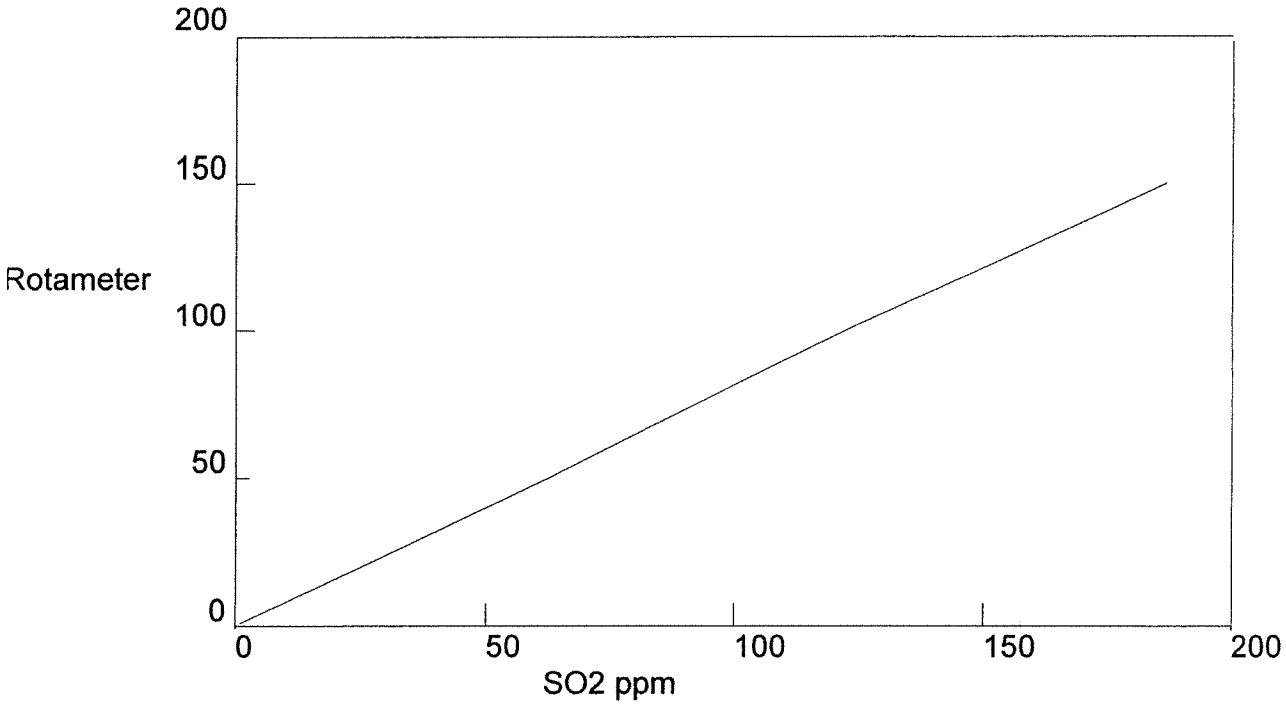
SETTING	cc/min
0	0.0
50	55.7
100	120.8
150	172.6

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

100 CC / MINUTE = 85.9

SO2 Rotameter

06/23/14



Regression Output:

Constant		-2.77556E-17
Std Err of Y Est		2.07259E-14
R Squared		1
No. of Observations		4
Degrees of Freedom		1
X Coefficient(s)	1.11022E-16	1
Std Err of Coef.	4.44745E-15	3.81162E-15

range-analyze-regression

0	0
50	55.7
100	120.8
150	172.6

TRACER GAS TRAIN RESPONSE TIME

DATE: 6-23-14

Elapsed Time	SO_2 Conc. (v.)	SO_2 Conc. (v.)	SO_2 Conc. (v.)
00 sec	.486	.487	.486
15	.318	.320	.320
30	.195	.193	.194
45	.140	.138	.137
60	.085	.084	.085
75	.070	.065	.067
90	.038	.035	.035
105	.021	.022	.021
120	.015	.014	.014
135	.010	.010	.009
150	.006	.005	.005
165	.003	.002	.002
180	.001	.000	.000
Initial Response	12	12	12
95 % Response	100	100	100
Flow Rate	1.5	1.5	1.5

CEM GAS TRAIN RESPONSE TIME

Elapsed Time	CO_2 Conc. (v.)	CO_2 Conc. (v.)	CO_2 Conc. (v.)	O_2 Conc. (v.)	O_2 Conc. (v.)	O_2 Conc. (v.)	CO Conc. (v.)	CO Conc. (v.)	CO Conc. (v.)
00 sec	.485	.485	.485	.000	.000	.000	.499	.500	.500
15	.473	.471	.471	.451	.459	.455	.240	.235	.236
30	.355	.351	.352	.766	.760	.761	.045	.046	.044
45	.145	.142	.142	.815	.817	.817	.016	.019	.018
60	.081	.079	.079	.822	.822	.823	.005	.005	.006
75	.042	.040	.040	.827	.828	.828	.001	.001	.002
90	.017	.016	.016				Ø	Ø	Ø
105	.009	.007	.009						
120	.005	.004	.006						
135	.002	.001	.003						
150	.001	Ø	.001						
165	Ø		Ø						
180									
Initial Response	14	14	14	5	6	6	7	7	7
95 % Response	85	85	85	40	40	40	38	38	38
Flow Rate	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5

ORSAT ANALYSIS DATA SHEET DATE : 6.23.14

Gas	1	2	3	AVE	CONC	TANK ID
CO_2	∅	∅	∅	∅	∅	168TAC-3A
O_2	∅	∅	∅	∅	∅	
CO	∅	∅	∅	∅	∅	
CO_2	12.2	12.2	12.2	12.2	12.21	481905
O_2	12.6	12.6	12.6	12.6	12.6	
CO	4.90	4.90	4.90	4.9	4.90	
CO_2	21.1	21.1	21.1	21.1	21.1	CAO6641
O_2	20.9	20.9	20.9	20.9	20.9	
CO	8.6	8.6	8.6	8.6	8.63	
CO_2	6.2	6.2	6.3	6.23	6.22	CC-12731
O_2	6.2	6.3	6.3	6.27	6.25	
CO	2.0	2.0	2.0	2.0	1.98	
CO_2						
O_2						
CO						

CO_2 ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Date: 11-24-14

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

Calibration by: GW

Cal Gas Flow: 1.5 SCFH Measured by: Rotameter

BP: 30.10 Instrument ID: PRINCO

Temp: 66 Instrument ID: TR

Cylinders:

1. # TC3AAM173 Concentration: 00.00 % CO_2 Cyl. Press.: 2010 PSI
   Certified by: AIR LIQUIDE Date: 2-14-13
2. # 487905 Concentration: 12.20 % CO_2 Cyl. Press.: 1360 PSI
   Certified by: AIR LIQUIDE Date: 11-1-07
3. # CA0666 41 Concentration: 21.1 % CO_2 Cyl. Press.: 1290 PSI
   Certified by: AIR LIQUIDE Date: 1-5-2007
4. # CC-12731 Concentration: 6.22 % CO_2 Cyl. Press.: 980 PSI
   Certified by: AIR LIQUIDE Date: 03-13-03

Analyzer: **Calibrated Range:** 0-25.0 % **Output:** 0-1.0 V.
Flow: 1.5 SCFH **Measured by:** Rotameter

Calibration Results

Point #	CYL. #	% CO2	EXPECTED METER	EXPECTED DVM	ACTUAL METER	ACTUAL DVM	ADJ. METER	ADJ. DVM
1	1	0.00	00.0	.000	00.0	-.003	00.0	.000
2	2	12.20	48.8	.488	48.4	.484	48.8	.488
3	3	21.1	84.4	.844	84.2	.847		
4	4	6.22	24.9	.249	25.3	.253		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 12.496

CO_2 Linear Regression Results:

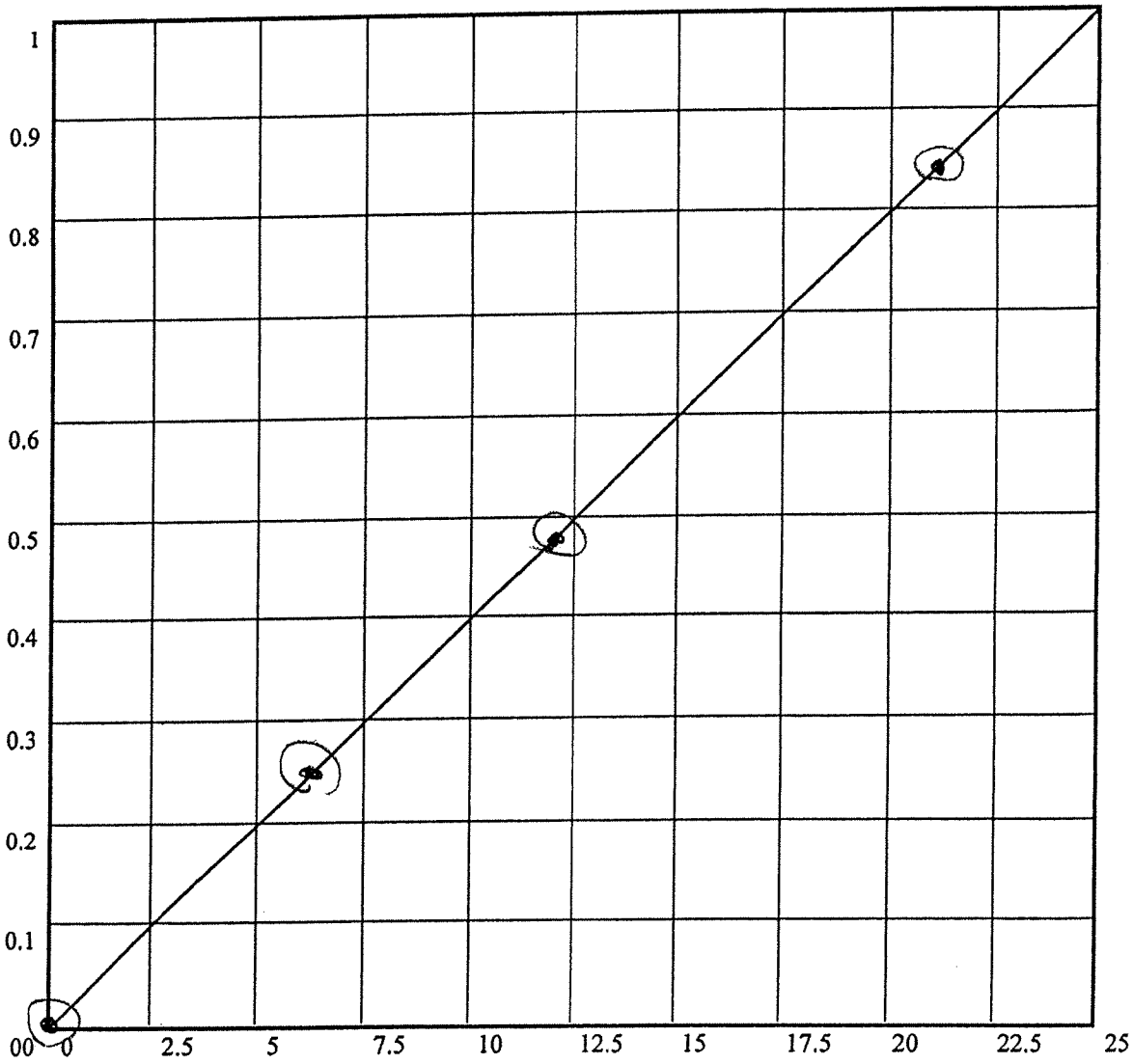
Y = MX +B

Slope (M) = .0620919

Y Intercept (B) = .0398439

Correlation Coefficient (r) = .9999811

r^2 = .9999622



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

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

HIGH VOLTS .842 = 21.05 - 21.10 = -.050 = -.200

LOW VOLTS .253 = 6.325 - 6.22 = .105 = .420

O_2 ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Date: 11-24-14

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

Calibration by: CW

Cal Gas Flow: 1.5 SCFH Measured by: Rotameter

BP: 30.10 Instrument ID: PRINCO

Temp: 66 Instrument ID: TR

Cylinders:

1. # TC3AAM173 Concentration: 00.00 % O_2 Cyl. Press.: 2010 PSI
   Certified by: AIR LIQUIDE Date: 2-14-13
2. # 487905 Concentration: 12.0 % O_2 Cyl. Press.: 1360 PSI
   Certified by: AIR LIQUIDE Date: 11-1-07
3. # CA0066641 Concentration: 20.9 % O_2 Cyl. Press.: 1290 PSI
   Certified by: AIR LIQUIDE Date: 1-5-2007
4. # CC-12731 Concentration: 6.25 % O_2 Cyl. Press.: 980 PSI
   Certified by: AIR LIQUIDE Date: 03-13-03

Analyzer: **Calibrated Range:** 0-25.0 % **Output:** 0-1.0 V.
Flow: 1.5 SCFH **Measured by:** Rotameter

Calibration Results

Point #	CYL. #	% O2	EXPECTED METER	EXPECTED DVM	ACTUAL METER	ACTUAL DVM	ADJ. METER	ADJ. DVM
1	1	0.00	00.0	.000	00.0	.000	00.0	.000
2	2	12.60	12.60	.504	12.6	.505	12.6	.504
3	3	20.9	20.9	.836	20.9	.834		
4	4	6.25	6.25	.250	6.3	.251		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 12.513

O_2 Linear Regression Results:

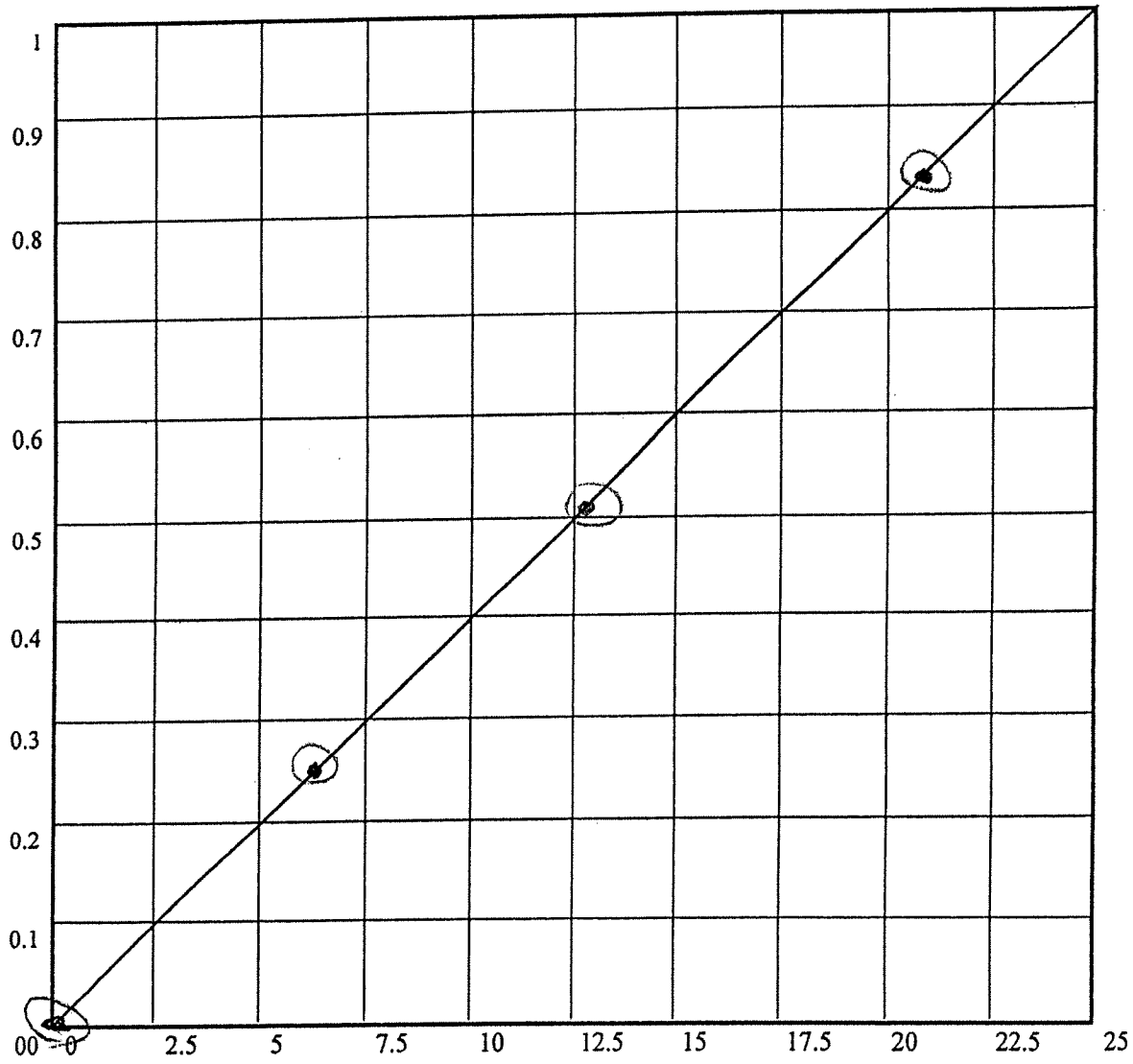
Y = MX +B

Slope (M) = .0008122

Y Intercept (B) = .1039893

Correlation Coefficient (r) = .9999974

r^2 = .9999947



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

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

HIGH VOLTS .834 = 20.85 - 20.90 = -.050 = -.200

LOW VOLTS .251 = 6.275 - 6.250 = .025 = .100

CO ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Date: 11-24-14

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

Calibration by: CW

Cal Gas Flow: 1.5 SCFH Measured by: Rotameter

BP: 30.10 Instrument ID: PRINCO

Temp: 66 Instrument ID: TR

Cylinders:

1. # TC3AAM173 Concentration: 00.00 % **CO** Cyl. Press.: 2010 PSI
   Certified by: AIR LIQUIDE Date: 2-14-13
2. # 487905 Concentration: 4.90 % **CO** Cyl. Press.: 1360 PSI
   Certified by: AIR LIQUIDE Date: 11-1-07
3. # CA06641 Concentration: 8.63 % **CO** Cyl. Press.: 1290 PSI
   Certified by: AIR LIQUIDE Date: 1-5-2007
4. # CC-12731 Concentration: 1.98 % **CO** Cyl. Press.: 980 PSI
   Certified by: AIR LIQUIDE Date: 03-13-03

Analyzer: **Calibrated Range:** 0-10.0 % **Output:** 0-1.0 V.
Flow: 1.5 SCFH **Measured by:** Rotameter

Calibration Results

Point #	CYL. #	% CO	EXPECTED METER	EXPECTED DVM	ACTUAL METER	ACTUAL DVM	ADJ. METER	ADJ. DVM
1	1	0.00	00.0	.000	00.0	-.001	00.0	.002
2	2	4.90	49.0	.490	48.5	.485	49.0	.490
3	3	8.63	86.3	.863	85.5	.855		
4	4	1.98	19.8	.198	19.7	.197		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 5.032

CO Linear Regression Results:

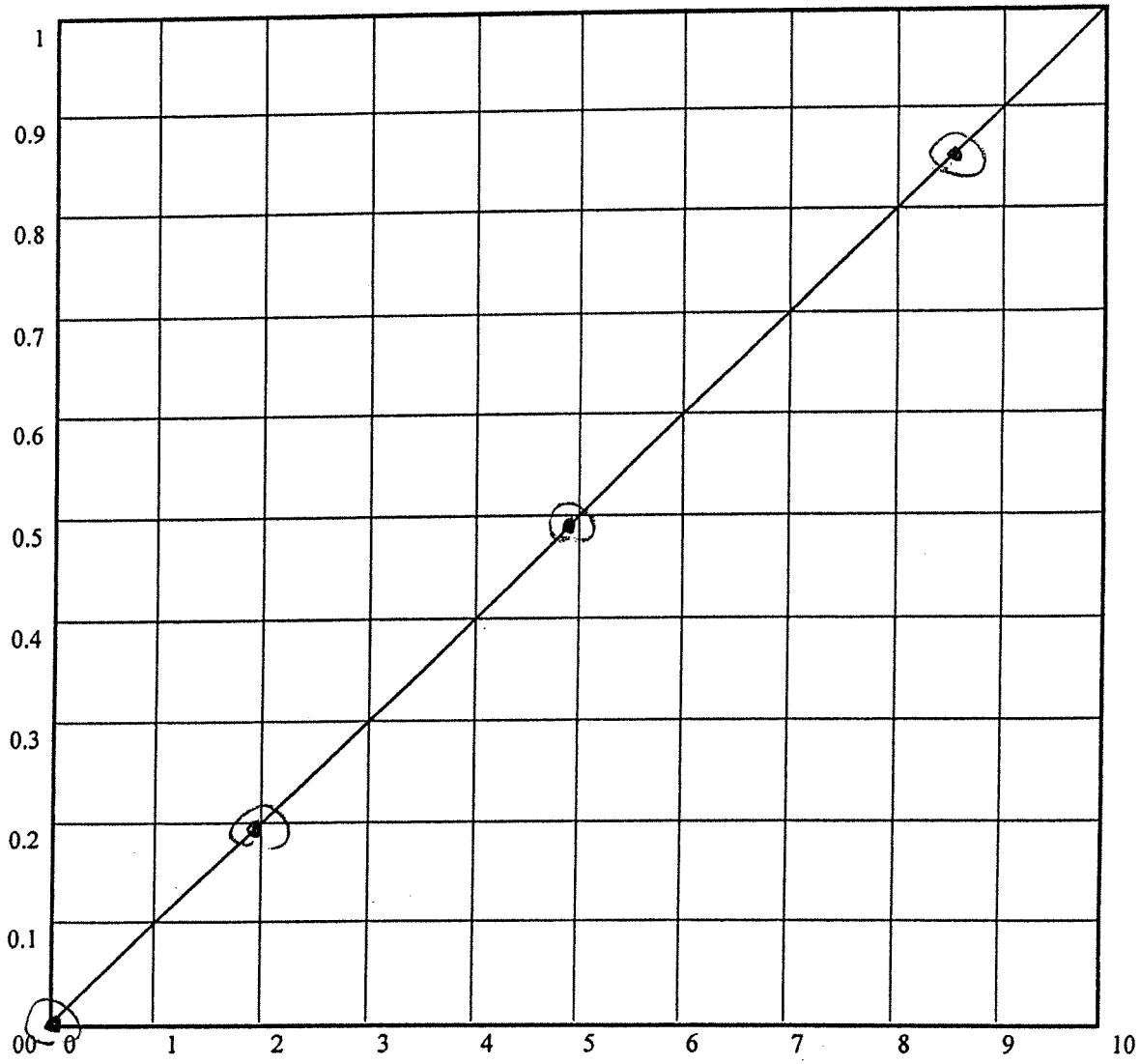
Y = MX +B

Slope (M) = .0010638

Y Intercept (B) = .0991454

Correlation Coefficient (r) = .9999833

r^2 = .9999666



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

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

HIGH VOLTS .855 = 8.55 - 8.63 = -.080 = -.800

LOW VOLTS .197 = 1.97 - 1.98 = -.010 = -.100

SO_2 ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Date: 11-24-14

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

Calibration by: CW

Cal Gas Flow: 1.5 SCFH Measured by: Rotameter

BP: 30.10 Instrument ID: PRINCO

Temp: 64 Instrument ID: TR

Cylinders:

1. # TC3AAM173 Concentration: 00 00 % SO_2 Cyl. Press.: 2010 PSI
   Certified by: AIR LIQUIDE Date: 2-14-13
2. # CC82089 Concentration: 1250 % SO_2 Cyl. Press.: 1610 PSI
   Certified by: AIR LIQUIDE Date: 1-3-2007
3. # ALM0 49127 Concentration: 1970 % SO_2 Cyl. Press.: 680 PSI
   Certified by: SCOTT SPECIALTY GASES Date: 05-15-97
4. # ALM0 52285 Concentration: 506 % SO_2 Cyl. Press.: 500 PSI
   Certified by: SCOTT SPECIALTY GASES Date: 05-15-97

Analyzer: **Calibrated Range:** 0-2500 PPM **Output:** 0-1.0 V.
Flow: 1.5 SCFH **Measured by:** Rotameter

Calibration Results

Point #	CYL. #	PPM SO2	EXPECTED		ACTUAL		ADJ.	
			METER	DVM	METER	DVM	METER	DVM
1	1	0.00	00.0	.000	00.0	-.004	00.0	1.000
2	2	1250	50.0	.500	49.8	.498	50.0	1.500
3	3	1970	70.8	.708	71.0	.710		
4	4	506	20.2	.202	20.2	.202		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 1,248.04

SO_2 Linear Regression Results:

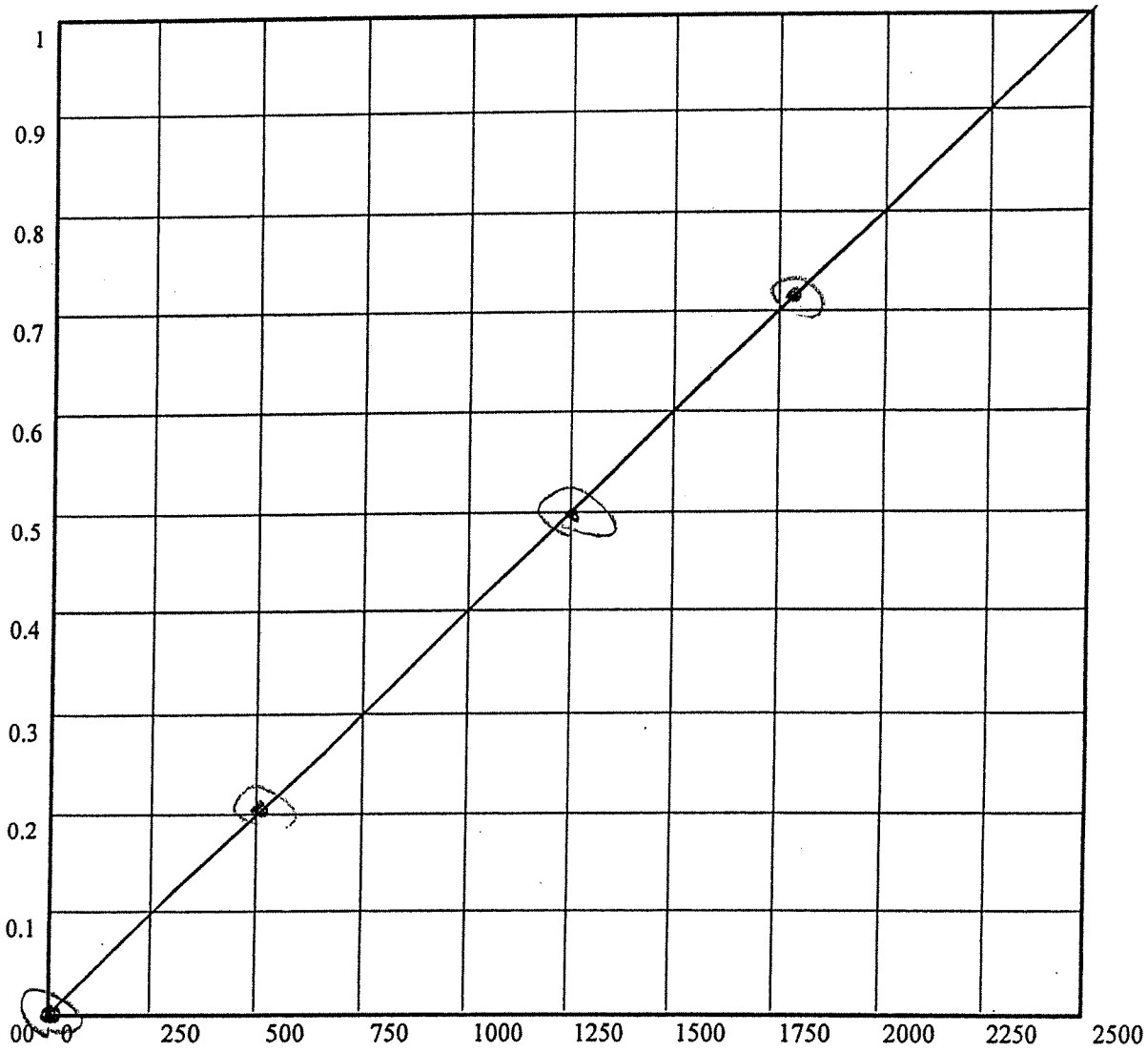
Y = MX +B

Slope (M) = -.000521b

Y Intercept (B) = .0004010

Correlation Coefficient (r) = .9999975

r^2 = .9999947

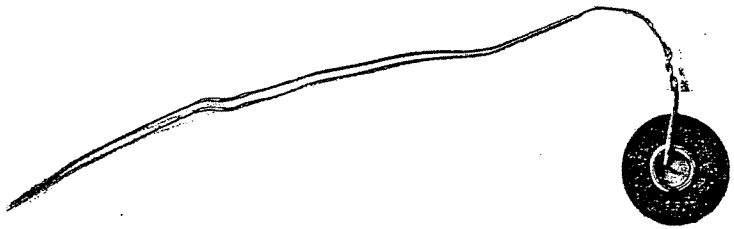


EPA Span Value = ± 2.0% of 2500 PPM SO_2 = ± 50 PPM

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

HIGH VOLTS .710 = 1775.0 - 1770.0 = 5.000 = .200

LOW VOLTS .207 = 505.0 - 506.0 = -1.000 = -.040



LOW SPAN

AIR LIQUIDE

GASES FOR RESEARCH AND DEVELOPMENT

CYL # CC-12731 CGA 590

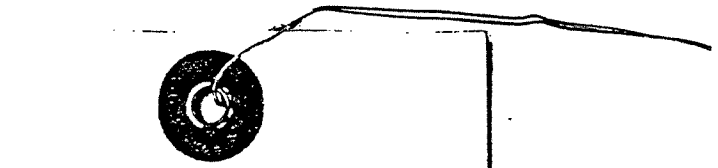
PRES 1665 VOL 130 c.f

TEST # 07203 DATE 03-13-03

Analytical Method GC/Paramagnetic

	Requested	Analyzed
Hydrogen		
Nitrogen	Bal.	Bal.
Argon		
Air		
Carbon Monoxide	2%	1.98%
Methane		
Oxygen	6.25%	6.25%
Helium		
Carbon Dioxide	6.25%	6.22%

SIGNED



AIR LIQUIDE

1451 THORNE RD.
TACOMA, WA 98421
TEL: (253) 383-3637

THE ONLY LIABILITY OF THIS COMPANY FOR GAS WHICH FAILS TO COMPLY WITH THE ANALYSIS SHALL BE REPLACEMENT THEREOF BY THE COMPANY WITHOUT EXTRA COST.

DO NOT REMOVE THIS TAG

AIR LIQUIDE™

CERTIFICATE OF ANALYSIS

Customer : Pacifice Rim Oxygen Service
P.O. Number : 200159
Document # : 23639406-1A
Mix/Lot # : SFS103795
Item Number : SFS103795
Valid Until : 4 January, 2012

Specification : CUSTOM CERTIFIED
Phase : GAS
Cyl. Size : 30AL Valve : CGA 590
Pressure : 1667
Volume : 120 SCF

Cylinder Number: **CAO6641**

Component	Requested Concentrations MOLE	Actual Concentration MOLE	% Analytical Uncertainty	Equipment Used Scale	Analyt. Inst.	Calibration Standard
NITROGEN	Balance	Balance		2		
CARBON MONOXIDE	8.6 %	8.63 %		2	4620	PQ
OXYGEN	21 %	20.9 %		2	4620	TB
CARBON DIOXIDE	21 %	21.1 %		2	4620	PD
7001-30AL						

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

Comments:-

Dewpoint calculated to 40° F, unless otherwise stated. Improper storage or use may affect the accuracy of this standard.
Reported impurities are approximate and should not be used for calibration purposes.

Prepared by _____ Date: 5-Jan-2007

8832 Dice Road -- Santa Fe Springs, CA 90670
Phone (562) 945-1383 **Fax** (562) 696-7903
ISO: 9001-2000

A-L WELDING PRODUCTS

A Division of Pacific Rim Oxygen Services, Inc.
15700 Nelson Road South • Tukwila, Washington 98188
Telephone (425) 228-2218 • Fax (425) 228-2397

Certificate of Analysis

Customer: AL Welding Products
Product: 5% CO. 12.5% CO2, 12.5% O2, balance Nitrogen
Grade: Certified Standard
Cylinder Number: 487905
Product Code: 2505COOXCDNTHC
Lot Number: K3171302

11-01-07

CGA 590
Pressure: 1650 psig
Contents: 175 ft^3

Mixture Analysis

Component	Specification	Concentration	Analytical Method
Oxygen	12.5%	12.6%	MTIGC-TCD
CO2	12.5%	12.2%	Varian
CO	5.0%	4.9%	MTIGC-TCD
Nitrogen	Balance	Balance	MTI GC-TCD

I certify the above referenced cylinder was analyzed and found to contain the listed concentrations.

Thomas M Chesser, Chemist

11-01-07
Date

Scott Specialty Gases

500 WEAVER PARK RD,LONGMONT,CO 80501 Phone: 303-442-4700 Fax: 303-772-7873

CERTIFICATE OF ANALYSIS: Interference-Free™ Multi-Component EPA Protocol Gas

Customer
ENERGY & ENV MEASUREMENT

C/O ED WADINGTON
3730 N. PELLEGRINO DR.
TUCSON,AZ 85749

Assay Laboratory

SCOTT SPECIALTY GASES
500 WEAVER PARK RD
LONGMONT,CO 80501

Project No.: 08-34135-001
P.O. No.: VERBAL

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards, Procedure #G1; September, 1993.

Cylinder Number: ALM052285 Certification Date: 4/21/97 Exp. Date: 4/21/2000
Cylinder Pressure***: 1996 PSIG

COMPONENT	CERTIFIED CONCENTRATION	ANALYTICAL ACCURACY**
SULFUR DIOXIDE *	506 PPM	+/- 1% NIST Traceable
NITROGEN	BALANCE	

*** Do not use when cylinder pressure is below 150 psig.

** Analytical accuracy is inclusive of usual known error sources which at least include precision of the measurement processes. Product certified as +/- 1% analytical accuracy is directly traceable to NIST standards.

* This Protocol has been certified using corrected NIST SO2 standard values, per EPA guidance dated 7/24/96 and will not correlate with Uncorrected Protocols.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 1661	9/27/98	ALM059505	488.5 PPM	SO2/N2

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	LAST DATE CALIBRATED	ANALYTICAL PRINCIPLE
FTIR System/8220/AAB9400251	03/20/97	Scott Enhanced FTIR

ANALYZER READINGS

(Z = Zero Gas R = Reference Gas T = Test Gas r = Correlation Coefficient)

First Triad Analysis

SULFUR DIOXIDE *

Date: 04/14/97 Response Unit: PPM

Z1 = 0.3847	R1 = 487.72	T1 = 505.77
R2 = 488.78	Z2 = 1.8201	T2 = 505.89
Z3 = 1.8428	T3 = 505.78	R3 = 488.85

Avg. Concentration: 505.8 PPM

Second Triad Analysis

Date: 04/21/97 Response Unit: PPM

Z1 = 0.3241	R1 = 488.29	T1 = 505.43
R2 = 488.83	Z2 = 1.8098	T2 = 505.75
Z3 = 0.5340	T3 = 505.74	R3 = 488.68

Avg. Concentration: 505.6 PPM

Calibration Curve

Concentration = A + Bx + Cx2 + Dx3 + Ex4

r = 0.999990

Constants:

B = 1.000000	C = 0.000000
D = 0.000000	E = 0.000000

Special Notes:

ANALYST: Devon VonFeldt
Devon VonFeldt

SO2 concentration analysis
06/23/14

Vm(std)	1.500			
mcf	1.004		dscf=	1.500
Hg	30.34			
DH	0.12			
temp	72	532	ppm =	504
ml BA ++	176			
Normality	0.0101			

Run1	504
Run 2	501
Run3	504
avg.	503

Tank I.D. # ALMO52285

AIR LIQUIDE™

CERTIFICATE OF ANALYSIS

Customer : Pacific Rim Oxygen Service Inc
P.O. Number : 200160
Document # : 23540983-1A
Mix/Lot # : SFS103340
Item Number : SFS103340
Valid Until : 2 January, 2010

Specification : CUSTOM CERTIFIED
Phase : GAS
Cyl. Size : 30AL
Valve : CGA 660
Pressure : 2000
Volume : 144 SCF

Cylinder Number: **CC82089**

Component	Requested Concentrations MOLE	Actual Concentration MOLE	% Analytical Uncertainty	Equipment Used Scale	Analyt. Inst.	Calibration Standard
NITROGEN	Balance	Balance		4		
SULFUR DIOXIDE	1250 PPM	1250 PPM	+/- 2%	4	4503	GL
6154-30AL						

This mixture was certified by analysis using one or more calibration standards prepared with scales 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

SO2 concentration analysis
06/23/14

Vm(std)	1.500			
mcf	1.004		dscf=	1.500
Hg	30.34			
DH	0.12			
temp	72	532	ppm =	1251
ml BA ++	437			
Normality	0.0101			

Run1	1249
Run 2	1254
Run3	1251
avg.	1251

Tank I.D. # CC82089

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
06/23/14

Vm(std)	1.500			
mcf	1.004		dscf=	1.500
Hg	30.34			
DH	0.12			
temp	72	532	ppm =	1773
ml BA ++	619			
Normality	0.0101			

Run1	1775
Run 2	1767
Run3	1773
avg.	1772

Tank I.D. # ALMO49127

Certificate of Analysis

ANALYTICAL CONTROL LABORATORY ANALYSIS
METHYLENE CHLORIDE - OPTIMA

Catalog No. D151
Lot No. 035941

July 23, 2003

This is to certify that this lot was tested and found to comply with the specifications for this product. The following are the actual analytical results obtained:

TESTS		ACTUAL ANALYSIS
Assay		99.9%
Color		5 APHA
Description		Clear, Colorless Liquid
Free Halogens		Pass Test
Identification		Pass Test
Fluorescence Background (as Quinine Sulfate)		Not more than 1 ppb
Certified for EPA Test #1625		Pass Test
Pesticide Residue Analysis (as Heptachlor Epoxide)		Not more than 10ng/l
Density (g/ml) at 25°C		1.317
Optical Absorbance	At 254 nm	0.002
	At 240 nm	0.10
	At 233 nm	0.54
Refractive Index at 25°C		1.4209
Residue after Evaporation		0.4 ppm
Titratable Acid		0.00004 Meq/g.
Preservative (Amylene)		64 ppm
Water (H_2O)		0.008%

Fisher Scientific

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

Approved By: Edgar E. Hess

Edgar E Hess
Q.C. Laboratory Manager

Certificate of Analysis

ANALYTICAL CONTROL LABORATORY ANALYSIS
METHYLENE CHLORIDE - OPTIMA

Catalog No. D151
Lot No. 035941

July 23, 2003

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TESTS		ACTUAL ANALYSIS
Assay		99.9%
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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

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

5.0 Operation

Please read the following section before building the first fire in your new Jøtul F 118 Black Bear.

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 panels. The logs should always be spaced at least one inch from the glass to allow for proper air flow within the firebox.

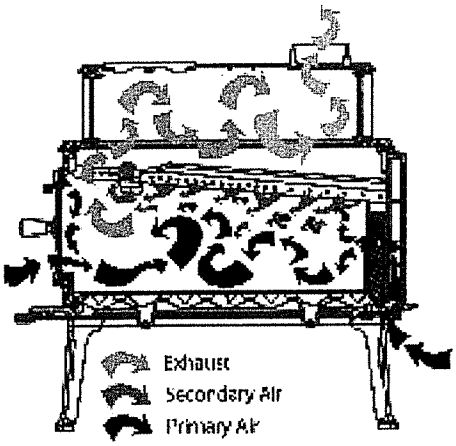


Figure 16. Combustion air paths

5.2 Jøtul F 118 Black Bear Funtionality

The modern version of the original Jøtul F 118 Black Bear builds on the strengths of its predecessor; a long, front-to-back burn pattern combines with a baffled heat exchange chamber to promote maximum heat transfer. Your new Jøtul F 118 Black Bear, however, burns fuel substantially more efficiently. The advanced CrossFlow combustion system directs a precise amount of preheated secondary air through stainless steel tubes located along the sides, directly under the baffle at the top of the burn chamber. Volatile gases, released unburned from the fuel bed, rise to the baffle where they are turbulently mixed with the fresh oxygen. Secondary combustion then occurs before the gases pass into the heat exchange chamber. See **fig. 16**.

Primary Combustion Air Shutter

Located in the Load Door, this shutter regulates and directs primary air to the front of the burn chamber. **Fig. 17, A**. 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.

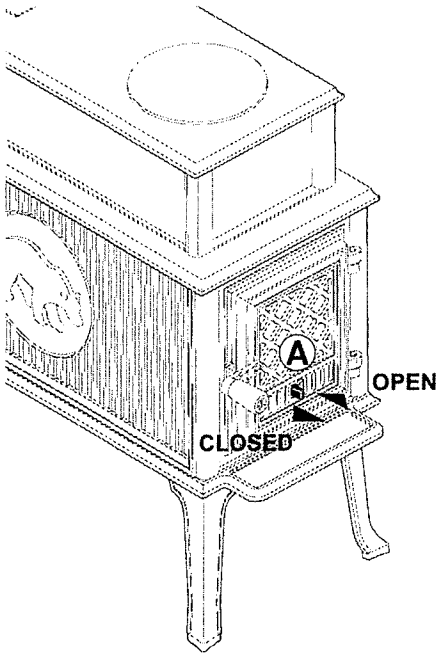


Figure 17. Air Shutter Control

Clean Glass / Air Wash

A fixed amount of primary air also enters the firebox directly above the glass panel on the door. This incoming air creates a turbulent barrier or «airwash» between the glass and the fire.

5.3 Break-In Procedure

The Jøtul F 118 Black Bear is constructed of cast iron and high- temperature furnace cement. This type of construction 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 the Jøtul F118 Black Bear. Use a stove-top thermometer to monitor stove temperature, placed directly on the top plate.

Set the Primary Air Shutter fully open. Set the FlashFire lever fully closed – all the way back.

1. Light a small fire of newspaper and kindling in the middle of the firebox floor. Gradually add small pieces of wood, but only allow the stove to reach a maximum surface temperature of 200°F (93° C). Burn 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 with the FlashFire Lever in Position 2.
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 stove to room temperature. This completes the "break-in" procedure.

Note: If the temperature exceeds the limit during any break-in fire, move the Air Shutter all the way to the left to shut off the air supply completely. It is normal that the stovetop temperature will continue to climb until the fuel burns down somewhat. Once the fire is out and the stove has cooled to room temperature, continue the break-in procedure. Never attempt to reduce the temperature by removing burning logs from the fire.

Break-in Odors: It is normal for a newly painted stove to emit odor and smoke during the first few fires. This is caused by curing of the high temperature paint and will diminish with each fire. Open a window or door to provide additional ventilation to alleviate this condition.

5.4 Starting and Maintaining a Fire

Burn only solid wood directly on the bottom grate of the stove. Do not elevate the fire in any way.

1. With the **Primary Air Shutter** in the full open position (to the right), start with several sheets of crumbled newspaper placed directly on the grate at the front of the burn chamber near the load door. On top of the newspaper, place several pieces of small dry kindling * (less than 1" in diameter) with two to three larger logs (approx. 3" to 4" in diameter) on top.

2. Light the fire and close the door, slowly building the fire by adding larger and larger logs. Be sure to follow the break-in procedure before creating a hot fire that might damage the stove.

3. Once the stove has reached a surface temperature range of between 400° and 600°, (204°C -316°C), adjust the primary air control lever as necessary to generate the heat output and burn time desired. Set the FlashFire Lever in Position 2 for standard operation over extended periods.

We recommend use of a magnetic stovetop thermometer to monitor the surface temperature of the stove. The optimum surface temperature range for the most efficient burn is between 400° and 600° (204°C -316°C).
You can also monitor stove performance through the window. Peak combustion efficiency occurs when exhaust gas is burned at the baffle in the top of the firebox. This is apparent as yellow flames appearing at the secondary air ports in the underside of the baffle plate.

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.

5.5 Adding Fuel

When reloading the stove while it is still hot and a bed of hot embers still exist, follow this reloading procedure:

- Always wear gloves when tending to the stove.
- Open both the Primary Air Shutter and the FlashFire Lever to the full open position and wait a few seconds before opening the load door. This will allow fresh air to flush the firebox and prevent smoke escaping when the door is opened..
- Use a stove tool or poker to distribute the hot embers equally around the firebox.
- Load the fuel, usually with smaller logs first.
- Close the door, be sure to latch the door tightly.
- Wait 5 – 10 minutes before setting the air controls for the desired heat output and burn time. (If you have at least a 2" thick ember bed when reloading, it may be possible to close the door and immediately adjust the air control setting).
- Set the Air Sutter on the door for the desired heat output.

5.6 Open Door Fire-viewing

Warning: This stove should be operated with the door either fully open with optional Spark Screen in place or with the door fully closed. If the door is left partly open, there is risk of overfiring. Also, gas and flame may be drawn out of the fireplace stove opening, creating risks from both fire and smoke.

Be aware that when operating with the door open, there exists the possibility of generating carbon monoxide by some fuels (e.g. charcoal), and the hazards of carbon monoxide. Be sure adequate fresh air and ventilation is available to the stove.

Creosote Formation and the Need for Removal

When wood is burned slowly, it produces tar and other vapors that combine with moisture to form creosote. Creosote vapors condense in the relatively cool chimney flue, and creosote residue accumulates on the flue lining. When ignited, this creosote fuels an extremely hot fire.

The chimney connector and chimney flue should be inspected at least twice monthly during the heating season to determine if creosote buildup has occurred.
If creosote has accumulated, it should be removed to reduce the chance of a chimney fire.

In the event that creosote ignites in the flue, the resulting fire is often accompanied by a roaring noise and crackling sound as flakes of burning creosote break loose. If you suspect you are having a chimney fire, immediately close the air controls and make sure the door is closed securely. Call the fire department and have everyone leave the house.

Do not attempt to extinguish the fire. Opening the door will only supply additional oxygen and intensify the fire. When the fire in the flue has subsided, resist the temptation to open the door to check on the fire. The fire may have suffocated, but could re-ignite with a supply of fresh air. After a chimney fire, do not use the stove until the chimney connector and flue have been cleaned and inspected to ensure no damage has been sustained.

See Section 6.6 of this manual regarding chimney cleaning.

5.7 Ash Removal

Ash removal will be required periodically, depending on how frequently the stove is used. Avoid letting the ash accumulate to spill over the front lip. For your protection, always wear safety gloves when handling the ashes. Use an ash shovel to remove the accumulation from the bottom of the firebox. It is a good idea to leave a bed of ash in the stove bottom to promote longer burn times and easy start-up.

Ashes should only be placed in a metal container equipped with a tight sealing lid. The container should be placed on a noncombustible floor or on the ground, well away from all combustible materials, pending final disposal. If the ashes are disposed of by burial in soil or otherwise locally dispersed, they should be kept in the closed container until all cinders have thoroughly cooled.

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.

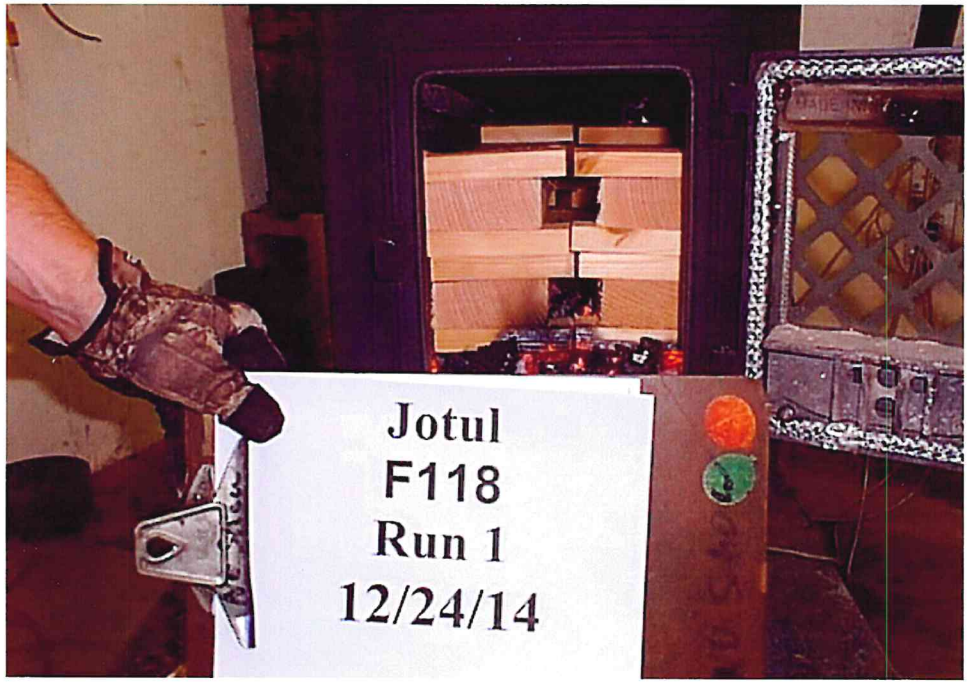
K. Record the stove surface temperatures, firebox and post catalytic or secondary burn temperatures and scale weigh for a minimum of one hour before the test run begins. As necessary add fuel, rake the coal bed, level the coal bed and/or remove coals during the first 45 minutes of the hour immediately 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.


Jotul
F118
Run 1
12/24/14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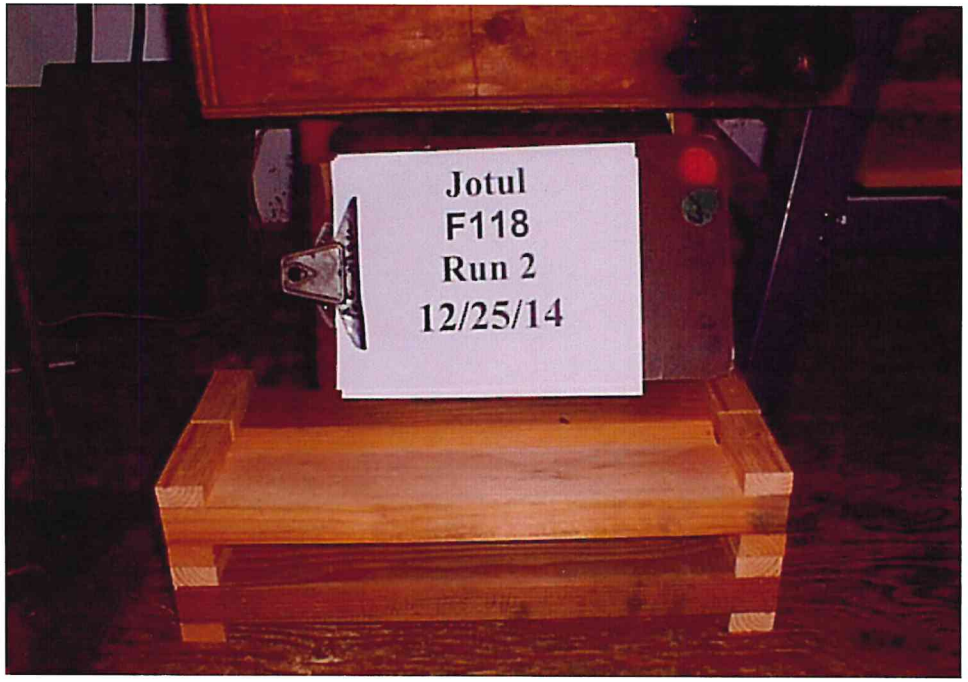
F118
Run 1
12/24/14


Jotul
F118
Run 2
12/25/14


Jotul
F118
Run 2
12/25/14


Jotul
F118
Run 3
12/26/14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Run 3
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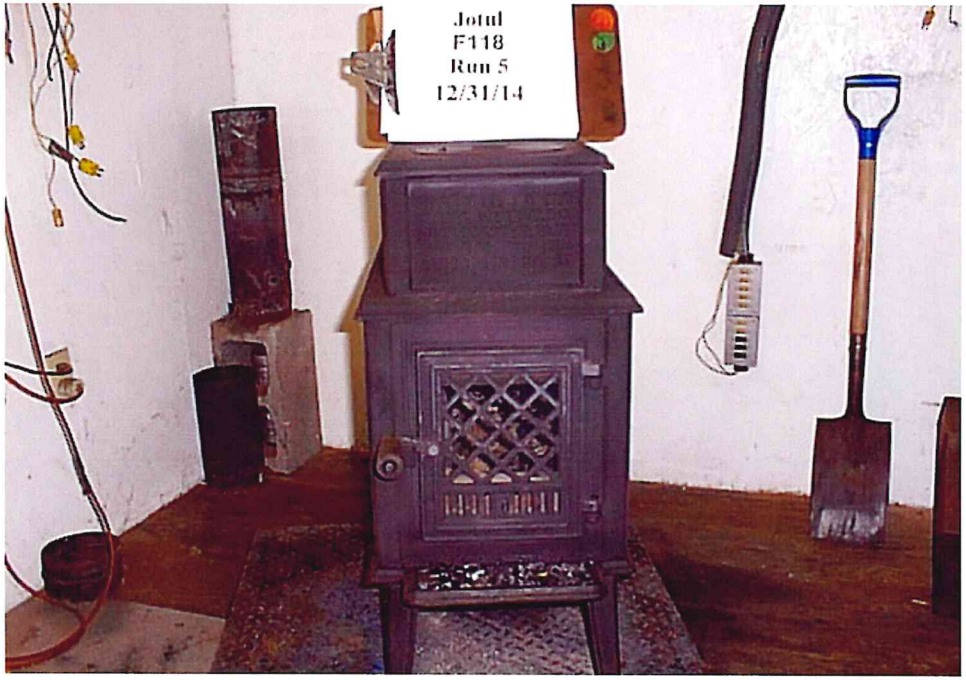
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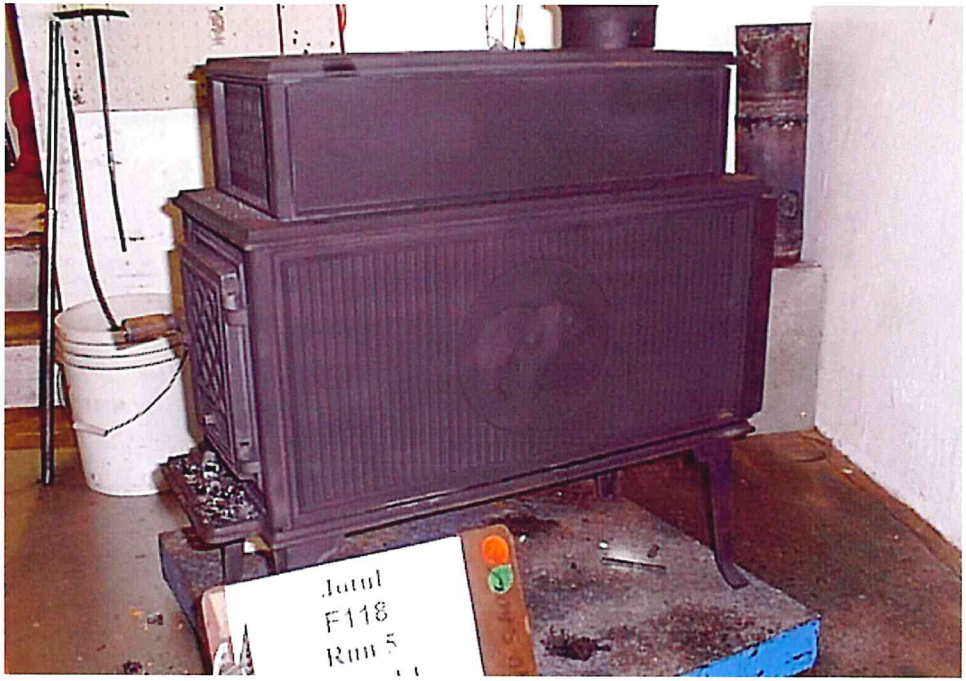
12/31/14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F118
Run 5