LOKEE TESTING Laboratory

United States
Environmental Protection Agency
Woodstove CertificationTest Report

Jotul North America, Inc.
F45

Volume 1 of 1

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

United States
Environmental Protection Agency
Wood Heater Certification Test Report

Jotul North America
55 Hutcherson Drive
Gorham, ME 04038

F45

Volume 1 of 1

Report By:

Chip Wadington

CONFIDENTIAL

RELEASED ONLY BY
AUTHORIZED PERSONNEL

1/2/2013

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TEST SERIES INFORMATION

Unit name and model number: F45

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: 10/8/2012 Aged:11/1-2/2012 Dates Tested: 11/28-12/7/2012

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

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

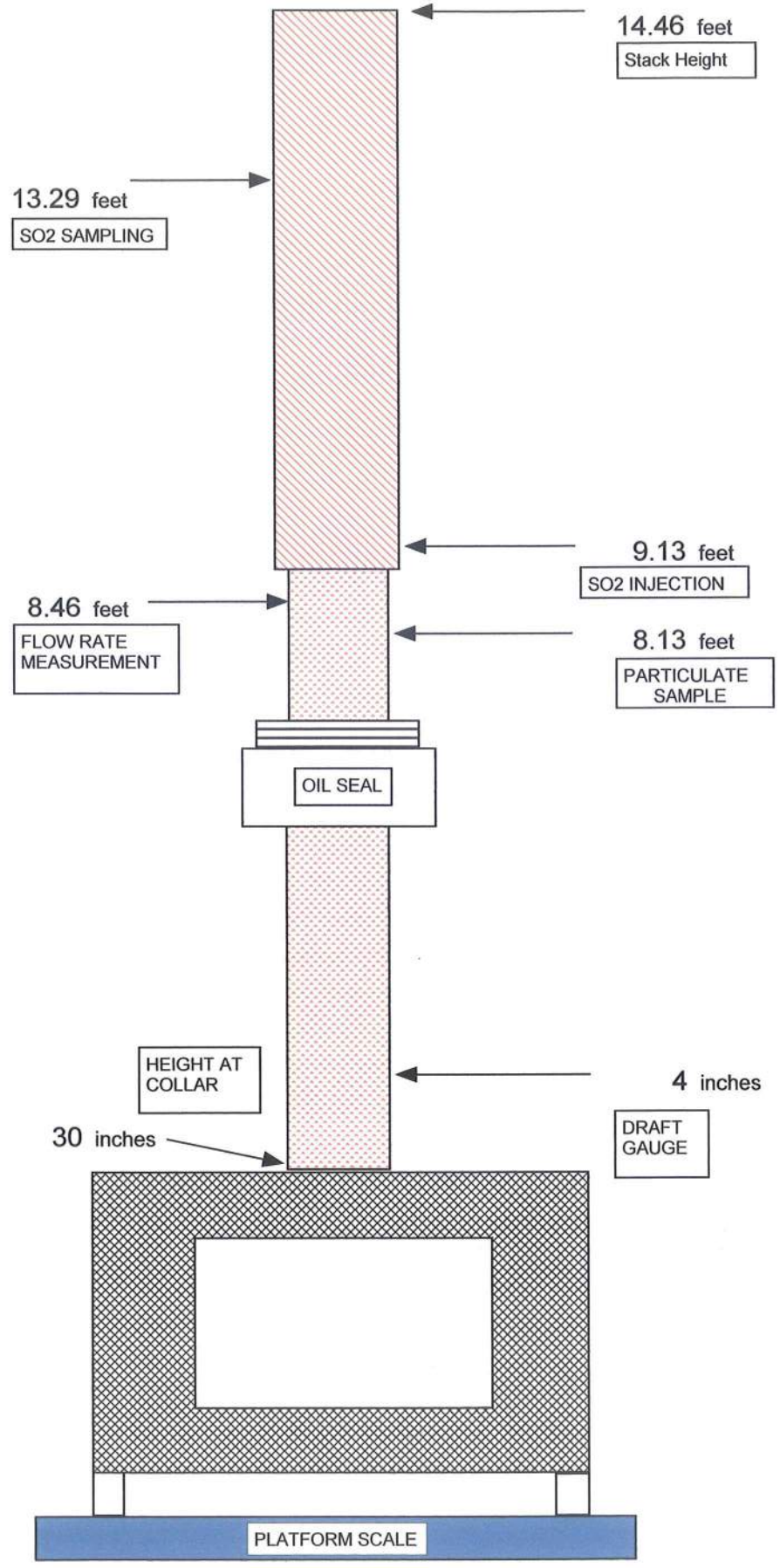
SEALED EPA TEST UNIT

DO NOT TAMPER WITH SEALS
TO DO SO WILL VOID CERTIFICATION

JOTUL NORTH AMERICA
F45

*NON CERTIFICATION STOVES EXEMPTED

Model: Jotul- F45 **Date:** 11/28/12



AGING DATA SHEET

UNIT : F45 DATE: 11-1-12

Hr #	DATE	TIME	TEMP Stack 1	TEMP Top 2
1	11-1-12	1155	535	872
2	"	1255	199	322
3	"	1355	207	313
4	"	1455	263	488
5	"	1555	216	372
6	"	1655	213	358
7	"	1755	179	286
8	"	1855	168	258
9	"	1955	166	253
10	11-2-12	1115	492	729
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				
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31				
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COMMENTS:

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

November 15, 2012

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

Mr. Dupree:

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

Jotul North America:
Model:F45

If you have any questions please feel free to call.

Sincerely,

Chip Wadington
Owner

LOKEE TESTING Laboratory

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

November 15, 2012

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

Mr. Dupree:

On November 15, 2012 at 12:00 pm PST, you waived the 30 day intent to certify notice at the request of LoKee Testing Laboratory in order to run certification tests on the:

Jotul North America :
Model: F45

If you have any questions please feel free to call.

Sincerely,

Chip Wadington
Owner

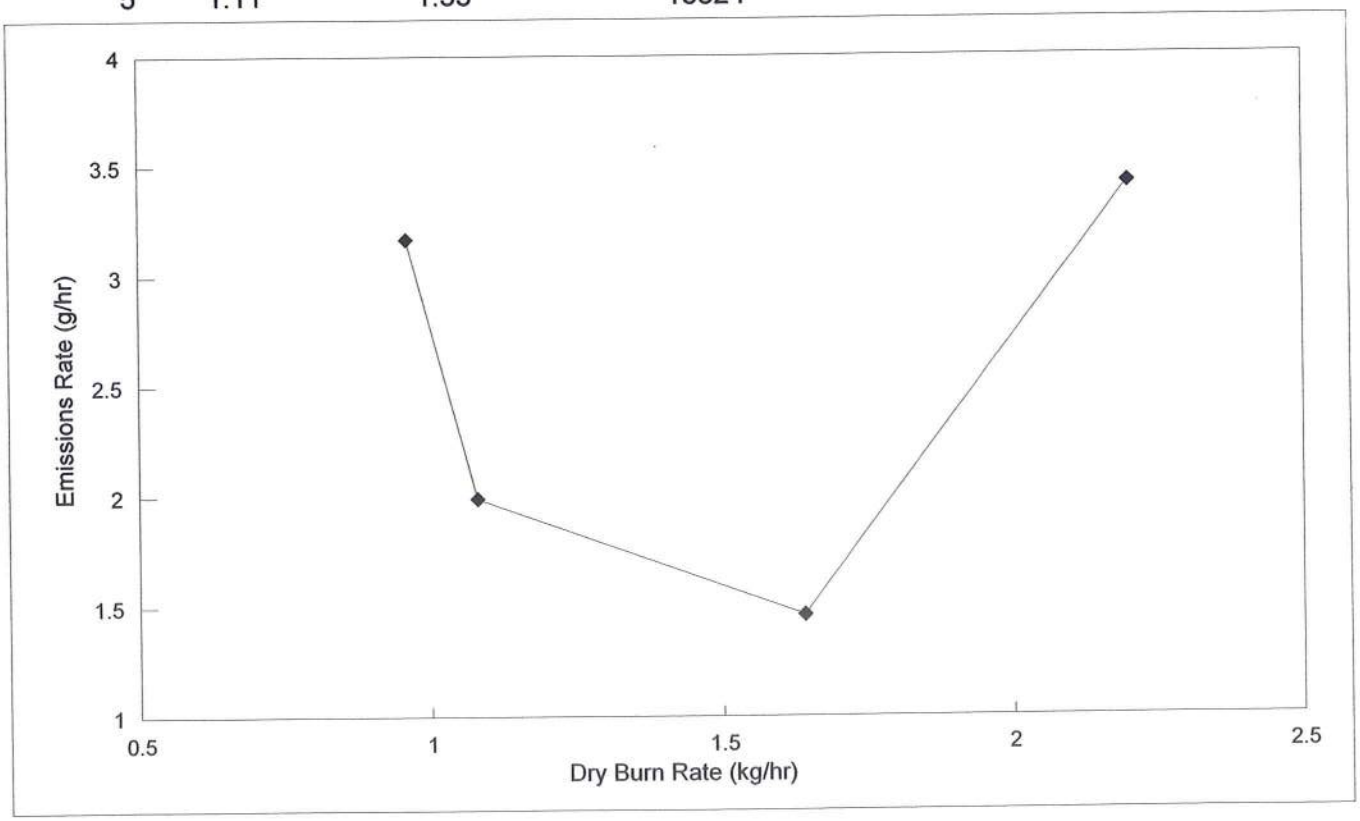
Data Summary

Wood Heater Emission Test Summary

Laboratory/Wood Heater Information

Stove Manufacturer:	Jotul
Model Identification:	F45
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:	Nov 28-Dec 7/12
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)
				2.31
1	0.96	3.17	11576	
3	1.08	1.99	13023	
2	1.64	1.46	19775	
4	2.20	3.42	26528	
			NA	
5	1.11	1.53	13324	



Unit: Jotul – Model F45

	RUN #	1	3	2	4	5			
Avg Stack Gas Flow Rate						FAN			
EPA CMB	dscfm	7.21	7.58	9.70	12.71	8.00			
Tracer Gas	dscfm	5.133	5.639	7.195	8.556	5.795			
Draft (static)	in H_2O	-.034	-.037	-.043	-.047	-.040			
Proportionality Average	%	100	100	100	100	100	100	100	100
Average Temperatures									
Stack Gas	°F	237	248	361	440	268			
Firebox	°F	-	-	-	-	-			
Secondary	°F	-	-	-	-	-			
Catalytic Combustor	°F	-	-	-	-	-			
Top	°F	371	408	510	565	415			
Left Side	°F	403	457	546	629	460			
Back	°F	300	343	412	365	400			
Right Side	°F	408	447	533	609	451			
Bottom	°F	328	347	401	422	340			
Temperature Change	°F	-63.6	-83.1	-40.0	-65.0	-55.9			
Test Chamber Enviroment									
Average Barometer	in. Hg	29.66	30.00	29.42	30.20	30.04			
Average Temperature	°F	69	76	78	78	74			
Ambient Moisture	% H_2O	1.35	1.50	1.5	1.4	1.4			
Relative Humidity	%RH	49.0	48.0	41.0	35.0	43.0			
Air Velocity	m/sec	0	0	0	0	0	0	0	0
Fuel Weight and Burn Time									
Density (dry basis)	gm/cm^3	-	-	-	-	-			
Coal Bed Weight	lbs	3.9	3.5	3.7	3.3	3.1			
Pre Test Fuel (inc kindling)	lbs	34.3	35.2	36.9	33.3	31.6			
Test Fuel	lbs	15.7	15.5	15.0	15.4	15.4			
Burn Time	min	375	330	210	160	320			

Minimum DBR

TABLE 1 ----- RAW DATA

CLIENT : Jotul TEST No. : 1

MODEL: F45 DATE:

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	269.500	0.150	77	0.87	4.40	700
5	271.000	0.620	77	0.35	4.90	350
10	274.067	0.150	78	0.40	4.60	700
15	275.610	0.150	78	0.42	4.40	700
20	277.153	0.170	78	0.42	5.00	675
25	278.753	0.140	78	0.48	4.10	725
30	280.243	0.150	78	0.44	4.40	700
35	281.786	0.180	78	0.42	6.40	650
40	283.447	0.210	78	0.52	6.50	600
45	285.247	0.210	78	0.37	6.50	600
50	287.046	0.230	78	0.39	6.90	575
55	288.924	0.230	78	0.31	8.20	575
60	290.801	0.180	78	0.49	6.60	650
65	292.463	0.230	78	0.32	7.90	575
70	294.340	0.230	78	0.35	7.50	575
75	296.218	0.230	78	0.39	7.20	575
80	298.096	0.210	78	0.61	10.40	600
85	299.896	0.190	78	0.76	11.00	625
90	301.623	0.210	78	0.65	11.20	600
95	303.423	0.270	78	0.29	11.20	525
100	305.479	0.270	78	0.27	11.10	525
105	307.535	0.270	78	0.13	11.10	525
110	309.591	0.270	78	0.14	10.00	525
115	311.647	0.250	78	0.12	9.50	550
120	313.610	0.250	79	0.12	9.30	550
125	315.580	0.230	79	0.13	9.10	550
130	317.550	0.230	79	0.13	8.70	550
135	319.520	0.210	79	0.28	8.90	600
140	321.325	0.210	79	0.41	7.70	600
145	323.132	0.190	79	0.48	7.60	625
150	324.866	0.160	79	0.56	7.40	675
155	326.472	0.180	79	0.49	7.40	650
160	328.140	0.150	79	0.65	7.10	700
165	329.689	0.150	79	0.65	7.00	700
170	331.237	0.140	79	0.51	6.50	725
175	332.733	0.130	79	0.77	5.70	750

180	334.178	0.120	79	0.89	5.60	775
185	335.579	0.140	79	0.92	5.20	725
190	337.076	0.150	79	0.90	5.10	700
195	338.627	0.150	79	1.03	3.00	700
200	340.178	0.150	79	1.05	4.50	700
205	341.729	0.150	79	1.10	4.50	700
210	343.279	0.150	79	1.08	4.50	700
215	344.830	0.150	79	1.19	4.40	700
220	346.381	0.140	79	1.22	4.40	725
225	347.878	0.140	79	1.19	3.00	725
230	349.376	0.140	79	1.23	3.00	725
235	350.873	0.130	79	1.30	4.40	750
240	352.321	0.130	79	1.33	4.40	750
245	353.770	0.130	79	1.31	4.40	750
250	355.219	0.130	79	1.29	4.50	750
255	356.668	0.130	79	1.19	4.70	750
260	358.117	0.130	79	1.17	4.90	750
265	359.566	0.120	79	1.25	4.80	775
270	360.968	0.120	79	1.16	4.80	775
275	362.370	0.120	79	1.06	4.80	775
280	363.772	0.120	79	1.14	4.70	775
285	365.175	0.130	79	1.25	4.70	750
290	366.624	0.130	79	1.26	4.60	750
295	368.073	0.130	79	1.29	3.00	750
300	369.522	0.130	79	1.28	4.50	750
305	370.972	0.130	79	1.20	4.40	750
310	372.423	0.130	79	1.22	4.30	750
315	373.873	0.130	79	1.27	4.30	750
320	375.324	0.130	79	1.36	4.30	750
325	376.774	0.130	79	1.26	4.20	750
330	378.224	0.120	79	1.31	4.10	775
335	379.628	0.120	79	1.36	4.00	775
340	381.032	0.120	79	1.43	4.00	775
345	382.436	0.130	79	1.62	3.90	750
350	383.886	0.130	79	1.63	3.80	750
355	385.336	0.130	79	1.26	4.00	750
360	386.787	0.130	79	1.28	3.90	750
365	388.237	0.130	79	1.28	3.80	750
370	389.688	0.130	79	1.26	3.80	750
375	391.138	0.120	79	1.26	3.70	775

TABLE 2---RAW DATA

CLIENT : Jotul TEST No. 1

MODEL: F45 DATE:

METER CAL. FACTOR (Y) -------	0.935		Wt. WOOD BURNED(LB) -------	15.7	Lbs
BAROMETRIC PRESS.(Pb) -------	29.66	in Hg	WET,FUEL MOISTURE % -------	15.555	%
LEAK RATE POST (Lp) -------	0.000	cfm	Wt. PART. COLLECTED -------	0.809	g
WATER VOL. (V1c) -------	170.4	Ml	METER VOLUME Vm -------	121.638	mcf
TEST TIME (MIN) -------	375	min	HC MOLE FRACTION -------	0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT : Jotul TEST No. 1

MODEL: F45 DATE:

****

AVG DELTA H	-------	0.17	in H2O	AVG PRCNT CO	-------	0.84	%
AVG METER TEMP. Tm	-------	79	deg F	AVG PRCNT CO2	-------	5.85	%
AVG PPM SO2	-------	683	PPM	AVG BAL CO2/CO	-------	6.92	%

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul TEST No. 1

MODEL: F45 DATE:

****

STD SAMPLE VOL. Vm(std) d) ------	110.58	dscf	STACK GAS FLOW Qsd -------	432.591	dscf/Hr
				7.21	& dscf/min
VOL. WATER VAPOR Vw(s td) -----	8.021	scf	PARTICULATE CONCTRT. C s ------	0.0073	g/dscf
PRCNT MSTR Bws -------	6.76	%	PARTC.EMISS. RATE E -------	3.17	g/Hr
BURN RATE BR -------	0.96	Kg/Hr	MOLES OF GAS PER Lb WOOD Nt ----	0.53	Lb-mole/Lb
CO EMISSION RATE -------	122.32	g/Hr	PART.EMISS. RATE ------	3.29	g/Kgdry fuel
	& 127.15	g/Kgdry fuel			

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Jotul TEST No. : 1

MODEL: F45 DATE:

TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR	PROPRTN RATE VAR. AVERAGE
5	957.4	97	100
10	979.0	99	
15	983.0	100	
20	983.0	100	
25	983.0	100	
30	983.2	100	
35	983.0	100	
40	982.7	100	
45	983.1	100	
50	982.5	100	
55	983.0	100	
60	982.5	100	
65	983.3	100	
70	982.5	100	
75	983.0	100	
80	983.0	100	
85	983.1	100	
90	982.5	100	
95	983.1	100	
100	982.7	100	
105	982.7	100	
110	982.7	100	
115	982.7	100	
120	982.0	100	
125	984.5	100	
130	984.5	100	
135	984.5	100	
140	984.0	100	
145	985.1	100	
150	984.6	100	
155	984.8	100	
160	985.0	100	
165	985.0	100	
170	984.4	100	
175	985.3	100	
180	984.5	100	

185	986.3	100
190	985.9	100
195	986.3	100
200	986.3	100
205	986.3	100
210	985.7	100
215	986.3	100
220	986.3	100
225	985.9	100
230	986.6	100
235	985.9	100
240	986.5	100
245	987.2	100
250	987.2	100
255	987.2	100
260	987.2	100
265	987.2	100
270	987.0	100
275	987.0	100
280	987.0	100
285	987.7	100
290	987.2	100
295	987.2	100
300	987.2	100
305	987.9	100
310	988.6	100
315	987.9	100
320	988.6	100
325	987.9	100
330	987.9	100
335	988.4	100
340	988.4	100
345	988.4	100
350	987.9	100
355	987.9	100
360	988.6	100
365	987.9	100
370	988.6	100
375	987.9	100

COMPUTER INPUT DATA SHEET #1

Client: Jotul North America

Address: 55 Hutcherson
Gorham, ME 04038

Phone: 1-800-797 5912 Fax: 1-207-591 6623

Run No.: _____ Date of Test: 11 - 28 - 2012 Burn Rate: .962 3,17

Model No.: F45 ☒ min ☐ min-1.25 ☐ fan

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

Dry Gas Meter Y Factor: .935 (0.000) (Data Sheet #2) Post Leak Rate: 0.000 cfm (.000) (Data Sheet #2) Time: 375 min. (000) (Data Sheet #2)

Dry Gas Meter Volume: 121.638 cf (00.000) (Data Sheet #2)

Stack Flow: 5.133 dscfm (00.000) (Data Sheet #2) Δ H: .170 in. H_2O (.000) (Data Sheet #2)

Maximum Vac.: 3.0 (0.0) (Data Sheet #2) Barometric Pressure: 29.66 in. Hg (00.00) (Data Sheet #2)

H_2O Captured: 170.4 g (00.0) (Data Sheet #3)

Front Half Catch % Of Total: 29.7 % (00.0) (Data Sheet #6) Total Particulate Catch: .8090 g (0.0000) (Data Sheet #6)

Flue Gas Moisture: 6.7705 % (00.000) (Data Sheet #7)

Particulate Emission: .1130 gr/dscf (0.0000) (Data Sheet #7)

Relative Humidity: 49.0 % RH (00.0) (Data Sheet #8) Ambient Moisture: 1.35 % H_2O (0.00) (Data Sheet #8)

Preburn Fuel Wt.: 34.3 lbs. (00.0) (Data Sheet #8) Coal Bed Wt.: 3.9 lbs. (00.0) (Data sheet #8) Test Fuel Wt.: 15.7 lbs. (00.0) (Data sheet #8)

Heat Output (EPA Default): 11600.0 BTU/hr (00,000.0) (Data Sheet #8)

Kindling Fuel % Moisture (wet): 10.608 % (00.000) (Data Sheet #10) Pretest Fuel % Moisture (wet): 17.264 % (00.000) (Data Sheet #10)

Test Fuel % Moisture (dry): 18.420 % (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove]) Test Fuel % Moisture (wet): 15.555 %

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

Stack Static Pressure: -.034 in. H_2O (+/- .000) (Data Sheet #12)

Average Ambient Temperature: 69 °F (00) (Data Sheet #14) Stove Temperature Change: -63.4 °F (+/- 000.0) (Data Sheet #14)

Test start = 1015
End = 1630

meter temp = 539

METER BOX DATA SHEET PAGE # 2

Page: 1 of 4

UNIT: Total F45 RUN: 1 DATE: 11-28-2012

Meter Box: SH Y Factor: .935

Leak checks: 15 " Hg @ 1,000 cfm _____ " Hg @ _____ cfm

15 " Hg @ 1,000 cfm _____ " Hg @ _____ cfm

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

ROTO: PRESS: .18			SAMPLING RATIO: 16 : 1				BP: 29.70		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1015	269.500	———	4.927	.15	77	700	77	20
5	20	271.000	———	9.854	.62	77	350	77	30
10	25	274.067	274.067	4.918	.15	78	700	78	2.0
15	30	275.610	275.610	4.918	.15	78	700	78	2.0
20	35	277.153	277.153	5.100	.17	78	675	78	2.0
25	40	278.753	278.753	4.748	.14	78	725	78	2.0
30	45	280.243	280.243	4.918	.15	78	700	78	2.0
35	50	281.786	281.786	5.296	.18	78	650	78	2.0
40	55	283.447	283.447	5.737	.21	78	600	78	2.0
45	1100	285.247	285.247	5.737	.21	78	600	78	2.0
50	05	287.046	287.046	5.987	.23	78	575	78	2.0
55	10	288.924	288.924	5.987	.23	78	575	78	2.0
ROTO PRESS: .18			TOTALS:	68.127	269	934	BP.: 29.70		
60	1115	290.801	290.801	5.296	.18	78	650	78	2.0
65	20	292.463	292.463	5.987	.23	78	575	78	2.0
70	25	294.340	294.340	5.987	.23	78	575	78	2.0
75	30	296.218	296.218	5.987	.23	78	575	78	2.0
80	35	298.096	298.096	5.737	.21	78	600	78	2.0
85	40	299.896	299.896	5.508	.19	78	625	78	2.0
90	45	301.623	301.623	5.737	.21	78	600	78	2.0
95	50	303.423	303.423	6.557	.27	78	525	78	2.0
100	55	305.479	305.479	6.557	.27	78	525	78	2.0
105	1200	307.535	307.535	6.557	.27	78	525	78	2.0
110	05	309.591	309.591	6.557	.27	78	525	78	2.0
115	10	311.647	311.647	6.259	.25	78	550	78	2.0
			TOTALS:	72.726	2.81	936	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	140.853	5.40	1870	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 2 of 4

UNIT: Jotul F45 RUN: 1 DATE: 11-28-2012

Meter Box: SH Y Factor: .935

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: 16 : 1 BP: 29.70

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1215	313.610	313.610	6.247	.25	79	550	79	2.0
125	20	315.580	315.580	6.247	.25	79	550	79	2.0
130	25	317.550	317.550	6.247	.25	79	550	79	2.0
135	30	319.520	319.520	5.727	.21	79	600	79	2.0
140	35	321.325	321.326	5.727	.21	79	600	79	2.0
145	40	323.132	323.132	5.498	.19	79	625	79	2.0
150	45	324.846	324.846	5.090	.16	79	675	79	2.0
155	50	326.472	326.472	5.286	.18	79	650	79	2.0
160	55	328.140	328.140	4.909	.15	79	700	79	2.0
165	1300	329.689	329.689	4.909	.15	79	700	79	2.0
170	05	331.237	331.237	4.739	.14	79	725	79	2.0
175	10	332.733	332.733	4.581	.13	79	750	79	2.0
ROTO PRESS:		.18	TOTALS:	65.207	2.27	948	BP.:	29.66	
180	1315	334.178	334.178	4.428	.12	79	775	79	2.0
185	20	335.579	335.579	4.733	.14	79	725	79	2.0
190	25	337.076	337.076	4.902	.15	79	700	79	2.0
195	30	338.627	338.627	4.902	.15	79	700	79	2.0
200	35	340.178	340.178	4.902	.15	79	700	79	2.0
205	40	341.729	341.729	4.902	.15	79	700	79	2.0
210	45	343.279	343.279	4.902	.15	79	700	79	2.0
215	50	344.830	344.830	4.902	.15	79	700	79	2.0
220	55	346.381	346.381	4.733	.14	79	725	79	2.0
225	1400	347.878	347.878	4.733	.14	79	725	79	2.0
230	05	349.376	349.376	4.733	.14	79	725	79	2.0
235	10	350.873	350.873	4.575	.13	79	750	79	2.0
			TOTALS:	57.347	1.71	948	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	122.554	3.98	1896	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 3 of 4

UNIT: Jotul F45 RUN: 1 DATE: 11-28-2012

Meter Box: SH Y Factor: .935

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

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

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

ROTO: PRESS: .18			SAMPLING RATIO: 16 : 1				BP: 29.63		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
240	1415	352.321	352.321	4.571	.13	79	750	79	2.0
245	20	353.770	353.770	4.571	.13	79	750	79	2.0
250	25	355.219	355.219	4.571	.13	79	750	79	2.0
255	30	356.668	356.668	4571	.13	79	750	79	2.0
260	35	358.117	358.117	4.571	.13	79	750	79	2.0
265	40	359.566	359.566	4.423	.12	79	775	79	2.0
270	45	360.968	360.968	4.423	.12	79	775	79	2.0
275	50	362.370	362.370	4.423	.12	79	775	79	2.0
280	55	363.772	363.772	4.423	.12	79	775	79	2.0
285	1500	365.175	365.175	4.571	.13	79	750	79	2.0
290	05	366.624	366.624	4.571	.13	79	750	79	2.0
295	10	368.073	368.073	4.571	.13	79	750	79	2.0
ROTO PRESS: .18			TOTALS:	54.260	1.52	948	BP.: 29.60		
300	1515	369.522	369.522	4.566	.13	79	750	79	2.0
305	20	370.972	370.972	4.566	.13	79	750	79	2.0
310	25	372.423	372.423	4.566	.13	79	750	79	2.0
315	30	373.873	373.873	4.566	.13	79	750	79	2.0
320	35	375.324	375.324	4.566	.13	79	750	79	2.0
325	40	376.774	376.774	4.566	.13	79	750	79	2.0
330	45	378.224	378.224	4.419	.12	79	775	79	2.0
335	50	379.628	379.628	4.419	.12	79	775	79	2.0
340	55	381.032	381.032	4.419	.12	79	775	79	2.0
345	1600	382.436	382.436	4.566	.13	79	750	79	2.0
350	05	383.886	383.886	4.566	.13	79	750	79	2.0
355	10	385.336	385.337	4.566	.13	79	750	79	2.0
			TOTALS:	54.351	1.53	948	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	108.611	3.05	1896	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 4 of 4

UNIT: Jotul F45 RUN: 1 DATE: 11-28-2017

Meter Box: 514 Y Factor: .935

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: 1.18 SAMPLING RATIO: 16 : 1 BP: 29.63

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
365	1615	386.787	386.787	4.566	.13	79	750	79	2.0
365	20	388.237	388.237	4.566	.13	79	750	79	2.0
370	25	389.688	389.688	4.566	.13	79	750	79	2.0
375	30	391.138	391.138	4.419	.12	79	775	79	2.0
				18.117	.510	316			

ROTO PRESS: TOTALS: BP.: ÷ 76

				390.135	12.94	5978			
						79			
			TOTALS:				MAX VACC =		3.0
TOTAL Cu Ft.		121.638	TOTALS:	5.133	.170	539	AVG. BP:		29.66

BLANK PROCESSING DATA SHEET # 5

UNIT : Total F45 RUN : 1 DATE : 11-28-2012

BLANKS DONE : 8-31-2010

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

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

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

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

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

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

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

TARE QC

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

FINAL QC

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

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : F45 RUN : 1 DATE : 11-28-12

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

SCALE	WEIGHT
295.0 g	295.0
590.0 g	590.0
885.0 g	885.0

IMPINGER	#1	#2	#3	#4
FINAL WT	747.2	589.0	487.2	939.0
INITIAL WT	610.0	578.9	484.5	918.6
NET WT GRAMS	137.2	10.1	2.7	20.4

TOTAL CATCH : 170.4 **GRAMS H_2O**

FRONT HALF

FILTER #	62F	
FINAL WT g	.7780	
INITIAL WT g	.6320	
NET WT g	.1460	

BEAKER #	61
DESC.	ACETONE
FINAL WT g	99.4383
INITIAL WT g	99.3431
NET WT g	.0952
VOL. DESC. ml	75

BACK HALF

FILTER #	62B	
FINAL WT g	.3970	
INITIAL WT g	.2805	
NET WT g	.1165	

BEAKER #	62	63	64	65	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	98.1260	93.2404	104.8625	98.5227	
INITIAL WT g	97.8602	93.2090	104.7829	98.4375	
NET WT g	.2658	.0314	.0796	.0852	(.1648)
VOL. DESC ml	150	75	175	175	(350)

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 2-15-12 Time : 1200 By : CP

Manufacturer S & S Grade : # 25 Glass Front Size : 11 cm Lot No. : 393580

Back Size: 8.2 cm Lot No. : 464341

	DATE: 2-20-12	BY: AV	DATE: 2-23-12	BY: CP	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
61F	0.6288	1330	.6285	1005		
62F	0.6320	1331	.6320	1006	← R-1	
63F	0.6300	1332	.6298	1007		
64F	0.6272	1333	.6268	1008		
65F	0.6314	1334	.6311	1009		
66F	0.6271	1335	.6272	1010		
67F	0.6314	1336	.6310	1011		
68F	0.6298	1337	.6295	1012		
69F	0.6302	1338	.6304	1013		
70F	0.6307	1339	.6307	1014		
61B	0.2826	1320	.2827	1015		
62B	0.2805	1321	.2805	1016	← R-1	
63B	0.2824	1322	.2824	1017		
64B	0.2811	1323	.2811	1018		
65B	0.2825	1324	.2827	1019		
66B	0.2835	1325	.2836	1020		
67B	0.2845	1326	.2846	1021		
68B	0.2845	1327	.2847	1022		
69B	0.2846	1328	.2846	1023		
70B	0.2836	1329	.2837	1024		

Checked by: Armando Date: 2-23-2012 Time: 1245

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
2-20-12	1200	CP		70	48
2-23-12	1005	CP		73	47

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 11-2-11 Time : 1300 By : CP

	DATE: 11-7-11	BY: CP	DATE: 11-14-11	BY: CP	DATE:	BY:
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
51	104.8708	1245	104.8709	0835	✓	
52	107.4940	1246	107.4943	0836	✓	
53	105.7315	1247	105.7317	0837	✓	
54	107.3008	1248	107.3005	0838	✓	
55	93.4825	1249	93.4821	0839	✓	
56	106.8588	1250	106.8590	0840	✓	
57	97.4049	1251	97.4052	0841	✓	
58	96.8864	1252	96.8861	0842	✓	
59	105.3467	1253	105.3468	0843	✓	
60	98.1962	1254	98.1961	0844	✓	
61	99.3426	1255	99.3431	0845	✓	
62	97.8600	1256	97.8602	0846	✓	
63	93.2089	1257	93.2090	0847	✓ R-1	
64	104.7824	1258	104.7829	0849	✓	
65	98.4370	1259	98.4375	0850	✓	
66	96.5039	1300	96.5042	0851	✓	
67	106.2183	1301	106.2188	0852	✓	
68	94.1500	1302	94.1505	0853	✓	
69	108.9871	1303	108.9876	0854	✓	
70	107.4739	1304	107.4743	0855		
71	104.1474	1305	104.1478	0856	✓	
72	103.8222	1306	103.8225	0857	✓	
73	104.3502	1307	104.3505	0900	✓	
74	107.5035	1308	107.5040	0901	✓	
75	96.4624	1310	96.4626	0902	✓	

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH	
11-7-11	1230	CW	-	72	46	Checked by : AV
11-11-11	0815	CW	-	70	46	Date : 11-14-11
		CW	-			Time : 10:00 am

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : F45 **RUN :** 1 **DATE :** 11-28-12 **Page :** 1 **of** 1

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
L1	11-30	0920	CP	99.4379	12-1	1806	CP	99.4383	12-2	1137	CP				
L2	11-30	0920	CP	98.1257	12-1	1807	CP	98.1260	12-2	1138	CP				
L3	11-30	0920	CP	93.2399	12-1	1808	CP	93.2404	12-2	1139	CP				
L4	11-30	0920	CP	104.8622	12-1	1809	CP	104.8625	12-2	1140	CP				
L5	11-30	0920	CP	98.5223	12-1	1810	CP	98.5227	12-2	1141	CP				

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
G2F	11-28	1730	CP	.7906	11-29	0915	CP	.7861	12-1	1804	CP	.7833	12-2	1135	CP
				.7780	12-3	0917	CP	.7780	12-4	1705	CP				
G2B	11-28	1730	CP	.4030	11-29	0916	CP	.3974	12-1	1805	CP	.3970	12-2	1136	CP

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	11-29-12	0910	CP	74	47
2	12-1-12	1800	CP	66	49
3	12-2-12	1130	CP	67	46
4	12-3-12	0915	CP	72	46
5	12-4-12	1700	CP	69	47

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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 10-10-12 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	.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	10-23-12	1800	65	48
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	.9994	.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

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	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	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	.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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 4-13-2011 Through 1-13-2012	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0000	10.0001	1.0000	.0998	CP	4-13-11	1030	66	49
100.0001	10.0002	1.0000	.0999	CP	4-15-11	1330	75	48
100.0004	10.0000	.9999	.0998	CP	4-19-11	1600	74	44
100.0003	10.0000	1.0000	.0999	CP	4-20-11	1815	72	46
100.0000	10.0001	.9999	.1000	CP	6-16-11	0900	76	39
99.9997	9.9999	.9998	.0999	CP	6-18-11	1530	74	44
99.9996	10.0002	1.0000	.0999	CP	6-20-11	1600	73	47
100.0000	10.0000	.9998	.0999	CP	6-21-11	1400	73	47
100.0000	10.0000	1.0001	.0999	CP	6-22-11	1200	72	46
99.9999	9.9998	1.0000	.1000	CP	6-23-11	1100	76	49
100.0000	10.0002	1.0000	.0999	CP	6-24-11	1400	75	48
100.0000	10.0000	1.0000	.0999	CP	6-27-11	1230	78	46
100.0001	10.0002	.9999	.0998	CP	6-30-11	1030	78	46
99.9995	10.0000	.9999	.0999	CP	7-1-11	1030	70	48
99.9999	9.9999	1.0000	.1000	CP	7-2-11	1145	75	45
100.0000	9.9999	.9999	.0999	CP	7-5-11	1000	73	47
99.9999	10.0001	1.0000	.0999	CP	7-6-11	0930	76	49
100.0000	9.9997	1.0000	.0997	CP	9-22-11	1700	77	46
100.0000	10.0001	1.0000	.0999	CP	9-24-11	1700	77	49
100.0000	9.9998	1.0001	.1000	CP	9-25-11	1300	76	49
100.0000	9.9999	1.0001	.0998	CP	9-27-11	1000	77	49
99.9996	9.9999	1.0000	.0998	CP	9-29-11	0840	72	42
99.9997	9.9998	.9999	.1000	CP	9-30-11	1000	70	48
99.9996	9.9998	1.0000	.0999	CP	10-1-11	1520	70	45
99.9998	10.0002	1.0000	.0997	CP	10-2-11	1430	74	47
99.9995	10.0001	1.0000	.0999	CP	10-5-11	1510	71	49
100.0000	9.9999	1.0000	.0998	CP	10-6-11	1000	78	40
100.0000	9.9999	1.0000	.0999	CP	10-9-11	1130	75	49
100.0000	10.0001	1.0000	.0998	CP	10-16-11	1540	68	47
100.0000	10.0000	1.0000	.0998	CP	11-9-11	1230	72	46
100.0000	10.0002	.9998	.0998	CP	11-11-11	0815	70	48
99.9999	10.0000	1.0000	.0996	CP	11-15-11	1200	75	48
99.9995	10.0001	.9999	.0999	CP	11-16-11	1400	70	44
99.9999	10.0001	.9999	.0998	CP	11-20-11	1600	73	43
99.9998	9.9999	.9999	.0999	CP	11-21-11	1715	74	47
100.0000	10.0000	1.0000	.0999	CP	11-22-11	1600	65	48
100.0000	10.0000	1.0000	.0999	CP	1-9-12	1030	70	48
100.0000	9.9999	1.0001	.1000	CP	1-11-12	1720	65	48
100.0000	10.0001	1.0000	.0997	CP	1-13-12	1036	72	46

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

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

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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

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

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0001	10.0004	.9999	.0999	CP	2-26-10	0840	72	46
100.0001	9.9999	.9999	.0999	CP	2-27-10	1045	72	46
100.0000	10.0000	1.0000	.0999	CP	2-28	1100	70	48
100.0000	10.0000	1.0000	.0999	CP	3-1	0900	66	49
100.0000	10.0002	.9998	.1002	CP	3-5	1200	70	48
100.0001	9.9999	.9999	.0998	CP	3-7	1330	68	47
100.0000	9.9999	.9999	.0999	CP	3-9	1130	70	41
100.0000	10.0001	1.0000	.0999	CP	3-10	1200	70	44
100.0000	10.0001	.9999	.0999	CP	3-11	0900	66	49
99.9999	9.9999	.9999	.0999	AV	3-15	1000	70	48
100.0000	10.0000	1.0000	.0998	CP	3-17	0900	72	46
100.0000	9.9998	1.0001	.1000	CP	4-8	1930	76	49
99.9999	10.0001	1.0000	.0999	CP	4-10	1630	73	47
99.9999	10.0001	1.0001	.1000	CP	4-11	1430	74	47
100.0000	10.0002	1.0000	.1000	CP	4-21	1830	77	49
100.0000	10.0000	1.0000	.0999	CP	4-22	1130	74	47
100.0000	10.0001	1.0000	.0999	CP	4-23	1015	74	44
100.0002	9.9999	1.0000	.1000	CP	4-24	0930	68	47
100.0000	9.9999	.9999	.1000	CP	4-25	0930	73	47
100.0000	9.9999	1.0001	.0999	CP	4-26	0900	76	42
100.0000	10.0002	1.0000	.0999	CP	4-30	1320	78	43
99.9998	10.0000	1.0002	.0999	CP	8-26	0845	78	49
100.0000	9.9998	1.0001	.0999	CP	8-27	0955	78	43
100.0000	10.0000	1.0000	.1000	CP	8-28	1600	73	47
99.9998	10.0000	.9999	.1000	CP	8-29	1400	70	48
100.0000	10.0000	1.0000	.0999	CP	8-31	0720	72	46
100.0001	10.0000	1.0000	.1000	CP	9-1	1330	76	49
100.0000	10.0001	1.0000	.0999	CP	9-2	1300	68	47
100.0000	10.0000	1.0000	.1000	CP	9-3	1130	72	46
100.0000	10.0001	1.0000	.0999	CP	10-26	0750	70	48
100.0000	10.0000	.9998	.0997	CP	10-27	1250	74	47
100.0000	9.9999	1.0000	.0999	CP	10-29	1400	71	49
100.0000	9.9999	1.0000	.0999	CP	11-1	1000	78	49
100.0000	10.0000	.9999	.0999	CP	11-2	0715	70	48
100.0000	10.0000	1.0000	.0999	CP	11-3	0900	70	48
100.0000	10.0001	.9999	.1000	CP	11-5	1320	76	42
100.0000	10.0001	.9999	.1000	CP	11-8	1230	70	48
100.0000	10.0001	1.0000	.0998	CP	11-9	1015	71	41
100.0000	10.0000	.9999	.0999	CP	11-10	0905	70	44

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT: Total F45 RUN: 1 DATE: 11-28-2012

BLANK CALCULATIONS

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

FRONT HALF CATCH

FILTERS : .1460 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .1460 g

BEAKERS : .0952 (Total Catch) g - 75 (ml Acetone) (.0007 / .000009 g) (Blank Value / ml Acetone) = .0945 g

TOTAL FRONT HALF CATCH : .2405 g

BACK HALF CATCH

FILTERS : .1165 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .1165 g

BEAKERS :

Acetone : .2658 (Total Catch) g - 150 (ml Acetone) (.0014 / .000009 g) (Blank Value / ml Acetone) = .2644 g

Extract : .0314 (Total Catch) g - 75 (ml Dichloromethane) (.0016 / .000021 g) (Blank Value / Dichloromethane) = .0298 g

Water : .1648 (Total Catch) g - 350 (ml Water) (.0070 / .000020 g) (Blank Value / Water) = .1578 g

TOTAL BACK HALF CATCH : .5685 g

TOTAL CATCH : .8090 g

% FRONT HALF : 29.7 %

CALCULATIONS DATA SHEET # 7

UNIT : JOTUL F45 RUN : 1 DATE : 11-28-2012

1) $Vm(std) = \dfrac{(121.638\ Vm)(17.64)(.935\ mcf)\left(29.46\text{" Hg} + \frac{.170\text{" } H_2O}{13.6}\right)}{(539\ TmA)} = \dfrac{110.4447}{000.0000}$ dscf

2) $Vw(std) = (.04707)(170.4\ ml\ H_2O) = \dfrac{8.0207}{00.0000}$ scf

3) $Asw = \dfrac{(8.0207\ scf)}{(8.0207\ scf + 110.4447\ dscf)} = \dfrac{.0677}{.0000}$ Bws × 100 = $\dfrac{6.7705}{00.0000}$ % H_2O

4) $Cs = \dfrac{(.8090\ g.)}{(110.4447\ dscf)}(15.43) = \dfrac{.1130}{0.0000}$ gr / dscf

5) Estimated g / hr = $\dfrac{(.8090\ g.)}{(110.4447\ dscf)}\left(\dfrac{5.129}{00.0000}\ dscfm\right)(60) = \dfrac{2.2542}{00.0000}$ 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 F45 RUN: 1 DATE: 11-28-2012

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

Wet Bulb / Dry Bulb

Pre : WB: 60 DB: 73 = 46.0 % RH 1.3 % H_2O

Post : WB: 60 DB: 71 = 52.9 % RH 1.4 % H_2O

Average: 49.0 % RH 1.35 % H_2O

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

Kindling Weight (lbs): Paper: .1 Wood: 2.3

Preburn Fuel Weight: 17.0 + 15.0 Total: 32.0

Kindling & Preburn Fuel Weight (wood only) (lbs): **Total**: 34.3

Coal Bed Wt Range (lbs): 3.9 - 3.2 **Scale**: 3.9 - 3.2

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

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

Maximum Coal Bed Removal (lbs): $((\underset{\text{Upper}}{3.9} + \underset{\text{Lower}}{3.2}) \div 2) .25 = \underset{\text{round down to nearest tenth}}{.8}$

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"	17	3	7.3	46.5
4" x 4"	17	2	8.4	53.5

Test Fuel Weight: 15.7 lbs

Estimated Dry Burn Rate:

$$\frac{15.7 - (15.7 \times .15555)}{2.2046} \times \frac{60}{\underset{\text{TIME}}{375}} = .962 \text{ kg / hr}$$

Estimated BTU's/hr: 19,140 x $\frac{63}{100}$ x $\frac{.962}{\text{DBR}}$ = 11600 BTU's/hr

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

365

WOOD STOVE OPERATING DATA PAGE #9

Unit : Jotul F45 Run : 1 Date : 11-28-2012

FIRE STARTED: 0600

WARM UP AND PREBURN:

PRIMARY AIR : Set wide open for all warm-up / preburn fuel charges. Then set to 7/16" at start of preburn.

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

CHARCOAL BED PREPARATION :

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

TEST:

DOOR wide open during loading 0 min. 30 sec.

PRIMARY AIR : Opened full for first 5 min., then set to run setting of 7/16".

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

FAN:

ON / (OFF) during warm-up

ON / (OFF) first 30 minutes of test

Fan speed set at Low

(ON) / OFF during preburn

(ON) / OFF balance of test run

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

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

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

All Grades WCLB rules:

WARM UP INFORMATION:

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

1st warm up / pre-burn fuel charge (17.0 lbs.) added at 0608

2nd warm up / pre-burn fuel charge (16.0 lbs.) added at 0740

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

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

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

TEST DATA SHEET #10

Unit : Jotul F45 Run : 1 Date : 11-28-2012

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

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

Time Test Fuel moisture reading taken : 0840

pc #	Dimen.	Use	TOP	BOTTOM	SIDE	Avg Corrected
1	2"×4"×8'	K	11.5	12.1	12.0	11.867
2						
3						
4	2"×4"×8'	P	19.7	20.2	20.2	20.0
5	2"×4"×8'	P	21.3	21.4	21.4	21.4
6	2"×4"×8'	P	21.0	21.3	21.3	21.2
7	2"×4"×8'	P				62.6
8	2"×4"×8'	P				
9						
10						
11						
12	2"×4"×17"	T	18.0	18.1	18.1	18.1
13	"	T	19.4	19.7	19.2	19.5
14	"	T	18.0	18.0	18.1	18.0
15	4"×4"×17"	T	18.0	18.2	18.1	18.1
16	"	T	18.4	18.4	18.4	18.4
17						92.1
18						
19						
20	Spacers	T	21.6	22.9	22.6	22.367

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	11.867 %	20.867 %	18.420 %
Wet Moisture % :	10.608 %	17.264 %	15.555 %

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

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

GAS DATA SHEET #12

WEIGHT: 3.9 DATE: 11-28-2012

UNIT: Jotul F45 RUN: 1 PAGE: 1 OF 3

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
0 10 15	19.6	15.7	—	.174	4.4	.621	15.5	.085	.97	.030	700
5 1020	19.3	15.4	.3	.196	4.9	.617	15.5	032	.35	035	350
10 25	18.9	15.0	.4	.185	4.6	.631	15.8	037	.40	.035	700
5 30	18.6	14.7	.3	.174	4.4	.637	15.9	039	.42	.033	700
10 35	18.2	14.3	.4	.200	5.0	.615	15.4	039	.42	.035	675
25 40	18.0	14.1	.2	.164	4.1	.646	16.2	.046	.48	.033	725
0 45	17.7	13.8	.3	.177	4.4	.638	16.0	042	.44	.034	700
5 50	17.3	13.4	.4	.256	6.4	.561	14.0	040	.42	.038	650
40 55	16.9	13.0	.4	.258	6.5	.551	13.8	050	.52	.037	600
5 1100	16.6	12.7	.3	.260	6.5	.553	13.8	034	.37	.041	600
50 05	16.2	12.3	.4	.275	6.9	.540	13.5	036	.39	.040	575
5 10	15.8	11.9	.4	.326	8.2	.489	12.2	028	.31	.042	575
JBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.433	*****
60 15	15.4	11.5	.4	.264	6.6	.548	13.7	047	.49	040	650
5 20	15.0	11.1	.4	.314	7.9	.501	12.5	.029	.32	042	575
10 25	14.6	10.7	.4	.298	7.5	.517	13.0	.032	.35	042	575
15 30	14.2	10.3	.4	.288	7.2	.526	13.2	.036	.39	.043	575
2 35	13.7	9.8	.5	.415	10.4	.391	9.8	.059	.61	.045	600
85 40	13.2	9.3	.5	.438	11.0	.363	9.1	074	.76	.047	625
45	12.6	8.7	.6	.446	11.2	.358	9.0	063	.65	.047	600
50	12.0	8.1	.6	.448	11.2	.370	9.3	026	.29	048	525
100 55	11.5	7.6	.5	455	11.1	.377	9.4	024	.27	048	525
5 1200	11.0	7.1	.5	442	11.1	.382	9.6	010	.13	048	525
10 05	10.5	6.6	.5	.401	10.0	.426	10.7	011	.14	048	525
15 10	10.1	6.2	.4	.381	9.5	.443	11.1	009	.12	047	550
3TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.515	*****
20 15	9.7	5.8	.4	371	9.3	.455	11.4	009	.12	046	550
20	9.3	5.4	.4	362	9.1	.464	11.6	010	.13	045	550
25	9.0	5.1	.3	347	8.7	.478	12.0	010	.13	.044	550
30 35	8.7	4.8	.3	356	8.9	.464	11.6	025	.28	045	600
35	8.3	4.4	.4	308	7.7	.507	12.7	036	.41	043	600
40	8.1	4.2	.2	302	7.6	.504	12.6	.046	.48	043	625
45	7.8	3.9	.3	295	7.4	.511	12.8	054	.56	042	675
50	7.6	3.7	.2	297	7.4	.516	12.9	047	.49	041	650
55	7.4	3.5	.2	284	7.1	.519	13.0	063	.65	040	700
1.00	7.1	3.2	.3	278	7.0	.523	13.1	063	.65	040	700
05	7.0	3.1	.1	260	6.5	.549	13.7	049	51	037	725
10	6.8	2.9	.2	227	5.7	.573	14.3	075	.77	036	750
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.502	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	1480	*****

GAS DATA SHEET #12

WEIGHT: 3.9 DATE: 11-28-2012

UNIT: Jotul F45 o/o RUN: 1 o/D PAGE: 2 OF 3

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
180 15	6.7	2.8	.1	225	5.6	.570	14.3	087	.89	-.035	775
185 20	6.6	2.7	.1	.209	5.2	.587	14.7	090	.92	-.034	725
190 25	6.5	2.6	.1	.204	5.1	.591	14.8	088	.90	-.033	701
195 30	6.5	2.6	0	.184	3.0	.668	16.7	101	1.03	-.032	700
200 35	6.4	2.5	.1	.181	4.5	.609	15.3	.103	1.05	-.031	700
205 40	6.3	2.4	.1	.181	4.5	.607	15.2	108	1.10	-.030	700
210 45	6.2	2.3	.1	.179	4.5	.608	15.2	.106	1.08	-.030	700
215 50	6.2	2.3	0	.177	4.4	.606	15.2	.117	1.19	-.030	700
220 55	6.1	2.2	.1	.177	4.4	.607	15.2	.120	1.22	-.029	725
225 200	6.0	2.1	.1	.184	3.0	.662	16.6	.117	1.19	-.027	725
230 05	5.9	2.0	.1	.184	3.0	.660	16.5	.121	1.23	-.027	725
235 10	5.9	2.0	0	.175	4.4	.601	15.1	.128	1.30	-.027	750
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.365	*****
240 15	5.8	1.9	.1	.175	4.4	.602	15.1	.131	1.33	-.027	750
245 20	5.7	1.8	.1	176	4.4	.601	15.0	129	1.31	-.027	750
250 25	5.6	1.7	.1	.179	4.5	.598	15.0	.127	1.29	-.027	750
255 30	5.6	1.7	0	.189	4.7	.596	14.9	.117	1.19	-.027	750
260 35	5.5	1.6	.1	.194	4.9	.587	14.7	.115	1.17	-.026	750
265 40	5.4	1.5	.1	.190	4.8	.587	14.7	.123	1.25	-.026	775
270 45	5.3	1.4	.1	.192	4.8	.591	14.8	114	1.16	-.026	775
275 50	5.3	1.4	0	193	4.8	.595	14.9	104	106	-.026	775
280 55	5.2	1.3	.1	189	4.7	.596	14.9	112	1.14	-.026	775
285 300	5.1	1.2	.1	187	4.7	.593	14.9	123	1.25	-.026	750
290 05	5.0	1.1	.1	185	4.6	.595	14.9	124	126	-.026	750
295 10	5.0	1.1	0	.184	3.0	.660	16.5	.127	1.29	-.027	750
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.317	*****
300 15	4.9	1.0	.1	.180	4.5	.598	15.0	.126	1.28	-.027	750
305 20	4.8	.9	.1	.177	4.4	.605	15.2	.118	1.20	-.027	750
310 25	4.7	.8	.1	.173	4.3	.611	15.3	.120	1.22	-.027	750
315 30	4.7	.8	0	173	4.3	.607	15.2	.125	1.27	-.027	750
320 35	4.6	.7	.1	.170	4.3	.603	15.1	.134	136	-.027	750
325 40	4.5	.6	.1	.169	4.2	.613	15.3	.124	1.26	-.027	750
330 45	4.5	.6	0	.165	4.1	.613	15.3	.129	1.31	-.027	775
335 50	4.4	.5	.1	.160	4.0	.615	15.4	.134	1.36	-.026	775
340 55	4.4	.5	0	158	4.0	.612	15.3	.141	1.43	-.026	775
345 400	4.3	.4	.1	.155	3.9	.609	15.2	.160	1.62	-.026	750
350 05	4.2	.3	.1	.153	3.8	.614	15.4	.161	1.63	-.026	750
355 10	4.2	.3	0	.160	4.0	.621	15.5	.124	1.26	-.026	750
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.319	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-1.001	*****

GAS DATA SHEET #12

WEIGHT: 3.9 DATE: 11-28-12

UNIT: Jotul F45 RUN: PAGE: 3 OF 3

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
~~300~~ 15	4.1	.2	.1	.154	3.9	.624	15.6	126	1.25	025	750
~~305~~ 20	4.1	.2	~~0~~	.153	3.8	.628	15.7	.126	1.25	.025	750
~~310~~ 25	4.0	.1	.1	.151	3.8	.629	15.7	.124	1.26	.025	750
~~315~~ 30	3.9	.0	.1	.148	3.7	.633	15.8	124	1.26	.024	775
380											
385											
390											
395											
400											
405											
410											
415											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.099	*****
420											
425											
430											
435											
440											
445											
450											
455											
460											
465											
470											
475											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****		*****
480											
485											
490											
495											
500											
505											
510											
515											
520											
525											
530											
535										2.58	
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****		*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****		*****

1.71

-.034

PREBURN DATA SHEET #13

UNIT: Jotul F45 RUN: 1 DATE: 1-28-2012 PAGE: 1 of 1

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
0 0915	4.7"	—	419	526	585	303	542	458			72	-.041	PREBURN START: # 18 UP
5 20	4.6	.1	303	481	577	323	537	463			71	-.038	COAL BED SCALE RANGE:
10 25	4.5	.1	278	441	561	329	525	464			72	-.037	3.9 → 3.2
15 30	4.4	.1	263	412	543	330	511	460			71	-.036	PRIMARY AIR:
20 35	4.4	—	253	389	525	329	498	455			71	-.035	SECONDARY AIR: N/A
25 40	4.3	.1	244	372	509	327	486	450			71	-.034	FAN: Low
30 45	4.2	.1	237	357	494	323	475	444			71	-.033	PUMPS ON AT:
35 50	4.2	—	232	344	480	318	465	438			71	-.033	CHECK WB/DB: N/A
40 55	4.1	.1	224	333	467	314	454	432			70	-.032	
45 1000	4.0	.1	219	323	456	311	445	426			71	-.031	
50 05	4.0	—	215	314	447	306	436	420			70	-.031	
55 10	3.9	.1	212	308	439	303	427	414			69	-.030	
*****	****	***	****	*****	*****	****	*****	*****	*****	*****	*****	****	
LO 15	3.9	Ø	212	295	431	299	417	408			70	-.030	
20													
25													
30													
35													
40													
45													

Jotul F45

Temperature Data Sheet 14

Run 1
11/28/12

Time	Stack	Top	LT Side	Back	Rt Side	Bottom	Firebox	Sec/Cat	Ambient	Tube Furn	Smpl Box	Smpl Out	C-Gas Box	C-Gas Out	SO2 Out
*********	Chn 103	Chn 104	Chn 105	Chn 106	Chn 107	Chn 108	Chn 109	Chn 110	Chn 111	Chn 112	Chn 113	Chn 114	Chn 115	Chn 116	Chn 117
0	212	295	431	299	417	408	######	######	70	1485	230	60	230	34	36
5	298	300	415	314	402	399	######	######	69	1458	230	44	231	35	36
10	233	304	395	304	387	396	######	######	69	1436	231	42	231	35	36
15	219	310	375	294	373	392	######	######	69	1419	231	40	231	36	37
20	235	336	360	288	362	386	######	######	70	1406	232	37	232	36	37
25	217	320	346	283	354	380	######	######	69	1394	232	37	232	36	37
30	216	316	333	279	345	375	######	######	68	1384	232	37	233	36	37
35	250	358	321	259	336	368	######	######	69	1375	233	38	234	36	38
40	253	388	315	244	334	363	######	######	68	1367	233	38	235	37	38
45	267	418	315	236	335	356	######	######	68	1361	234	37	236	37	38
50	272	438	319	231	337	350	######	######	68	1357	235	37	238	37	38
55	282	461	326	228	339	345	######	######	68	1352	235	38	238	37	38
60	267	448	335	228	346	340	######	######	68	1350	236	38	239	37	39
65	284	479	342	227	350	337	######	######	68	1348	237	38	240	37	39
70	286	492	347	227	352	334	######	######	68	1347	237	38	241	37	39
75	282	486	354	227	355	331	######	######	68	1345	238	38	242	38	39
80	317	537	364	229	358	328	######	######	68	1344	238	38	243	38	39
85	339	582	382	234	370	326	######	######	68	1344	239	39	244	38	39
90	350	603	404	241	393	322	######	######	68	1343	240	39	245	38	39
95	356	607	425	250	416	321	######	######	68	1342	240	39	246	38	39
100	363	614	445	259	436	320	######	######	69	1342	241	40	247	38	38
105	364	621	462	268	453	319	######	######	68	1342	241	40	247	38	38
110	354	609	477	276	467	317	######	######	70	1341	241	40	248	37	38
115	344	589	489	283	484	316	######	######	70	1341	242	41	248	37	38
120	336	574	501	292	503	315	######	######	70	1342	243	41	248	37	38
125	329	563	511	301	511	315	######	######	70	1344	243	42	248	37	38
130	321	553	513	310	511	314	######	######	71	1344	243	42	248	37	38
135	321	550	514	317	508	313	######	######	71	1344	243	42	248	37	37
140	310	538	510	320	503	314	######	######	70	1345	243	42	248	37	37
145	301	510	506	323	497	315	######	######	70	1345	244	42	248	37	37
150	293	492	502	326	491	318	######	######	71	1345	243	42	248	37	37
155	287	481	500	328	487	320	######	######	71	1345	243	43	248	37	37
160	279	467	500	331	483	322	######	######	72	1345	243	43	248	36	37
165	271	451	499	334	482	323	######	######	71	1344	243	43	248	36	37
170	262	434	497	338	481	325	######	######	71	1343	242	43	248	36	37

175	250	411	490	338	478	327	######	######	71	1344	243	43	248	36	37
180	240	389	480	338	474	330	######	######	70	1346	243	43	248	36	37
185	233	373	469	335	469	332	######	######	70	1347	242	43	247	35	36
190	226	358	459	331	463	336	######	######	71	1345	242	43	246	35	36
195	219	344	450	327	456	340	######	######	70	1345	242	44	245	35	36
200	213	333	440	323	449	343	######	######	70	1345	242	44	245	35	36
205	210	324	431	319	442	344	######	######	70	1346	241	44	245	34	36
210	206	316	422	315	436	345	######	######	70	1347	242	44	245	34	36
215	203	308	415	313	429	345	######	######	70	1347	242	44	244	34	36
220	200	302	408	311	424	344	######	######	70	1346	241	43	244	34	35
225	198	297	402	310	419	342	######	######	70	1345	240	43	243	34	35
230	196	294	398	310	415	340	######	######	69	1344	240	44	243	34	35
235	193	289	393	308	411	338	######	######	69	1342	240	44	242	34	35
240	191	285	389	307	406	336	######	######	70	1342	240	44	242	33	35
245	190	281	385	306	403	334	######	######	70	1341	240	45	241	33	35
250	188	278	382	306	399	332	######	######	69	1339	240	45	241	33	35
255	187	276	380	306	395	329	######	######	69	1337	240	45	240	33	34
260	186	274	377	310	393	327	######	######	69	1336	240	45	240	33	34
265	186	271	376	314	391	323	######	######	69	1336	240	45	240	33	34
270	185	270	376	317	390	320	######	######	69	1338	240	45	240	33	34
275	185	269	376	320	389	317	######	######	69	1340	240	46	239	33	34
280	185	268	376	322	388	314	######	######	69	1341	240	46	239	33	33
285	184	266	377	323	388	311	######	######	69	1341	239	46	239	33	33
290	184	266	377	323	388	309	######	######	69	1340	239	46	238	33	33
295	183	265	377	323	388	307	######	######	69	1338	239	46	238	33	33
300	182	264	376	324	387	306	######	######	69	1336	239	46	238	33	33
305	182	262	376	324	386	304	######	######	68	1334	239	47	238	32	32
310	180	261	374	324	384	303	######	######	68	1334	239	47	238	32	32
315	180	259	372	324	382	302	######	######	68	1334	239	47	238	32	32
320	179	258	370	324	380	301	######	######	69	1336	238	46	237	32	32
325	178	257	367	323	379	299	######	######	68	1339	238	46	237	32	31
330	177	255	365	321	377	299	######	######	68	1343	238	46	237	32	31
335	177	253	362	319	374	298	######	######	68	1345	238	47	237	32	31
340	176	252	360	319	372	296	######	######	68	1347	237	47	237	32	31
345	175	249	358	318	370	296	######	######	69	1347	237	48	236	32	31
350	173	247	356	317	367	295	######	######	68	1348	237	48	236	32	31
355	172	246	354	314	365	293	######	######	69	1350	237	49	236	32	30

360	171	244	352	313	362	292	######	######	68	1350	237	49	235	31	30
365	170	242	350	311	360	291	######	######	68	1349	236	49	235	31	30
370	169	240	348	310	357	288	######	######	68	1346	236	49	234	31	30
375	168	238	346	308	354	287	######	######	68	1345	236	48	234	31	30

TEMPERATURE DATA SHEET #14A

		TEST TIME	375		
STACK AVG	237	TOP AVG	371	LT SIDE AVG	403
BACK AVG	300	RT SIDE AVG	408	BOTTOM AVG	328
FIREBOX AVG	########	SEC/CAT AVG	########	AMBIENT AVG	69

END	306.6	
START	370.2	
	-63.6	DELTA T

CIRCLE: LOSS / GAIN

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 11-28-2012 Analyte : CO_2 (15-1)

Unit : Jotul F45 Run # : 1

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 % CO_2 Cyl. Press. : 490 PSI

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

Span Cyl. # : 487905 Conc. : 12.20 % CO_2 Cyl. Press. : 1500 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 : Chp Wedding Time : 0830 Temp : 67 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.013	.013	.051
SPAN	48.8	.488	12.20	48.8	.488	12.219	.019	.074

POST RUN Audit : by : Chp Wedding Time : 1700 Temp : 69 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.001	.038	.038	.151
SPAN	48.8	.488	12.20	48.6	.486	12.169	-.031	+.126

± 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 : 11-28-2012 Analyte : O_2 (15-2)

Unit : Jotul F45 Run # : 1

Zero Cyl. # : 168TAC 3A Conc. : 0.00 % O_2 Cyl. Press. : 490 PSI

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

Span Cyl. # : 487905 Conc. : 12.60 % O_2 Cyl. Press. : 1500 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 : Clyde Watkins Time : 0830 Temp : 67 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.005	.005	.020
SPAN	12.60	.504	12.6	12.6	.504	12.615	.015	.058

POST RUN Audit : by : Clyde Watkins Time : 1700 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	.001	.030	.030	.120
SPAN	12.60	.504	12.6	12.6	.505	12.640	.040	.158

± 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 : 11-28-2012 Analyte : CO (15-3)

Unit : Jotul F45 Run # : 1

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 % CO Cyl. Press. : 490 PSI

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

Span Cyl. # : CA487905 Conc. : 4.90 % CO Cyl. Press. : 1500 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 : 67 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.026	.026	.256
SPAN	49.0	.490	4.90	49.0	.490	4.912	.012	.122

POST RUN Audit : by : [signature] Time : 1700 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	.026	.026	.256
SPAN	49.0	.490	4.90	49.1	.491	4.922	.022	.221

± 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 : 11-28-2012 Analyte : SO_2 (15-4)

Unit : Jotul F45 Run # : 1

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 ppm SO_2 Cyl. Press. : 490 PSI

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

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

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 2500 ppm SO_2

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

PRE RUN Audit : by : Op Watkins Time : 0830 Temp : 67 °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	6,273	6,273	.251
SPAN	50.0	,500	1250	50.0	,500	1251.3	1,300	,520

POST RUN Audit : by : Op Watkins Time : 1700 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	-,003	-1,197	-1,197	-,048
SPAN	50.0	.500	1250	50,2	,502	1256,2	6,200	,248

± 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 F45 RUN: 1 DATE: 11 - 28 - 2012

Thermocouple Check:

T/C # 1	— °F	T/C # 13	575 °F
T/C # 2	— °F	T/C # 14	57.6 °F
T/C # 3	57.8 °F	T/C # 15	57.8 °F
T/C # 4	56.0 °F	T/C # 16	57.4 °F
T/C # 5	55.9 °F	T/C # 17	56.7 °F
T/C # 6	55.9 °F	T/C # 18	59.2 °F
T/C # 7	56.0 °F	T/C # 19	— °F
T/C # 8	55.8 °F	T/C # 20	— °F
T/C # 9	— °F	T/C # 21	— °F
T/C # 10	— °F	T/C # 22	— °F
T/C # 11	535 °F	T/C # 23	— °F
T/C # 12	58.0 °F	T/C # 24	— °F

Thermocouple Readout:

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

ZERO .6 °F Adj. to 0.0 °F ZERO 0.0 °F Difference .00 %

SPAN 1996.6 °F Adj. to 2000.0 °F SPAN 1999.7 °F Difference -.015 %

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 200.2 °F	400	= 399.9 °F
600	= 599.8 °F	800	= 799.7 °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: 14.0 - 4.0 = 10.0

Post: 13.9 - 3.9 = 10.0

Stack Cleaned Prior to Test Run: YES X NO ____

TABLE 1 ----- RAW DATA

CLIENT : Jotul TEST No. : 3

MODEL: F45 DATE:

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	458.000	0.150	77	0.69	2.50	525
5	459.500	0.390	77	0.33	4.00	325
10	461.951	0.120	78	0.48	3.80	575
15	463.344	0.120	78	0.40	4.60	575
20	464.737	0.110	79	0.58	4.40	625
25	466.023	0.140	79	0.41	6.00	550
30	467.484	0.180	80	0.40	9.80	475
35	469.181	0.200	81	0.21	9.60	450
40	470.973	0.230	81	0.14	10.47	425
45	472.870	0.200	82	0.43	12.40	450
50	474.676	0.200	83	0.27	12.20	450
55	476.488	0.200	83	0.17	11.80	450
60	478.300	0.140	84	0.86	13.00	525
65	479.859	0.160	85	0.57	12.50	500
70	481.502	0.200	85	0.17	11.80	450
75	483.327	0.200	85	0.15	10.70	450
80	485.152	0.170	86	0.19	11.10	475
85	486.888	0.170	86	0.26	11.60	475
90	488.624	0.170	86	0.20	12.10	475
95	490.360	0.170	86	0.11	11.40	475
100	492.096	0.160	88	0.40	9.80	500
105	493.757	0.130	88	0.45	8.20	550
110	495.267	0.130	88	0.43	7.70	550
115	496.778	0.110	88	0.55	7.60	600
120	498.162	0.120	88	0.23	8.20	575
125	499.610	0.110	88	0.49	6.90	600
130	500.997	0.090	88	0.48	6.80	675
135	502.230	0.090	88	0.55	6.50	675
140	503.463	0.090	88	0.53	6.50	675
145	504.696	0.070	88	0.74	5.60	750
150	505.805	0.070	88	0.78	5.30	775
155	506.879	0.070	88	0.79	5.40	775
160	507.953	0.070	88	0.77	5.30	750
165	509.063	0.070	88	0.84	5.20	725
170	510.211	0.070	88	0.84	5.10	725
175	511.359	0.080	88	0.87	5.10	700

180	512.548	0.070	88	0.89	5.10	725
185	513.696	0.070	88	0.89	5.10	725
190	514.845	0.070	88	0.88	5.10	725
195	515.993	0.070	88	0.84	5.10	725
200	517.141	0.080	86	0.83	5.30	700
205	518.321	0.080	86	0.85	5.10	725
210	519.461	0.070	86	0.84	5.20	750
215	520.562	0.070	86	0.85	5.20	750
220	521.664	0.070	86	0.81	5.10	750
225	522.766	0.080	86	0.81	5.00	725
230	523.906	0.080	86	0.78	4.90	725
235	525.045	0.080	86	0.73	4.90	725
240	526.185	0.070	86	0.72	5.00	725
245	527.325	0.080	86	0.73	5.00	700
250	528.507	0.070	86	0.76	5.00	725
255	529.647	0.080	86	0.82	5.00	700
260	530.828	0.080	86	0.81	4.90	700
265	532.009	0.080	86	0.80	4.90	700
270	533.190	0.080	86	0.80	4.90	700
275	534.372	0.080	86	0.77	4.70	700
280	535.553	0.080	86	0.78	4.80	700
285	536.734	0.080	86	0.82	4.70	700
290	537.915	0.080	86	0.80	4.70	700
295	539.096	0.080	86	0.80	4.80	700
300	540.277	0.080	86	0.79	4.70	700
305	541.460	0.080	88	0.79	4.70	700
310	542.643	0.080	88	0.82	4.80	700
315	543.825	0.080	88	0.83	4.70	700
320	545.008	0.080	88	0.78	4.50	700
325	546.191	0.080	88	0.81	4.40	700
330	547.374	0.080	88	0.86	4.40	700

TABLE 2---RAW DATA

CLIENT : Jotul TEST No. 3

MODEL: F45 DATE:

METER CAL. FACTOR (Y) -------	0.935		Wt. WOOD BURNED(LB) -------	15.5	Lbs
BAROMETRIC PRESS.(Pb) -------	30	in Hg	WET,FUEL MOISTURE % -------	15.512	%
LEAK RATE POST (Lp) -------	0.000	cfm	Wt. PART. COLLECTED -------	0.3554	g
WATER VOL. (V1c) -------	121.6	Ml	METER VOLUME Vm -------	89.374	mcf
TEST TIME (MIN) -------	330	min	HC MOLE FRACTION -------	0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT : Jotul TEST No. 3

MODEL: F45 DATE:

****

AVG DELTA H	-------	0.11	in H2O	AVG PRCNT CO	-------	0.62	%
AVG METER TEMP. Tm	-------	86	deg F	AVG PRCNT CO2	-------	6.61	%
AVG PPM SO2	-------	633	PPM	AVG BAL CO2/CO	-------	10.58	%

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul TEST No. 3

MODEL: F45 DATE:

STD SAMPLE VOL. Vm(std) d) ------	81.12	dscf	STACK GAS FLOW Qsd -------	454.915	dscf/Hr
				7.58	& dscf/min
VOL. WATER VAPOR Vw(s td) -----	5.724	scf	PARTICULATE CONCTRT. C s ------	0.0044	g/dscf
PRCNT MSTR Bws -------	6.59	%	PARTC.EMISS. RATE E -------	1.99	g/Hr
BURN RATE BR -------	1.08	Kg/Hr	MOLES OF GAS PER Lb WOOD Nt ----	0.50	Lb-mole/Lb
CO EMISSION RATE -------	95.16	g/Hr	PART.EMISS. RATE ------	1.85	g/Kgdry fuel
	& 88.11	g/Kgdry fuel			

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Jotul TEST No. : 3

MODEL: F45 DATE:

TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR	PROPRTN RATE VAR. AVERAGE
5	726.3	97	100
10	734.4	98	
15	737.3	99	
20	736.6	99	
25	738.5	99	
30	737.6	99	
35	738.7	99	
40	738.3	99	
45	737.5	99	
50	742.0	99	
55	743.8	99	
60	743.1	99	
65	744.4	100	
70	746.6	100	
75	746.4	100	
80	745.7	100	
85	748.0	100	
90	748.0	100	
95	748.0	100	
100	746.6	100	
105	750.6	100	
110	750.5	100	
115	751.0	100	
120	750.4	100	
125	752.4	101	
130	752.0	101	
135	752.1	101	
140	752.1	101	
145	752.1	101	
150	751.6	101	
155	752.1	101	
160	752.1	101	
165	752.2	101	
170	752.1	101	
175	752.1	101	
180	752.1	101	

185	752.1	101
190	752.7	101
195	752.1	101
200	753.4	101
205	749.1	100
210	749.6	100
215	748.9	100
220	749.6	100
225	749.6	100
230	749.6	100
235	748.9	100
240	749.6	100
245	749.6	100
250	750.4	100
255	749.6	100
260	749.8	100
265	749.8	100
270	749.8	100
275	750.4	100
280	749.8	100
285	749.8	100
290	749.8	100
295	749.8	100
300	749.8	100
305	749.6	100
310	748.3	100
315	747.6	100
320	748.3	100
325	748.3	100
330	748.3	100

COMPUTER INPUT DATA SHEET #1

Client: Jotul North America

Address: 55 Hutcherson
Gorham, ME 04038

1.99

Phone: 1-800-797 5912 Fax: 1-207-591 6623

Run No.: 3 Date of Test: 12-3-2012 Burn Rate: 1.08

Model No.: F45 ☐ min ☒ min-1.25 ☐ fan

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

Dry Gas Meter Y Factor: .935 (0.000) (Data Sheet #2) Post Leak Rate: .000 cfm (.000) (Data Sheet #2) Time: 330 min. (000) (Data Sheet #2)

Dry Gas Meter Volume: 89.374 cf (00.000) (Data Sheet #2)

Stack Flow: 5.639 dscfm (00.000) (Data Sheet #2) Δ H: .113 in. H_2O (.000) (Data Sheet #2)

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

H_2O Captured: 121.6 g (00.0) (Data Sheet #3)

Front Half Catch % Of Total: 52.6 % (00.0) (Data Sheet #6) Total Particulate Catch: .3554 g (0.0000) (Data Sheet #6)

Flue Gas Moisture: 6.587 % (00.000) (Data Sheet #7)

Particulate Emission: .0676 gr/dscf (0.0000) (Data Sheet #7)

Relative Humidity: 48.6 % RH (00.0) (Data Sheet #8) Ambient Moisture: 1.5 % H_2O (0.00) (Data Sheet #8)

Preburn Fuel Wt.: 35.2 lbs. (00.0) (Data Sheet #8) Coal Bed Wt.: 3.5 lbs. (00.0) (Data sheet #8) Test Fuel Wt.: 15.5 lbs. (00.0) (Data sheet #8)

Heat Output (EPA Default): 13022.9 BTU/hr (00,000.0) (Data Sheet #8)

Kindling Fuel % Moisture (wet): 10.847 % (00.000) (Data Sheet #10) Pretest Fuel % Moisture (wet): 16.411 % (00.000) (Data Sheet #10)

Test Fuel % Moisture (dry): 18.360 % (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove]) Test Fuel % Moisture (wet): 15.512 %

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

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

Average Ambient Temperature: 76 °F (00) (Data Sheet #14) Stove Temperature Change: -83.1 °F (+/- 000.0) (Data Sheet #14)

Test start = 1100
End = 1630

meter temp = 545

METER BOX DATA SHEET PAGE # 2

Page: 1 of 3

UNIT: Jotul F45 RUN: 3 DATE: 12-3-2012

Meter Box: SH Y Factor: .935

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

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

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

ROTO: PRESS: .18 SAMPLING RATIO: 22 : 1 BP: 30.05

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1100	458.000	—	6.642	.15	77	525	77	20
5	05	459.500	—	10.730	.39	77	325	77	3.0
10	10	461.951	461.951	6.053	.12	78	575	78	2.0
15	15	463.344	463.344	6.053	.12	78	575	78	2.0
20	20	464.737	464.737	5.559	.11	79	625	79	2.0
25	25	466.023	466.023	6.137	.14	79	550	79	2.0
30	30	467.484	467.484	7.301	.18	80	475	80	2.0
35	35	469.181	469.181	7.706	.20	81	450	81	2.0
40	40	470.973	470.973	8.160	.23	81	425	81	2.0
45	45	472.870	472.870	7.678	.20	82	450	82	2.0
50	50	474.676	474.676	7.664	.20	83	450	83	2.0
55	55	476.488	476.488	7.664	.20	83	450	83	2.0
ROTO PRESS:		.18	TOTALS:	87.347	2.24	958	BP.:	30.05	
60	1200	478.300	478.300	6.557	.14	84	525	84	2.0
65	05	479.859	479.859	6.872	.16	85	500	85	2.0
70	10	481.502	481.502	7.636	.20	85	450	85	2.0
75	15	483.327	483.327	7.636	.20	85	450	85	2.0
80	20	485.152	485.152	7.220	.17	86	475	86	2.0
85	25	486.888	486.888	7.220	.17	86	475	86	2.0
90	30	488.624	488.624	7.220	.17	86	475	86	2.0
95	35	490.360	490.360	7.220	.17	86	475	86	2.0
100	40	492.096	492.096	6.834	.16	88	500	88	2.0
105	45	493.757	493.757	6.213	.13	88	550	88	2.0
110	50	495.267	495.267	6.213	.13	88	550	88	2.0
115	55	496.778	496.778	5.695	.11	88	600	88	2.0
			TOTALS:	82.536	1.910	1035	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	169.883	4.15	1993	AVG. BP:		

bgl 12:10

METER BOX DATA SHEET PAGE # 2

Page: 2 of 3

UNIT: Jotul F45 RUN: 3 DATE: 12-3-2012

Meter Box: SH Y Factor: .935

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: 22			: 1	BP: 30.00		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1300	498.162	498.162	5.937	.12	88	575	88	2.0
125	05	499.610	499.610	5.690	.11	88	600	88	2.0
130	10	500.997	500.997	6.057	.09	88	675	88	2.0
135	15	502.230	502.230	5.057	.09	88	675	88	2.0
140	20	503.463	503.463	5.057	.09	88	675	88	2.0
145	25	504.696	504.696	4.552	.07	88	750	88	2.0
150	30	505.805	505.805	4.405	.07	88	775	88	2.0
155	35	506.879	506.879	4.405	.07	88	775	88	2.0
160	40	507.953	507.953	4.552	.07	88	750	88	2.0
165	45	509.063	509.063	4.709	.07	88	725	88	2.0
170	50	510.211	510.211	4.709	.07	88	725	88	2.0
175	55	511.359	511.359	4.877	.08	88	700	88	2.0
ROTO PRESS: .18			TOTALS:	59.007	1.00	1052	BP.: 30.00		
180	1400	512.548	512.548	4.709	.07	88	725	88	2.0
185	05	513.696	513.696	4.709	.07	88	725	88	2.0
190	10	514.845	514.845	4.709	.07	88	725	88	2.0
195	15	515.993	515.993	4.709	.07	88	725	88	2.0
200	20	517.141	517.141	4.895	.08	86	700	86	2.0
205	25	518.321	518.321	4.726	.08	86	725	86	2.0
210	30	519.461	519.461	4.568	.07	86	750	86	2.0
215	33	520.562	520.562	4.568	.07	86	750	86	2.0
220	40	521.664	521.664	4.568	.07	86	750	86	2.0
225	45	522.766	522.766	4.726	.08	86	725	86	2.0
230	50	523.906	523.906	4.726	.08	86	725	86	2.0
235	55	525.045	525.045	4.726	.08	86	725	86	2.0
			TOTALS:	56.339	.89	1040	MAX VACC =		
TOTAL Cu Ft			TOTALS:	115.346	1.89	2096	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 3 of 3

UNIT: F45 RUN: 3 DATE: 12-3-2012

Meter Box: SH Y Factor: .935

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

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

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

ROTO: PRESS: .18			SAMPLING RATIO: 22 : 1				BP: 29.98		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
240	1500	526.185	526.185	4.723	.07	86	725	86	2.0
245	05	527.325	527.325	4.891	.08	86	700	86	2.0
250	10	528.507	528.507	4.723	.07	86	725	86	2.0
255	15	529.647	529.647	4.891	.08	86	700	86	2.0
260	20	530.828	530.828	4.891	.08	86	700	86	2.0
265	25	532.009	532.009	4.891	.08	86	700	86	2.0
270	30	533.190	533.190	4.891	.08	86	700	86	2.0
275	35	534.372	534.372	4.891	.08	86	700	86	2.0
280	40	535.553	535.553	4.891	.08	86	700	86	2.0
285	45	536.734	536.734	4.891	.08	86	700	86	2.0
290	50	537.915	537.915	4.891	.08	86	700	86	2.0
295	55	539.096	539.096	4.891	.08	86	700	86	2.0
ROTO PRESS: .18			TOTALS:	58.356	.94	1032	BP.: 29.94		
300	1600	540.277	540.277	4.885	.08	86	700	86	2.0
305	05	541.460	541.460	4.885	.08	86	700	86	2.0
310	10	542.643	542.643	4.885	.08	86	700	86	2.0
315	15	543.825	543.825	4.885	.08	86	700	86	2.0
320	20	545.008	545.008	4.885	.08	86	700	86	2.0
325	25	546.191	546.191	4.885	.08	86	700	86	2.0
330	30	547.374	547.374	4.885	.08	86	700	86	2.0
335				(34.195)	(.56)	(402)			
340				(92.550)	(1.50)	(1634)			
345									
350						5723			
355				377.780	7.54	85			
			TOTALS:				MAX VACC =		3.0
TOTAL Cu Ft.		89.374	TOTALS:	5,639	.113	545	AVG. BP: 30.00		

* 1/67

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : F45 RUN : 3 DATE : 12-3-12

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

SCALE	WEIGHT
295.0 g	295.0
590.0 g	590.0
885.0 g	885.0

IMPINGER	#1	#2	#3	#4
FINAL WT	709.0	576.7	485.1	884.5
INITIAL WT	607.6	574.2	484.4	867.5
NET WT GRAMS	101.4	2.5	.7	17.0

TOTAL CATCH : 121.6 **GRAMS H_2O**

FRONT HALF

FILTER #	65F	
FINAL WT g	.7227	
INITIAL WT g	.6311	
NET WT g	.0916	

BEAKER #	71
DESC.	ACETONE
FINAL WT g	104.2440
INITIAL WT g	104.1478
NET WT g	.0962
VOL. DESC. ml	75

BACK HALF

FILTER #	65B	
FINAL WT g	.2916	
INITIAL WT g	.2827	
NET WT g	.0089	

BEAKER #	72	73	74	75	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	103.9300	104.3619	107.5239	96.4915	
INITIAL WT g	103.8225	104.3505	107.5040	96.4626	
NET WT g	.1075	.0114	.0199	.0289	.0488
VOL. DESC ml	150	75	125	140	(265)

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 2-15-12 Time : 1200 By : CP

Manufacturer S & S Grade : # 25 Glass Front Size : 11 cm Lot No. : 393580

Back Size: 8.2 cm Lot No. : 4642341

	DATE: 2-20-12	BY: AV	DATE: 2-23-12	BY: CP	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
61F	0.6288	1330	.6285	1005		
62F	0.6320	1331	.6320	1006		
63F	0.6300	1332	.6298	1007		
64F	0.6272	1333	.6268	1008		
65F	0.6314	1334	.6311	1009	← R-3	
66F	0.6271	1335	.6272	1010		
67F	0.6314	1336	.6310	1011		
68F	0.6298	1337	.6295	1012		
69F	0.6302	1338	.6304	1013		
70F	0.6307	1339	.6307	1014		

61B	0.2826	1320	.2827	1015		
62B	0.2805	1321	.2805	1016		
63B	0.2824	1322	.2824	1017		
64B	0.2811	1323	.2811	1018		
65B	0.2825	1324	.2827	1019	← R-3	
66B	0.2835	1325	.2836	1020		
67B	0.2845	1326	.2846	1021		
68B	0.2845	1327	.2847	1022		
69B	0.2846	1328	.2846	1023		
70B	0.2836	1329	.2837	1024		

Checked by: Armando Date: 2-23-2012 Time: 1245

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
2-20-12	1200	CP		70	48
2-23-12	1000	CP		73	47

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 11-2-11 Time : 1300 By : CP

	DATE: 11-7-11	BY: CP	DATE: 11-14-11	BY: CP	DATE:	BY:
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
51	104.8708	1245	104.8709	0835	✓	
52	107.4940	1246	107.4943	0836	✓	
53	105.7315	1247	105.7317	0837	✓	
54	107.3008	1248	107.3005	0838	✓	
55	93.4825	1249	93.4821	0839	✓	
56	106.8588	1250	106.8590	0840	✓	
57	97.4049	1251	97.4052	0841	✓	
58	96.8864	1252	96.8861	0842	✓	
59	105.3467	1253	105.3468	0843	✓	
60	98.1962	1254	98.1961	0844	✓	
61	99.3426	1255	99.3431	0845	✓	
62	97.8600	1256	97.8602	0846	✓	
63	93.2089	1257	93.2090	0847	✓	
64	104.7824	1258	104.7829	0849	✓	
65	98.4370	1259	98.4375	0850	✓	
66	96.5039	1300	96.5042	0851	✓	
67	106.2183	1301	106.2188	0852	✓	
68	94.1500	1302	94.1505	0853	✓	
69	108.9871	1303	108.9876	0854	✓	
70	107.4739	1304	107.4743	0855		
71	104.1474	1305	104.1478	0856	✓	
72	103.8222	1306	103.8225	0859	✓	
73	104.3502	1307	104.3505	0900	✓ R-3	
74	107.5035	1308	107.5040	0901	✓	
75	96.4624	1310	96.4626	0902	✓	

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
11-7-11	1230	CW	-	72	46
11-11-11	0815	CW	-	70	46
		CW	-		

Checked by : AV

Date : 11-14-11

Time : 10:00 am

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : F45 **RUN :** 3 **DATE :** 12-3-12 **Page :** 1 **of** 1

Beaker #	Date	Time	By	Weight	Date	Time	By	~~Weight~~	Date	Time	By	Weight	Date	Time	By
71	12-5	1100	CP	104.2436	12-6	1405	CP	104.2440	12-8	1735	CP				
72	12-5	1100	CP	103.9296	12-6	1406	CP	103.9300	12-8	1736	CP				
73	12-5	1100	CP	104.3614	12-6	1407	CP	104.3619	12-8	1737	CP				
74	12-5	1100	CP	107.5244	12-6	1408	CP	107.5239	12-8	1738	CP				
75	12-5	1100	CP	96.4918	12-6	1409	CP	96.4915	12-8	1739	CP				

Filter #	Date	Time	By	Weight	Date	Time	By	~~Weight~~	Date	Time	By	Weight	Date	Time	By
GSF	12-3		CP	.7231	12-4	1707	CP	.7227	12-5	1050	CP				
GSB	12-3		CP	.2917	12-4	1708	CP	.2916	12-5	1051	CP				

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	12-4-12	1700	CP	69	47
2	12-5-12	1045	CP	74	44
3	12-6-12	1400	CP	66	49
4	12-8-12	1730	CP	65	48
5					

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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 10-10-12 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	.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	10.0000	.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	10-23-12	1800	65	48
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	1080	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	.9994	.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

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	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	47
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	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	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	.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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 4-13-2011 Through 1-13-2012	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0000	10.0001	1.0000	.0998	CP	4-13-11	1030	66	49
100.0001	10.0002	1.0000	.0999	CP	4-15-11	1330	75	48
100.0004	10.0000	.9999	.0998	CP	4-19-11	1600	74	44
100.0003	10.0000	1.0000	.0999	CP	4-20-11	1815	72	46
100.0000	10.0001	.9999	.1000	CP	6-16-11	0900	76	39
99.9997	9.9999	.9998	.0999	CP	6-18-11	1530	74	44
99.9996	10.0002	1.0000	.0999	CP	6-20-11	1600	73	47
100.0000	10.0000	.9998	.0999	CP	6-21-11	1400	73	47
100.0000	10.0000	1.0001	.0999	CP	6-22-11	1200	72	46
99.9999	9.9998	1.0000	.1000	CP	6-23-11	1100	76	49
100.0000	10.0002	1.0000	.0999	CP	6-24-11	1400	75	48
100.0000	10.0000	1.0000	.0999	CP	6-27-11	1230	78	46
100.0001	10.0002	.9999	.0998	CP	6-30-11	1030	78	46
99.9995	10.0000	.9999	.0999	CP	7-1-11	1030	70	48
99.9999	9.9999	1.0000	.1000	CP	7-2-11	1145	75	45
100.0000	9.9999	.9999	.0999	CP	7-5-11	1000	73	47
99.9999	10.0001	1.0000	.0999	CP	7-6-11	0930	76	49
100.0000	9.9997	1.0000	.0997	CP	9-22-11	1700	77	46
100.0000	10.0001	1.0000	.0999	CP	9-24-11	1200	77	49
100.0000	9.9998	1.0001	.1000	CP	9-25-11	1300	76	49
100.0000	9.9999	1.0001	.0998	CP	9-27-11	1000	77	49
99.9996	9.9999	1.0000	.0998	CP	9-29-11	0840	72	42
99.9997	9.9998	.9999	.1000	CP	9-30-11	1000	70	48
99.9996	9.9998	1.0000	.0999	CP	10-1-11	1520	70	45
99.9998	10.0002	1.0000	.0997	CP	10-2-11	1430	74	47
99.9995	10.0001	1.0000	.0999	CP	10-5-11	1510	71	49
100.0000	9.9999	1.0000	.0998	CP	10-6-11	1100	78	40
100.0000	9.9999	1.0000	.0999	CP	10-9-11	1130	75	48
100.0000	10.0001	1.0000	.0998	CP	10-16-11	1540	68	47
100.0000	10.0000	1.0000	.0998	CP	11-9-11	1230	72	46
100.0000	10.0002	.9998	.0998	CP	11-11-11	0515	70	48
99.9999	10.0000	1.0000	.0996	CP	11-15-11	1200	75	48
99.9995	10.0001	.9999	.0999	CP	11-16-11	1400	70	44
99.9999	10.0001	.9999	.0998	CP	11-20-11	1600	73	43
99.9998	9.9999	.9999	.0999	CP	11-21-11	1715	74	47
100.0000	10.0000	1.0000	.0999	CP	11-22-11	1600	65	48
100.0000	10.0000	1.0000	.0999	CP	1-9-12	1030	70	48
100.0000	9.9999	1.0001	.1000	CP	1-11-12	1720	65	48
100.0000	10.0001	1.0000	.0997	CP	1-13-12	1036	72	46

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

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

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0000	10.0002	1.0000	.0998	CP	11-11	0846	67	42
100.0000	10.0000	1.0001	.1000	CP	11-15	0930	70	48
100.0000	10.0001	1.0000	.0999	CP	11-19	0930	65	48
100.0000	10.0000	1.0000	.1000	CP	11-23	1400	66	45
100.0000	9.9997	1.0000	.0998	CP	11-24	1400	65	48
100.0000	10.0000	.9999	.0998	CP	11-26	1100	67	46
100.0000	10.0001	1.0001	.0997	CP	12-14	1000	75	41
100.0001	10.0003	1.0000	.0999	CP	12-16	1100	75	48
100.0000	10.0002	1.0000	.0999	CP	12-18	1000	77	46
100.0000	10.0000	1.0000	.0999	CP	12-21	1100	66	49
100.0000	10.0004	1.0000	.0997	CP	12-22	1400	72	48
100.0000	10.0001	1.0000	.1001	CP	12-23	1100	76	38
100.0000	10.0000	.9999	.0999	CP	12-24	1000	67	46
100.0000	10.0001	1.0001	.0999	CP	12-25	1100	75	48
100.0000	10.0000	1.0000	.0999	CP	1-19-11	0930	66	49
100.0000	9.9999	1.0000	.0999	CP	1-21-11	1400	77	44
99.9996	10.0000	1.0000	.0998	CP	1-25-11	0900	75	48
100.0000	10.0002	1.0001	.1000	CP	1-26-11	1400	74	44
100.0000	10.0001	.9998	.0998	CP	1-27-11	1200	65	48
100.0000	10.0002	1.0000	.0999	CP	1-28-11	1630	70	48
100.0000	10.0001	1.0001	.0999	CP	1-29-11	1200	68	48
100.0000	10.0002	1.0000	.0999	CP	1-30-11	1500	66	49
100.0000	9.9999	1.0000	.0999	CP	2-15-11	0930	75	41
100.0000	10.0000	1.0001	.1000	CP	2-16-11	0930	66	49
100.0000	10.0002	1.0000	.0999	CP	2-22-11	1000	70	48
100.0000	10.0001	1.0002	.0999	CP	3-4-11	1200	69	47
100.0000	10.0004	.9999	.1000	CP	3-5-11	1000	70	48
100.0000	10.0001	1.0000	.0999	CP	3-8-11	1000	74	47
100.0000	10.0000	1.0000	.1000	CP	3-9-11	1600	67	46
100.0000	10.0002	0.9999	.0999	CP	3-10-11	1600	66	49
100.0000	10.0000	1.0000	.0999	CP	3-12-11	1530	73	47
100.0000	10.0001	.9999	.0998	CP	3-13-11	1200	65	48
100.0000	10.0001	1.0000	.0999	CP	3-29-11	1120	76	49
100.0000	10.0000	.9999	.0998	CP	3-30-11	0800	74	47
100.0000	10.0001	1.0000	.0999	CP	3-31-11	1050	70	48
100.0000	10.0002	.9998	.0999	CP	4-4-11	0830	74	47
100.0000	10.0003	1.0000	.1000	CP	4-5-11	1130	73	47
100.0000	9.9999	1.0001	.0999	CP	4-6-11	1030	77	49
100.0000	10.0000	9.9999	.1001	CP	4-7-11	1000	78	40

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

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

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

BLANK PROCESSING DATA SHEET # 5

UNIT : Total F45 RUN : 3 DATE : 12-3-2012

BLANKS DONE : 8-31-2010

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

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

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

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

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

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

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

TARE QC

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

FINAL QC

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

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT: Jotul F45 RUN: 3 DATE: 12-3-2012

BLANK CALCULATIONS

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

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

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

FRONT HALF CATCH

FILTERS: .0916 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0916 g

BEAKERS: .0962 (Total Catch) g - 75 (ml Acetone) (.0007 .000009 g) (Blank Value / ml Acetone) = .0955 g

TOTAL FRONT HALF CATCH : .1871 g

BACK HALF CATCH

FILTERS: .0089 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0089 g

BEAKERS:

Acetone: .1075 (Total Catch) g - 150 (ml Acetone) (.0014 .000009 g) (Blank Value / ml Acetone) = .1061 g

Extract: .0114 (Total Catch) g - 75 (ml Dichloromethane) (.0016 .000021 g) (Blank Value / Dichloromethane) = .0098 g

Water: .0488 (Total Catch) g - 265 (ml Water) (.0053 .000020 g) (Blank Value / Water) = .0435 g

TOTAL BACK HALF CATCH : .1683 g

TOTAL CATCH : .3554 g

% FRONT HALF : 52.6 %

CALCULATIONS DATA SHEET # 7

UNIT : JOTUL F45 RUN : 3 DATE : 12-3-2012

1) $Vm(std) = \dfrac{(89.374\ Vm)(17.64)(.935\ mcf)\left(30.00\ "Hg + \frac{.113\ "H_2O}{13.6}\right)}{(545\ TmA)} = \dfrac{81.1646}{000.0000}$ dscf

2) $Vw(std) = (.04707)(121.6\ ml\ H_2O) = \dfrac{5.7237}{00.0000}$ scf

3) $Asw = \dfrac{(5.7237\ scf)}{(5.7237\ scf + 81.1646\ dscf)} = \dfrac{.0659}{.0000}$ Bws × 100 = $\dfrac{6.5874}{00.0000}$ % H_2O

4) $Cs = \dfrac{(.3554\ g.)}{(81.1646\ dscf)}(15.43) = \dfrac{.0674}{0.0000}$ gr / dscf

5) Estimated g / hr = $\dfrac{(.3554\ g.)}{(81.1646\ dscf)}\left(\dfrac{5.639}{00.0000}\ dscfm\right)(60) = \dfrac{1.4815}{00.0000}$ 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 F45 RUN: 3 DATE: 12-3-202

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

Wet Bulb / Dry Bulb

Pre : WB: 64 DB: 77 = 48.0 % RH 1.5 % H_2O

Post : WB: 64 DB: 77 = 48.0 % RH 1.5 % H_2O

Average: 48.0 % RH 1.5 % H_2O

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

Kindling Weight (lbs): Paper: .1 Wood: 3.3

Preburn Fuel Weight: 17.8+14.1 Total: 31.9

Kindling & Preburn Fuel Weight (wood only) (lbs): **Total:** 35.2

Coal Bed Wt Range (lbs): 3.8 - 3.1 **Scale:** 3.8 - 3.1

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

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

Maximum Coal Bed Removal (lbs): ((3.8 (Upper) + 3.1 (Lower)) ÷ 2) .25 = .8 (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"	17	3	7.5	48.4
4" x 4"	17	2	8.0	51.6

Test Fuel Weight: 15.5 lbs

Estimated Dry Burn Rate:

$$\frac{15.5 - (15.5 \times .15512)}{2.2046} \times \frac{60}{\frac{330}{\text{TIME}}} = 1.0800 \text{ kg/hr}$$

Estimated BTU's/hr: $19{,}140 \times \frac{63}{100} \times \frac{1.080}{\text{DBR}} = 13022.9$ BTU's/hr

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

240

WOOD STOVE OPERATING DATA PAGE #9

Unit : Jotul F45 Run : 3 Date : 12-3-2012

FIRE STARTED: 0710

WARM UP AND PREBURN:

PRIMARY AIR : Set wide open for all warm-up / preburn fuel charges. Then set to 1/2" 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. 45 sec.

PRIMARY AIR : Opened full for first 5 min., then set to run setting of 1/2".

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

FAN:

ON / OFF during warm-up

ON / OFF first 30 minutes of test

Fan speed set at Low

ON / OFF during preburn

ON / OFF balance of test run

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

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

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

All Grades WCLB rules:

WARM UP INFORMATION:

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

1st warm up / pre-burn fuel charge (17.8 lbs.) added at 0720

2nd warm up / pre-burn fuel charge (14.1 lbs.) added at 0855

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

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

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

TEST DATA SHEET #10

Unit : Jotul F45 Run : 3 Date : 12-3-2012

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

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

Time Test Fuel moisture reading taken : 0945

pc #	Dimen.	Use	TOP	BOTTOM	SIDE	Avg Corrected
1	2"×4"×8'	K	11.7	12.6	12.2	12.167
2						
3						
4	2"×4"×8'	P	19.1	19.4	19.0	19.2
5	2"×4"×8'	P	21.0	21.8	21.6	21.5
6	2"×4"×8'	P	18.0	18.3	18.2	18.2
7	2"×4"×8'	P				(58.9)
8	2"×4"×8'	P				
9						
10						
11						
12	2"×4"×17"	T	18.1	18.1	18.1	18.1
13	"	T	18.5	18.6	18.6	18.0
14	"	T	19.7	19.5	19.6	19.6
15	4"×4"×17"	T	18.0	18.2	18.2	18.1
16	"	T	18.0	18.0	18.0	18.0
17						(91.8)
18						
19						
20	Spacers	T	22.6	21.5	21.6	21.9

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	12.167 %	19.633 %	18.360 %
Wet Moisture % :	10.847 %	16.411 %	15.512 %

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

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

GAS DATA SHEET #12

WEIGHT: 3.5 DATE: 12-3-2012

UNIT: Jotul F45 RUN: 3 PAGE: 1 OF 2

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
0 11 00	19.0	15.5	—	099	2.5	—	—	067	.69	-.035	525
5 05	18.8	15.3	.2	.160	4.0	.1659	16.5	032	.33	-.035	325
10 10	18.4	14.9	.4	.150	3.8	659	16.5	046	.48	-.036	575
5 15	18.0	14.5	.4	.185	4.6	.631	15.8	037	.40	-.037	575
0 20	17.7	14.2	.3	.175	4.4	.631	15.8	056	.58	-.035	625
25 25	17.3	13.8	.4	.240	6.0	.575	14.4	038	.41	-.037	550
0 30	16.7	13.2	.6	.390	9.8	.423	10.6	037	.40	-.043	475
35 35	16.2	12.7	.5	.382	9.6	.439	11.0	018	.21	-.045	450
40 40	15.6	12.1	.6	.428	10.7	.399	10.0	011	.14	-.047	425
5 45	14.9	11.4	.7	.495	12.4	.320	8.0	041	.43	-.050	450
50 50	14.2	10.7	.7	.489	12.2	.332	8.3	024	.27	-.050	450
5 55	13.7	10.2	.5	.473	11.8	.352	8.8	014	.17	-.050	450
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.500	*****
0 12 00	13.0	9.5	.7	.518	13.0	.276	6.9	084	.86	-.051	525
5 05	12.3	8.8	.7	.499	12.5	.308	7.7	055	.57	-.051	500
10 10	11.7	8.2	.6	.471	11.8	.352	8.8	014	.17	-.051	450
15 15	11.2	7.7	.5	.437	10.7	.399	10.0	012	.15	-.050	450
20 20	10.7	7.2	.5	.442	11.1	.380	9.5	016	.19	-.050	475
25 25	10.1	6.6	.6	464	11.6	.356	8.9	023	.26	-.050	475
30 30	9.6	6.1	.5	.485	12.1	.340	8.5	017	.20	-.050	475
35 35	9.0	5.5	.6	.455	11.4	.372	9.3	.008	.11	-.050	475
40 40	8.7	5.2	.3	390	9.8	.423	10.6	037	.40	-.049	500
45 45	8.4	4.9	.3	327	8.2	.487	12.2	.043	.45	-.045	550
50 50	8.0	4.5	.4	.309	7.7	.507	12.7	041	.43	-.044	550
55 55	7.7	4.2	.3	.304	7.6	.507	12.7	053	.55	-.043	600
1 STOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.584	*****
1 00	7.5	4.0	.2	327	8.2	.495	12.4	020	.23	-.043	575
1 05	7.3	3.8	.2	277	6.9	.535	13.4	047	.49	-.042	600
1 10	7.1	3.6	.2	271	6.8	.539	13.5	046	.48	-.042	675
1 15	6.9	3.4	.2	258	6.5	.551	13.8	053	.55	-.039	675
1 20	6.8	3.3	.1	.260	65	.551	13.8	051	.53	-.039	675
1 25	6.6	3.1	.2	.224	5.6	.579	14.5	072	.74	-.038	750
1 30	6.5	3.0	.1	.213	5.3	.587	14.7	076	.78	-.038	775
1 35	6.3	2.8	.2	214	5.4	.583	14.6	077	.79	-.035	775
1 40	6.2	2.7	.1	210	5.3	.587	14.7	075	.77	-.035	750
1 45	6.2	2.7	0	208	5.2	.591	14.8	082	.84	-.034	725
1 50	6.1	2.6	.1	.202	5.1	.595	14.9	082	.84	-.034	725
1 55	6.0	2.5	.1	202	5.1	.591	14.8	085	.87	-.033	700
2 TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.452	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	1,536	*****

GAS DATA SHEET #12

WEIGHT: 3.5 DATE: 12-3-12

UNIT: Jotul F45 RUN: PAGE: 2 OF 2

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
180 200	5.9	2.4	.1	204	5.1	.591	14.8	.087	.89	-.033	.725
185 05	5.8	2.3	.1	.202	5.1	.591	14.8	.087	.89	-.033	.725
190 10	5.7	2.2	.1	.203	5.1	.591	14.8	.086	.88	-.032	.725
195 15	5.6	2.1	.1	.205	5.1	.587	14.7	082	.84	-.032	.725
200 20	5.5	2.0	.1	.213	5.3	.587	14.7	081	.83	-.031	.700
205 25	5.4	1.9	.1	.205	5.1	.595	14.9	.083	.85	-.030	.725
210 30	5.4	1.9	0	.208	5.2	.591	14.8	.082	.84	-.030	750
215 35	5.3	1.8	.1	207	5.2	.591	14.8	083	.85	-.030	750
220 40	5.2	1.7	.1	.203	5.1	595	14.9	.079	.81	-.030	750
225 45	5.1	1.6	.1	.201	5.0	.599	15.0	079	.81	-.030	725
230 50	5.1	1.6	0	.196	4.9	.603	15.1	076	.78	-.029	725
235 55	5.0	1.5	.1	.197	4.9	.607	15.2	071	.73	-.030	725
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.370	*****
240 300	4.9	1.4	.1	.199	5.0	.603	15.1	070	.72	-.029	.725
245 05	4.9	1.4	0	.199	5.0	.603	15.1	071	.73	-.029	700
250 10	4.7	1.3	.1	.199	5.0	.599	15.0	074	.76	-.029	725
255 15	4.6	1.1	.2	.198	5.0	.599	15.0	.080	.82	-.029	700
260 20	4.5	1.0	.1	.194	4.9	.603	15.1	.079	.81	-.029	700
265 25	4.5	1.0	0	.195	4.9	.603	15.1	078	.80	-.029	700
270 30	4.4	.9	.1	195	4.9	.603	15.1	078	.80	-.029	700
275 35	4.3	.8	.1	.187	4.7	.611	15.3	.075	.77	-.029	700
280 40	4.3	.8	0	.191	4.8	.607	15.2	.076	.78	-.029	700
285 45	4.2	.7	.1	.188	4.7	.611	15.3	.080	.82	-.029	700
290 50	4.1	.6	.1	.186	4.7	.611	15.3	.078	.80	-.029	700
295 55	4.1	.6	0	.190	4.8	.607	15.2	078	.80	-.029	700
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.348	*****
300 400	3.9	.4	.2	.189	4.7	.611	15.3	.077	.79	-.029	700
305 05	3.9	.4	0	188	4.7	611	15.3	077	.79	-.029	700
310 10	3.8	.3	.1	.190	4.8	.603	15.1	080	.82	-.029	700
315 15	3.7	.2	.1	.186	4.7	.611	15.3	.081	.83	-.029	700
320 20	3.7	.2	0	.178	4.5	.619	15.5	.076	.78	-.029	700
325 25	3.6	.1	.1	.177	4.4	623	15.6	.079	.81	-.029	700
330 30	3.5	0	.1	.176	4.4	.619	15.5	084	.86	-.029	700
335										(.203)	
340											
345										(.921)	
350											
355											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	2.457	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.037	*****

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PREBURN DATA SHEET #13

UNIT: Jotul F45 RUN: 3 DATE: 12-3-2012 PAGE: 1 of 1

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
0 1000	4.7"	—	426	590	680	486	647	505			76	-.048	PREBURN START: # 19 UP
5 05	4.6	.1	315	540	664	481	638	522			75	-.044	COAL BED SCALE RANGE:
10 10	4.4	.2	285	496	641	458	616	529			76	-.040	3.8 → 3.1
15 15	4.3	.1	268	464	617	434	593	526			75	-.040	PRIMARY AIR: 1/2"
20 20	4.2	.1	257	440	596	416	573	522			75	-.039	SECONDARY AIR: N/A
25 25	4.1	.1	247	419	577	400	554	517			75	-.037	FAN: Low
30 30	4.1	0	240	401	558	389	537	511			75	-.037	PUMPS ON AT:
35 35	4.0	.1	233	390	543	384	524	505			75	-.035	CHECK WB/DB: N/A
40 40	3.9	.1	227	378	530	378	511	498			75	-.034	
45 45	3.8	.1	221	367	518	371	500	493			75	-.033	
50 50	3.7	.1	216	356	506	365	490	486			75	-.033	
55 55	3.6	.1	211	346	493	360	481	480			74	-.032	
*****	****	***	****	*****	*****	****	*****	*****	*****	*****	*****	****	
LO 1100	3.5	.1	219	334	482	355	472	475			75	-.031	
65													
70													
75													
80													
85													
90													

Jotul - F45

Temperature Data Sheet 14

Run 3
12/3/12

Time	Stack	Top	LT Side	Back	Rt Side	Bottom	Firebox	Sec/Cat	Ambient	Tube Furn	Smpl Box	Smpl Out	C-Gas Box	C-Gas Out	SO2 Out
*********	Chn 103	Chn 104	Chn 105	Chn 106	Chn 107	Chn 108	Chn 109	Chn 110	Chn 111	Chn 112	Chn 113	Chn 114	Chn 115	Chn 116	Chn 117
0	219	334	482	355	472	475	######	######	75	1496	229	44	228	31	30
5	262	316	460	368	449	464	######	######	76	1477	230	38	228	31	30
10	225	324	441	352	427	450	######	######	76	1459	230	38	228	31	30
15	225	338	420	338	410	439	######	######	75	1443	231	38	229	32	30
20	216	328	401	329	397	428	######	######	75	1429	231	38	229	32	31
25	229	352	385	320	384	417	######	######	74	1416	232	38	229	32	31
30	277	460	374	314	377	406	######	######	75	1405	232	39	229	33	31
35	301	536	376	298	376	396	######	######	74	1397	233	39	230	33	32
40	325	578	384	280	379	387	######	######	74	1392	233	39	233	33	32
45	348	623	398	276	388	380	######	######	74	1388	233	39	234	34	32
50	366	660	418	278	404	372	######	######	75	1384	234	39	236	34	33
55	364	666	438	280	420	367	######	######	75	1382	234	40	238	34	33
60	373	683	458	285	439	363	######	######	75	1380	234	40	240	34	34
65	380	696	478	291	459	360	######	######	75	1378	234	40	241	35	34
70	374	686	498	297	477	358	######	######	76	1375	233	41	243	35	34
75	357	659	515	304	492	359	######	######	76	1374	234	41	244	35	35
80	350	648	527	310	504	360	######	######	77	1374	235	41	245	35	35
85	354	647	537	317	516	362	######	######	77	1373	236	42	246	36	35
90	359	650	544	324	528	363	######	######	78	1373	238	42	244	36	35
95	362	655	550	332	540	364	######	######	78	1374	239	42	242	36	36
100	338	631	551	340	552	364	######	######	80	1374	239	42	240	36	36
105	311	575	556	348	557	365	######	######	79	1374	240	42	240	37	36
110	298	543	553	355	553	364	######	######	79	1375	240	42	239	37	36
115	290	526	546	360	546	363	######	######	79	1378	242	42	239	37	36
120	297	524	538	364	540	361	######	######	80	1379	241	43	238	37	36
125	286	493	534	370	536	358	######	######	78	1379	242	43	237	38	36
130	277	469	527	372	531	356	######	######	79	1379	244	43	239	38	36
135	268	449	522	372	525	355	######	######	78	1380	246	43	239	38	36
140	264	437	516	369	519	354	######	######	77	1380	247	43	240	38	36
145	254	422	509	367	513	352	######	######	77	1381	248	43	241	38	36
150	246	402	497	365	506	352	######	######	77	1382	248	43	242	38	35
155	239	387	487	364	498	351	######	######	75	1382	248	43	242	37	35
160	233	376	478	360	491	350	######	######	76	1383	248	44	243	37	35
165	228	364	471	357	485	349	######	######	76	1383	248	44	243	37	35
170	223	352	464	358	478	347	######	######	76	1383	248	44	243	37	35

175	219	343	458	358	471	345	######	######	76	1382	248	44	243	37	34
180	215	335	452	358	465	343	######	######	75	1382	248	44	243	37	34
185	212	328	447	358	459	341	######	######	76	1383	247	44	244	37	34
190	210	323	442	356	454	338	######	######	75	1384	246	44	243	36	34
195	208	318	438	355	450	335	######	######	75	1384	245	44	243	36	33
200	207	315	435	353	445	333	######	######	75	1383	244	45	243	36	33
205	205	312	433	353	441	332	######	######	75	1383	243	45	243	36	33
210	204	309	432	353	436	330	######	######	73	1382	243	45	243	36	33
215	203	307	432	354	433	328	######	######	74	1382	243	45	243	36	33
220	201	306	434	356	430	326	######	######	74	1382	242	45	243	36	32
225	200	303	435	355	426	324	######	######	72	1383	242	45	243	36	32
230	199	300	435	354	423	322	######	######	74	1383	242	46	243	35	32
235	197	298	435	353	419	319	######	######	74	1383	242	46	241	35	32
240	196	297	434	352	415	318	######	######	75	1384	240	46	239	35	32
245	195	295	433	352	413	316	######	######	75	1383	239	46	237	35	31
250	194	294	433	352	410	314	######	######	75	1382	237	45	236	35	31
255	194	293	433	351	408	312	######	######	75	1383	236	45	235	35	31
260	193	291	433	350	405	310	######	######	76	1382	235	45	233	34	31
265	193	291	433	349	404	308	######	######	76	1382	234	45	233	34	31
270	192	290	433	349	402	306	######	######	76	1380	234	45	232	34	30
275	191	289	432	348	400	304	######	######	76	1380	233	46	231	34	30
280	191	287	431	349	398	302	######	######	76	1380	232	46	230	34	30
285	190	285	429	352	397	300	######	######	75	1379	232	46	229	34	30
290	190	283	426	352	395	298	######	######	76	1379	232	46	230	33	30
295	190	282	423	353	394	296	######	######	76	1379	232	46	230	33	30
300	190	281	421	356	392	295	######	######	76	1377	232	46	229	33	29
305	189	280	419	356	391	292	######	######	76	1375	231	46	229	33	29
310	189	280	417	357	389	291	######	######	76	1374	231	46	229	33	29
315	189	280	417	355	388	289	######	######	75	1373	232	47	229	33	29
320	188	279	417	352	386	287	######	######	75	1373	232	47	229	32	29
325	188	277	417	349	384	285	######	######	75	1373	232	47	229	32	29
330	187	276	416	346	381	283	######	######	75	1374	231	57	229	32	29

TEMPERATURE DATA SHEET #14A

		TEST TIME	330		
STACK AVG	248	TOP AVG	408	LT SIDE AVG	457
BACK AVG	343	RT SIDE AVG	447	BOTTOM AVG	347
FIREBOX AVG	########	SEC/CAT AVG	########	AMBIENT AVG	76

END	340.5	
START	423.6	
	-83.1	DELTA T

CIRCLE: LOSS / GAIN

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 12-3-2012 Analyte : CO_2 (15-1)

Unit : JOHN F45 Run # : 3

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 % CO_2 Cyl. Press. : 500 PSI

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

Span Cyl. # : 487905 Conc. : 12.20 % CO_2 Cyl. Press. : 1500 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % CO_2

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

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

PRE RUN Audit : by : Clp Watling Time : 0935 Temp : 71 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.013	.013	.051
SPAN	48.8	.488	12.20	48.8	.488	12.219	.019	.074

POST RUN Audit : by : Clp Watling Time : 1700 Temp : 74 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.2	.002	.063	.063	.251
SPAN	48.8	.488	12.20	48.4	.484	12.119	-.081	±.326

± 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: 12-3-2012 Analyte: O_2 (15-2)

Unit: Jotul F45 Run #: 3

Zero Cyl. #: 168TAC 3A Conc.: 0.00 % O_2 Cyl. Press.: 490 PSI

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

Span Cyl. #: 487905 Conc.: 12.60 % O_2 Cyl. Press.: 1500 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: Clyde Watkins Time: 0935 Temp: 71 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.005	.005	.020
SPAN	12.60	.504	12.6	12.6	.504	12.615	.015	.058

POST RUN Audit: by: Clyde Watkins Time: 1700 Temp: 74 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.001	.030	.030	.120
SPAN	12.60	.504	12.6	12.6	.504	12.615	.015	.058

± 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 - 3 - 2012 Analyte: CO (15-3)

Unit: Total F45 Run #: 3

Zero Cyl. #: 168TAC 3-A Conc.: 0.00 % CO Cyl. Press.: 490 PSI

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

Span Cyl. #: CC487905 Conc.: 4.90 % CO Cyl. Press.: 1500 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: 0935 Temp: 71 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.026	.026	.256
SPAN	49.0	.490	4.90	49.0	.490	4.912	.012	.122

POST RUN Audit: by: [signature] Time: 1700 Temp: 74 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.026	.026	.256
SPAN	49.0	.490	4.90	49.0	.490	4.912	.012	.122

± 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: 12-3-2012 Analyte: SO_2 (15-4)

Unit: Jotul F45 Run #: 3

Zero Cyl. #: 168TAC 3-A Conc.: 0.00 ppm SO_2 Cyl. Press.: 490 PSI

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

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

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

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

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

Flow: 1.5 SCFH Measured by: Rotameter

EPA Span Value = 2500 ppm SO_2

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

PRE RUN Audit: by: Cp Wadsworth Time: 0935 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	6.273	6.273	.251
SPAN	50.0	.500	1250	50.0	.500	1251.3	1.300	.520

POST RUN Audit: by: Cp Wadsworth Time: 1700 Temp: 74 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	-.001	3.783	3.783	.151
SPAN	50.0	.500	1250	49.8	.498	1246.3	-3.700	-.148

± 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 F45 RUN: 3 DATE: 12-3-2012

Thermocouple Check:

T/C # 1	— °F	T/C # 13	58.0 °F
T/C # 2	— °F	T/C # 14	58.0 °F
T/C # 3	57.8 °F	T/C # 15	58.0 °F
T/C # 4	53.0 °F	T/C # 16	55.2 °F
T/C # 5	52.1 °F	T/C # 17	51.8 °F
T/C # 6	51.8 °F	T/C # 18	54.4 °F
T/C # 7	52.0 °F	T/C # 19	— °F
T/C # 8	51.8 °F	T/C # 20	— °F
T/C # 9	— °F	T/C # 21	— °F
T/C # 10	— °F	T/C # 22	— °F
T/C # 11	51.6 °F	T/C # 23	— °F
T/C # 12	61.2 °F	T/C # 24	— °F

Thermocouple Readout:

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

ZERO -.8 °F Adj. to 0.0 °F ZERO -1.2 °F Difference -.020 %

SPAN 2000.8 °F Adj. to 2000.0 °F SPAN 2000.2 °F Difference .010 %

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 200.3 °F	400	= 400.0 °F
600	= 599.9 °F	800	= 799.8 °F	1000	= 999.8 °F
1200	= 1199.7 °F	1400	= 1399.5 °F	1600	= 1599.5 °F
1800	= 1800.0 °F	2000	= 2000.0 °F		

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

Scale Check Pre: 14.0 - 4.0 = 10.0

Post: — = 10.0

Stack Cleaned Prior to Test Run: YES ____ NO X

TABLE 1 ----- RAW DATA

CLIENT : Jotul TEST No. : 2

MODEL: F45 DATE:

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	391.500	0.150	80	0.64	3.10	450
5	393.000	0.240	82	0.53	9.70	350
10	395.003	0.180	83	0.25	10.70	400
15	396.775	0.180	83	0.24	12.10	400
20	398.548	0.180	83	0.32	12.80	400
25	400.320	0.140	83	0.46	13.90	450
30	401.896	0.100	83	1.01	14.20	550
35	403.185	0.060	84	1.74	14.20	675
40	404.240	0.130	85	0.44	14.00	475
45	405.744	0.140	86	0.43	14.00	450
50	407.332	0.120	86	0.68	14.20	500
55	408.761	0.130	86	0.61	14.10	475
60	410.265	0.080	88	1.07	14.20	600
65	411.470	0.130	88	0.47	13.90	475
70	412.993	0.160	88	0.08	12.90	425
75	414.694	0.160	88	0.16	10.00	425
80	416.396	0.160	88	0.08	9.30	425
85	418.097	0.160	88	0.15	8.10	425
90	419.799	0.140	88	0.21	7.40	450
95	421.406	0.140	88	0.34	7.00	450
100	423.013	0.130	88	0.53	6.60	475
105	424.536	0.110	88	0.75	5.70	500
110	425.983	0.110	88	0.76	6.00	500
115	427.429	0.110	88	0.75	5.70	500
120	428.876	0.130	88	0.66	5.80	475
125	430.400	0.130	88	0.66	5.90	475
130	431.923	0.130	88	0.72	5.70	475
135	433.447	0.130	88	0.73	5.70	475
140	434.971	0.130	88	0.75	5.70	475
145	436.494	0.130	88	0.76	5.60	475
150	438.018	0.130	88	0.73	5.60	475
155	439.542	0.130	88	0.71	5.70	475
160	441.065	0.130	88	0.68	5.50	475
165	442.589	0.130	88	0.67	5.50	475
170	444.113	0.140	88	0.76	5.10	450
175	445.721	0.130	88	0.83	4.80	475

180	447.245	0.130	88	0.80	4.80	475
185	448.768	0.130	88	0.75	4.90	475
190	450.292	0.130	88	0.62	4.70	475
195	451.816	0.130	88	0.66	4.80	475
200	453.339	0.130	88	0.66	4.90	475
205	454.863	0.110	88	0.69	4.80	500
210	456.311	0.110	88	0.74	4.70	500

TABLE 2---RAW DATA

CLIENT : Jotul TEST No. 2

MODEL: F45 DATE:

METER CAL. FACTOR (Y) -------	0.935		Wt. WOOD BURNED(LB) -------	15.0	Lbs
BAROMETRIC PRESS.(Pb) -------	29.42	in Hg	WET,FUEL MOISTURE % -------	15.555	%
LEAK RATE POST (Lp) -------	0.000	cfm	Wt. PART. COLLECTED -------	0.1446	g
WATER VOL. (V1c) -------	106.7	Ml	METER VOLUME Vm -------	64.811	mcf
TEST TIME (MIN) -------	210	min	HC MOLE FRACTION -------	0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT : Jotul TEST No. 2

MODEL: F45 DATE:

****

AVG DELTA H	-------	0.13	in H2O	AVG PRCNT CO	-------	0.61	%
AVG METER TEMP. Tm	-------	87	deg F	AVG PRCNT CO2	-------	8.23	%
AVG PPM SO2	-------	472	PPM	AVG BAL CO2/CO	-------	13.47	%

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul TEST No. 2

MODEL: F45 DATE:

****

STD SAMPLE VOL. Vm(std) d) ------	57.57	dscf	STACK GAS FLOW Qsd -------	581.938 9.70	dscf/Hr & dscf/min
VOL. WATER VAPOR Vw(s td) -----	5.022	scf	PARTICULATE CONCTRT. C s ------	0.0025	g/dscf
PRCNT MSTR Bws -------	8.02	%	PARTC.EMISS. RATE E -------	1.46	g/Hr
BURN RATE BR -------	1.64	Kg/Hr	MOLES OF GAS PER Lb WOOD Nt ----	0.42	Lb-mole/Lb
CO EMISSION RATE -------	119.10 & 72.54	g/Hr g/Kgdry fuel	PART.EMISS. RATE ------	0.89	g/Kgdry fuel

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Jotul TEST No. : 2

MODEL: F45 DATE:

TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR	PROPRTN RATE VAR. AVERAGE
5	606.0	95	100
10	627.8	98	
15	634.0	99	
20	634.4	99	
25	634.0	99	
30	634.3	99	
35	633.5	99	
40	635.1	99	
45	636.0	100	
50	635.7	100	
55	635.5	100	
60	634.3	99	
65	640.7	100	
70	641.1	100	
75	640.7	100	
80	641.1	100	
85	640.7	100	
90	641.1	100	
95	640.9	100	
100	640.9	100	
105	641.1	100	
110	641.2	100	
115	640.7	100	
120	641.2	100	
125	641.6	100	
130	641.1	100	
135	641.6	100	
140	641.6	100	
145	641.1	100	
150	641.6	100	
155	641.6	100	
160	641.1	100	
165	641.6	100	
170	641.6	100	
175	641.3	100	
180	641.6	100	

185	641.1	100
190	641.6	100
195	641.6	100
200	641.1	100
205	641.6	100
210	641.6	100

COMPUTER INPUT DATA SHEET #1

Client: Jotul North America

Address: 55 Hutcherson
Gorham, ME 04038

1.46

Phone: 1-800-797 5912 Fax: 1-207-591-6623

Run No.: 2 Date of Test: 11-30-2012 Burn Rate: 1.642

Model No.: F45 ☐ min ☐ min-1.25 ☐ fan

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

Dry Gas Meter Y Factor: .935 (0.000) (Data Sheet #2) Post Leak Rate: .000 (.000) (Data Sheet #2) cfm Time: 210 (000) (Data Sheet #2) min.

Dry Gas Meter Volume: 64.811 (00.000) (Data Sheet #2) cf

Stack Flow: 7.195 (00.000) (Data Sheet #2) dscfm Δ H: .134 (.000) (Data Sheet #2) in. H_2O

Maximum Vac.: 3.0 (0.0) (Data Sheet #2) Barometric Pressure: 29.42 (00.00) (Data Sheet #2) in. Hg

H_2O Captured: 106.7 (00.0) (Data Sheet #3) g

Front Half Catch % Of Total: 47.9 (00.0) (Data Sheet #6) % Total Particulate Catch: .1446 (0.0000) (Data Sheet #6) g

Flue Gas Moisture: 8.0314 (00.000) (Data Sheet #7) %

Particulate Emission: .0388 (0.0000) (Data Sheet #7) gr/dscf

Relative Humidity: 41.0 (00.0) (Data Sheet #8) % RH Ambient Moisture: 1.5 (0.00) (Data Sheet #8) % H_2O

Preburn Fuel Wt.: 36.9 (00.0) (Data Sheet #8) lbs. Coal Bed Wt.: 3.7 (00.0) (Data sheet #8) lbs. Test Fuel Wt.: 15.0 (00.0) (Data sheet #8) lbs.

Heat Output (EPA Default): 19800. (00,000.0) (Data Sheet #8) BTU/hr

Kindling Fuel % Moisture (wet): 11.006 (00.000) (Data Sheet #10) % Pretest Fuel % Moisture (wet): 16.505 (00.000) (Data Sheet #10) %

Test Fuel % Moisture (dry): 18.420 (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove]) % Test Fuel % Moisture (wet): 15.555 %

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

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

Average Ambient Temperature: 78 (00) (Data Sheet #14) °F Stove Temperature Change: -40.0 (+/- 000.0) (Data Sheet #14) °F

Test start = 1125
End = 1455

meter temp = 547

185

METER BOX DATA SHEET PAGE # 2

Page: 1 of 2

UNIT: Jotul F45 RUN: 2 DATE: 11-30-2012

Meter Box: SH Y Factor: .935

Leak checks: 15 " Hg @ 1,000 cfm _____ " Hg @ _____ cfm

15 " Hg @ 1,000 cfm _____ " Hg @ _____ cfm

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

ROTO: PRESS: .18 SAMPLING RATIO: 25 : 1 BP: 29.46

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1125	391.500	—	7.560	.15	80	450	80	2.0
5	30	393.000	—	9.720	.24	82	350	82	3.0
10	35	395.003	395.003	8.458	.18	83	400	83	2.0
15	40	396.775	396.775	8.458	.18	83	400	83	2.0
20	45	398.548	398.548	8.458	.18	83	400	83	2.0
25	50	400.320	400.320	7.518	.14	83	450	83	2.0
30	55	401.896	401.896	6.151	.10	83	550	83	2.0
35	1200	403.185	403.185	5.003	.06	84	675	84	2.0
40	05	404.240	404.240	7.096	.13	85	475	85	2.0
45	10	405.744	405.744	7.477	.14	86	450	86	2.0
50	15	407.332	407.332	6.729	.12	86	500	86	2.0
55	20	408.761	408.761	7.083	.13	86	475	86	2.0
ROTO PRESS:		.18	TOTALS:	89.711	1.75	1064	BP.:	29.42	
60	1225	410.265	410.265	5.580	.08	88	600	88	2.0
65	30	411.470	411.470	7.048	.13	88	475	88	2.0
70	35	412.993	412.993	7.877	.16	88	425	88	2.0
75	40	414.694	414.694	7.877	.16	88	425	88	2.0
80	45	416.396	416.396	7.877	.16	88	425	88	2.0
85	50	418.097	418.097	7.877	.16	88	425	88	2.0
90	55	419.799	419.799	7.440	.14	88	450	88	2.0
95	1300	421.406	421.406	7.440	.14	88	450	88	2.0
100	05	423.013	423.013	7.048	.13	88	475	88	2.0
105	10	424.536	424.536	6.696	.11	88	500	88	2.0
110	15	425.983	425.983	6.696	.11	88	500	88	2.0
115	20	427.429	427.429	6.696	.11	88	500	88	2.0
			TOTALS:	86.152	1.59	1056	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	175.863	3.34	2060	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 2 of 2

UNIT: Jotol F45 RUN: 2 DATE: 11-30-2012

Meter Box: SH Y Factor: .935

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: 25 : 1 BP: 29.40

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1325	428.876	428.876	7.043	.13	88	475	88	2.0
125	30	430.400	430.400	7.043	.13	88	475	88	2.0
130	35	431.923	431.923	7.043	.13	88	475	88	2.0
135	40	433.447	433.447	7.043	.13	88	475	88	2.0
140	45	434.971	434.971	7.043	.13	88	475	88	2.0
145	50	436.494	436.494	7.043	.13	88	475	88	2.0
150	55	438.018	438.018	7.043	.13	88	475	88	2.0
155	1400	439.542	439.542	7.043	.13	88	475	88	2.0
160	05	441.065	441.065	7.043	.13	88	475	88	2.0
165	10	442.589	442.589	7.043	.13	88	475	88	2.0
170	15	444.113	444.113	7.434	.14	88	450	88	2.0
175	20	445.721	445.721	7.043	.13	88	475	88	2.0
ROTO PRESS:		.18	TOTALS:	84.907	1.57	1056	BP.:	29.40	
180	1425	447.245	447.245	7.043	.13	88	475	88	2.0
185	30	448.768	448.768	7.043	.13	88	475	88	2.0
190	35	450.292	450.292	7.043	.13	88	475	88	2.0
195	40	451.816	451.816	7.043	.13	88	475	88	2.0
200	45	453.339	453.339	7.043	.13	88	475	88	2.0
205	50	454.863	454.863	6.691	.11	88	500	88	2.0
210	55	456.311	456.311	6.691	.11	88	500	88	2.0
215				48.597	.870	616			
220				133.504	2.44	1672			
225									
230									
235				309.367	5.78	3732			
			TOTALS:			87	MAX VACC =		3.0
TOTAL Cu Ft		64.811	TOTALS:	7.195	.134	547	AVG. BP:	29.42	

* 1.43

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : F45 RUN : 2 DATE : 11-30-12

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

SCALE	WEIGHT
295.0 g	295.0
590.0 g	590.0
885.0 g	885.0

IMPINGER	#1	#2	#3	#4
FINAL WT	694.6	587.5	487.0	868.5
INITIAL WT	610.0	582.2	485.2	853.5
NET WT GRAMS	84.6	5.3	1.8	15.0

TOTAL CATCH : 106.7 **GRAMS H_2O**

FRONT HALF

FILTER #	64F	
FINAL WT g	.6755	
INITIAL WT g	.6268	
NET WT g	.0487	

BEAKER #	64
DESC.	ACETONE
FINAL WT g	96.5256
INITIAL WT g	96.5042
NET WT g	.0214
VOL. DESC. ml	100

BACK HALF

FILTER #	64B	
FINAL WT g	.3036	
INITIAL WT g	.2811	
NET WT g	.0225	

BEAKER #	67	68	69	70	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	106.2525	94.1529	109.0010	107.4864	
INITIAL WT g	106.2188	94.1505	108.9876	107.4743	
NET WT g	.0337	.0024	.0134	.0121	(.0255)
VOL. DESC ml	125	75	175	125	(300)

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 2-15-12 Time : 1200 By : Cp

Manufacturer S & S Grade : # 25 Glass Front Size : 11 cm Lot No. : 393580

Back Size: 8.2 cm Lot No. : 4642341

	DATE: 2-20-12	BY: AV	DATE: 2-23-12	BY: Cp	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
61F	0.6288	1330	.6285	1005		
62F	0.6320	1331	.6320	1006		
63F	0.6300	1332	.6298	1007		
64F	0.6272	1333	.6268	1008	← R-2	
65F	0.6314	1334	.6311	1009		
66F	0.6271	1335	.6272	1010		
67F	0.6314	1336	.6310	1011		
68F	0.6296	1337	.6295	1012		
69F	0.6302	1338	.6304	1013		
70F	0.6307	1339	.6307	1014		

61B	0.2826	1320	.2827	1015		
62B	0.2805	1321	.2805	1016		
63B	0.2824	1322	.2824	1017		
64B	0.2811	1323	.2811	1018	← R-2	
65B	0.2825	1324	.2827	1019		
66B	0.2835	1325	.2836	1020		
67B	0.2845	1326	.2846	1021		
68B	0.2845	1327	.2847	1022		
69B	0.2846	1328	.2846	1023		
70B	0.2836	1329	.2837	1024		

Checked by: Armando Date: 2-23-2012 Time: 1245

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
2-20-12	1200	Cp		70	48
2-23-12	1005	Cp		73	47

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 10-26-11 Time : 1300 By : CP

	DATE: 11-7-11	BY: CP	DATE: 11-14-11	BY: CP	DATE:	BY:
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
51	104.8708	1245	104.8709	0835	✓	
52	107.4440	1246	107.4443	0836	✓	
53	105.7315	1247	105.7317	0837	✓	
54	107.3008	1248	107.3005	0838	✓	
55	93.4825	1249	93.4821	0839	✓	
56	106.8588	1250	106.8590	0840	✓	
57	97.4049	1251	97.4052	0841	✓	
58	96.8864	1252	96.8861	0842	✓	
59	105.3467	1253	105.3468	0843	✓	
60	98.1962	1254	98.1961	0844	✓	
61	99.3426	1255	99.3431	0845	✓	
62	97.8600	1256	97.8602	0846	✓	
63	93.2089	1257	93.2090	0847	✓	
64	104.7824	1258	104.7829	0849	✓	
65	98.4370	1259	98.4375	0850	✓	
66	96.5039	1300	96.5042	0851	✓	
67	106.2183	1301	106.2188	0852	✓	
68	94.1500	1302	94.1505	0853	✓ R-2	
69	108.9871	1303	108.9876	0854	✓	
70	107.4739	1304	107.4743	0855	✓	
71	104.1474	1305	104.1478	0856	✓	
72	103.8222	1306	103.8225	0859	✓	
73	104.3502	1307	104.3505	0900	✓	
74	107.5035	1308	107.5040	0901	✓	
75	96.4624	1310	96.4626	0902		

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH	
11-7-11	1230	CW	-	72	46	Checked by : AV
11-11-11	0815	CW	-	70	46	Date : 11-14-11
		CW	-			Time : 10:00 am

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : F45 RUN : 2 DATE : 11-30-12 Page : 1 of

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
L6	12-1	1800	CP	96.5255	12-2	1145	CP	96.5256	12-3	0926	CP				
L7	12-1	1800	CP	106.2529	12-2	1146	CP	106.2525	12-3	0921	CP				
L8	12-1	1800	CP	94.1530	12-2	1147	CP	94.1529	12-3	0922	CP				
L9	12-1	1800	CP	109.0013	12-2	1148	CP	109.0010	12-3	0923	CP				
L10	12-1	1800	CP	107.4865	12-2	1149	CP	107.4864	12-3	0924	CP				

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
L4F	11-30	1630	CP	.6759	12-1	811	CP	.6755	12-2	1143	CP				
L4B	11-30	1630	CP	.3041	12-1	1812	CP	.3036	12-2	1144	CP				

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	12-1-12	1800	CP	67	49
2	12-2-12	1130	CP	67	42
3	12-3-12	0915	CP	72	46
4					
5					

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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 10-10-12 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	.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	1400	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	10-23-12	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	.9994	.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	11-24-12	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	1460	62	49
100.0002	10.0001	.9999	.1000	CP	12-10-12	1500	66	49

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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 4-13-2011 Through 1-13-2012	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0000	10.0001	1.0000	.0998	CP	4-13-11	1030	66	49
100.0001	10.0002	1.0000	.0999	CP	4-15-11	1330	75	48
100.0004	10.0000	.9999	.0998	CP	4-19-11	1600	74	44
100.0003	10.0000	1.0000	.0999	CP	4-20-11	1815	72	46
100.0000	10.0001	.9999	.1000	CP	6-16-11	0900	76	39
99.9997	9.9999	.9998	.0999	CP	6-19-11	1530	74	44
99.9996	10.0002	1.0000	.0999	CP	6-20-11	1600	73	47
100.0000	10.0000	.9998	.0999	CP	6-21-11	1400	73	47
100.0000	10.0000	1.0001	.0999	CP	6-22-11	1200	72	46
99.9999	9.9998	1.0000	.1000	CP	6-23-11	1700	76	49
100.0000	10.0002	1.0000	.0999	CP	6-24-11	1400	75	48
100.0000	10.0000	1.0000	.0999	CP	6-27-11	1230	78	46
100.0001	10.0002	.9999	.0998	CP	6-30-11	1030	78	46
99.9995	10.0000	.9999	.0999	CP	7-1-11	1030	70	48
99.9999	9.9999	1.0000	.1000	CP	7-2-11	1145	75	45
100.0000	9.9999	.9999	.0999	CP	7-5-11	1000	73	47
99.9999	10.0001	1.0000	.0999	CP	7-6-11	0930	76	49
100.0000	9.9997	1.0000	.0997	CP	9-22-11	1700	77	46
100.0000	10.0001	1.0000	.0999	CP	9-24-11	1200	77	49
100.0000	9.9998	1.0001	.1000	CP	9-25-11	1300	76	49
100.0000	9.9999	1.0001	.0998	CP	9-27-11	1000	77	49
99.9996	9.9999	1.0000	.0998	CP	9-29-11	0840	72	42
99.9997	9.9998	.9999	.1000	CP	9-30-11	1000	70	48
99.9996	9.9998	1.0000	.0999	CP	10-1-11	1520	70	45
99.9998	10.0002	1.0000	.0997	CP	10-2-11	1430	74	47
99.9995	10.0001	1.0000	.0999	CP	10-5-11	1510	71	49
100.0000	9.9999	1.0000	.0998	CP	10-6-11	1000	78	40
100.0000	9.9999	1.0000	.0999	CP	10-9-11	1130	75	49
100.0000	10.0001	1.0000	.0998	CP	10-16-11	1540	68	47
100.0000	10.0000	1.0000	.0998	CP	11-9-11	1230	72	46
100.0000	10.0002	.9998	.0998	CP	11-11-11	0815	70	48
99.9999	10.0000	1.0000	.0996	CP	11-15-11	1200	75	48
99.9995	10.0001	.9999	.0999	CP	11-16-11	1400	70	44
99.9999	10.0001	.9999	.0998	CP	11-20-11	1600	73	43
99.9998	9.9999	.9999	.0999	CP	11-21-11	1715	74	47
100.0000	10.0000	1.0000	.0999	CP	11-22-11	1600	65	48
100.0000	10.0000	1.0000	.0999	CP	1-9-12	1030	70	48
100.0000	9.9999	1.0001	.1000	CP	1-11-12	1720	65	48
100.0000	10.0001	1.0000	.0997	CP	1-13-12	1036	72	46

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

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

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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

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

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0001	10.0004	.9999	.0999	CP	2-26-10	0840	72	46
100.0001	9.9999	.9999	.0999	CP	2-27-10	1045	72	46
100.0000	10.0000	1.0000	.0999	CP	2-28	1100	70	48
100.0000	10.0000	1.0000	.0999	CP	3-1	0900	66	49
100.0000	10.0002	.9998	.1002	CP	3-5	1200	70	48
100.0001	9.9999	.9999	.0998	CP	3-7	1330	68	47
100.0000	9.9999	.9999	.0999	CP	3-9	1130	70	41
100.0000	10.0001	1.0000	.0999	CP	3-10	1200	70	44
100.0000	10.0001	.9999	.0999	CP	3-11	0900	66	49
99.9999	9.9999	.9999	.0999	AN	3-15	1000	70	48
100.0000	10.0000	1.0000	.0998	CP	3-17	0900	72	46
100.0000	9.9998	1.0001	.1000	CP	4-8	1930	76	49
99.9999	10.0001	1.0000	.0999	CP	4-10	1630	73	47
99.9999	10.0001	1.0001	.1000	CP	4-11	1430	74	47
100.0000	10.0002	1.0000	.1000	CP	4-21	1830	77	49
100.0000	10.0000	1.0000	.0999	CP	4-22	1130	74	47
100.0000	10.0001	1.0000	.0999	CP	4-23	1015	74	44
100.0002	9.9999	1.0000	.1000	CP	4-24	0930	68	47
100.0000	9.9999	.9999	.1000	CP	4-25	0930	73	47
100.0000	9.9999	1.0001	.0999	CP	4-26	0900	76	42
100.0000	10.0002	1.0000	.0999	CP	4-30	1320	78	43
99.9998	10.0000	1.0002	.0999	CP	8-26	0845	78	49
100.0000	9.9998	1.0001	.0999	CP	8-27	0955	78	43
100.0000	10.0000	1.0000	.1000	CP	8-28	1600	73	47
99.9998	10.0000	.9999	.1000	CP	8-29	1400	70	48
100.0000	10.0000	1.0000	.0999	CP	8-31	0720	72	46
100.0001	10.0000	1.0000	.1000	CP	9-1	1330	76	49
100.0000	10.0001	1.0000	.0999	CP	9-2	1300	68	47
100.0000	10.0000	1.0000	.1000	CP	9-3	1130	72	46
100.0000	10.0001	1.0000	.0999	CP	10-26	0750	70	48
100.0000	10.0000	.9998	.0997	CP	10-27	1250	74	47
100.0000	9.9999	1.0000	.0999	CP	10-29	1400	71	49
100.0000	9.9999	1.0000	.0999	CP	11-1	1000	78	49
100.0000	10.0000	.9999	.0999	CP	11-2	0715	70	48
100.0000	10.0000	1.0000	.0999	CP	11-3	0900	70	48
100.0000	10.0001	.9999	.1000	CP	11-5	1320	76	42
100.0000	10.0001	.9999	.1000	CP	11-8	1230	70	48
100.0000	10.0001	1.0000	.0998	CP	11-9	1015	71	41
100.0000	10.0000	.9999	.0995	CP	11-10	0900	70	44

BLANK PROCESSING DATA SHEET # 5

UNIT : JOTOI F45 RUN : 2 DATE : 11-30-2012

BLANKS DONE : 8-31-2010

BEAKER	A	B	C
	200 ml ACETONE	75 ml DICHLOR	200 ml WATER
	FISHER OPTIMA LOT # 023283	FISHER OPTIMA LOT # 066390	DWNA, Inc Sparkletts Distilled
FINAL WEIGHT	108.9019	106.3074	106,9680
TARE WEIGHT	108.9001	106,3058	106,9640
NET WEIGHT	.0018	.0016	.0040

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

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

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.8999	0435	108.9001	1050		
B	106.3061	0436	106,3058	1051		
C	106.9641	0437	106,9640	1052		

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

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

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9019	1501	108.9019	0742		
B	106.3076	1502	106.3074	0743		
C	106.9676	1503	106,9680	0744		

TARE QC

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

FINAL QC

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

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT: Jotul F45 RUN: 2 DATE: 11-30-2012

BLANK CALCULATIONS

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

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

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

FRONT HALF CATCH

FILTERS: .0487 (Total Catch) g - 1 (# of Filters) (.0000 g (Blank Value / Filter)) = .0487 g

BEAKERS: .0214 (Total Catch) g - 100 (ml Acetone) (.000009 (.0009) g (Blank Value / ml Acetone)) = .0205 g

TOTAL FRONT HALF CATCH : .0692 g

BACK HALF CATCH

FILTERS: .0225 (Total Catch) g - 1 (# of Filters) (.0000 g (Blank Value / Filter)) = .0225 g

BEAKERS:

Acetone: .0337 (Total Catch) g - 125 (ml Acetone) (.000009 (.0011) g (Blank Value / ml Acetone)) = .0326 g

Extract: .0024 (Total Catch) g - 75 (ml Dichloromethane) (.000021 (.0016) g (Blank Value / Dichloromethane)) = .0008 g

Water: .0255 (Total Catch) g - 300 (ml Water) (.000020 (.0060) g (Blank Value / Water)) = .0195 g

TOTAL BACK HALF CATCH : .0754 g

TOTAL CATCH : .1446 g

% FRONT HALF : 47.9 %

CALCULATIONS DATA SHEET # 7

UNIT : Jotul F45 RUN : 2 DATE : 11-30-2012

1) $Vm(std) = \dfrac{(64.811\ Vm)(17.64)(.935\ mcf)\left(29.42\text{" Hg} + \frac{.134\text{" } H_2O}{13.6}\right)}{(547\ TmA)} = \underset{000.0000}{57.5122}$ dscf

2) $Vw(std) = (.04707)(106.7\ ml\ H_2O) = \underset{00.0000}{5.0224}$ scf

3) $Asw = \dfrac{(5.0224\ scf)}{(5.0224\ scf + 57.5122\ dscf)} = \underset{.0000}{.0803}$ Bws × 100 = $\underset{00.0000}{8.0314}$ % H_2O

4) $Cs = \dfrac{(.1446\ g.)}{(57.5122\ dscf)}(15.43) = \underset{0.0000}{.0388}$ gr / dscf

5) Estimated g / hr = $\dfrac{(.1446\ g.)}{(57.5122\ dscf)}\left(\underset{00.0000}{7.195}\ dscfm\right)(60) = \underset{00.0000}{1.0854}$ 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 F45 RUN: 2 DATE: 11-30-2012

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

Wet Bulb / Dry Bulb

Pre : WB: 63 DB: 79 = 40.0 % RH 1.4 % H_2O

Post : WB: 61 DB: 81 = 42.0 % RH 1.6 % H_2O

Average: 41.0 % RH 1.5 % H_2O

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

Kindling Weight (lbs): Paper: .1 Wood: 3.3

Preburn Fuel Weight: 16.1 + 17.5 Total: 33.6

Kindling & Preburn Fuel Weight (wood only) (lbs): **Total**: 36.9

Coal Bed Wt Range (lbs): 3.7 - 3.0 **Scale**: 3.7 - 3.0

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

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

Maximum Coal Bed Removal (lbs): ((3.7 (Upper) + 3.0 (Lower)) ÷ 2) .25 = .8 (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"	17	3	7.6	50.7
4" x 4"	17	2	7.4	49.3

Test Fuel Weight: 15.0 lbs

Estimated Dry Burn Rate:

$$\frac{15.0 - (15.0 \times .15555)}{2.2046} \times \frac{60}{\frac{210}{\text{TIME}}} = 1.642 \text{ kg / hr}$$

Estimated BTU's/hr: $19{,}140 \times \frac{63}{100} \times \frac{1.642}{\text{DBR}} = 19800.$ BTU's/hr

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

WOOD STOVE OPERATING DATA PAGE #9

Unit : Jotul F45 Run : 2 Date : 11-30-2012

FIRE STARTED: 0716

WARM UP AND PREBURN:

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

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

CHARCOAL BED PREPARATION :

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

TEST:

DOOR wide open during loading 0 min. 35 sec.

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

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

FAN:

(ON) / OFF during warm-up

ON / (OFF) first 30 minutes of test

Fan speed set at Low

(ON) / OFF during preburn

(ON) / OFF balance of test run

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

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

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

All Grades WCLB rules:

WARM UP INFORMATION:

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

1st warm up / pre-burn fuel charge (16.1 lbs.) added at 0729

2nd warm up / pre-burn fuel charge (17.5 lbs.) added at 0850

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

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

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

TEST DATA SHEET #10

Unit : Jotul F45 Run : 2 Date : 11-30-2012

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

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

Time Test Fuel moisture reading taken : 0910

pc #	Dimen.	Use	TOP	BOTTOM	SIDE	Avg Corrected
1	2"×4"×8'	K	12.8	11.9	12.4	12.367
2						
3						
4	2"×4"×8'	P	23.7	20.9	18.8	21.1
5	2"×4"×8'	P	19.6	20.5	20.1	20.1
6	2"×4"×8'	P	17.8	18.4	18.1	18.1
7	2"×4"×8'	P				(59.3)
8	2"×4"×8'	P				
9						
10						
11						
12	2"×4"×17"	T	18.1	18.1	18.2	18.1
13	"	T	19.5	19.6	19.4	19.5
14	"	T	18.5	18.4	18.4	18.4
15	4"×4"×17"	T	18.1	18.1	18.0	18.1
16	"	T	18.0	18.0	18.0	18.0
17						(92.1)
18						
19						
20	Spacers	T	21.7	22.3	20.5	21.5

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	12.367 %	19.767 %	18.420 %
Wet Moisture % :	11.006 %	16.505 %	15.555 %

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

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

GAS DATA SHEET #12

WEIGHT: 3.7 DATE: 11-30-2012

UNIT: Jotul F45 RUN: 2 PAGE: 1 OF 2

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
0 11:25	18.7	15.0	—	.124	3.1	.680	17.1	.062	.64	-.017	450
5 30	18.3	14.6	.4	.366	9.7	.420	10.5	.051	.53	-.042	350
10 35	17.6	13.9	.7	.429	10.7	.392	9.8	.022	.25	-.047	400
5 40	16.8	13.1	.8	.483	12.1	.334	8.4	.021	.24	-.051	400
0 45	16.0	12.3	.8	.511	12.8	.305	7.6	.029	.32	-.053	400
25 56	14.9	11.2	1.1	.555	13.9	.255	6.4	.044	.46	-.053	450
0 55	14.1	10.4	.8	.568	14.2	.219	5.5	.099	1.01	-.054	550
5 1200	13.1	9.4	1.0	.569	14.2	.192	4.8	.172	1.74	-.054	675
10 05	12.2	8.5	.9	.560	14.0	.250	6.3	.042	.44	-.053	475
5 10	11.4	7.7	.8	.559	14.0	.252	6.3	.041	.43	-.053	450
10 15	10.6	6.9	.8	.568	14.2	.234	5.9	.066	.68	-.054	500
5 20	9.7	6.0	.9	.562	14.1	.243	6.1	.059	.61	-.054	475
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.585	*****
10 25	9.0	5.3	.7	.566	14.2	.221	5.5	.105	1.07	.053	600
5 30	8.2	4.5	.8	.557	13.9	.257	6.4	.045	.47	.054	725
10 35	7.7	4.0	.5	.517	12.9	.310	7.8	.005	.08	-.054	425
5 40	7.2	3.5	.5	.400	10.0	.425	10.6	.013	.16	-.051	425
5 45	6.9	3.2	.3	.371	9.3	.454	11.4	.005	.08	-.050	425
85 50	6.6	2.9	.3	.372	8.1	.501	12.6	.012	.15	-.048	425
5 55	6.4	2.7	.2	.296	7.4	.525	13.1	.018	.21	-.046	450
0 1100	6.2	2.5	.2	.280	7.0	.536	13.4	.031	.34	.045	450
100 05	6.1	2.4	.1	.263	6.6	.542	13.6	.051	.53	-.044	475
5 10	6.0	2.3	.1	.229	5.7	.571	14.3	.073	.75	-.042	500
110 15	5.9	2.2	.1	.238	6.0	.557	13.9	.074	.76	-.041	500
5 20	5.7	2.0	.2	.229	5.7	.571	14.3	.073	.75	-.039	500
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.567	*****
20 25	5.6	1.9	.1	.232	5.8	.571	14.3	.064	.66	-.038	475
5 30	5.5	1.8	.1	.235	5.9	.567	14.2	.064	.66	-.037	475
5 35	5.4	1.7	.1	.229	5.7	.573	14.3	.070	.72	-.037	475
35 40	5.3	1.6	.1	.227	5.7	.572	14.3	.071	.73	-.037	475
45	5.1	1.4	.2	.227	5.7	.571	14.3	.073	.75	-.037	475
45 50	5.0	1.3	.1	.224	5.6	.575	14.4	.074	.76	-.037	475
55	4.9	1.2	.1	.224	5.6	.576	14.4	.071	.73	-.037	475
200	4.8	1.1	.1	.228	5.7	.573	14.3	.069	.71	-.037	475
50 05	4.8	1.1	0	.220	5.5	.582	14.6	.066	.68	-.037	475
10	4.6	.9	.2	.220	5.5	.583	14.6	.065	.67	-.037	475
15	4.5	.8	.1	.205	5.1	.597	14.9	.074	.76	-.037	450
20	4.4	.7	.1	.193	4.8	.602	15.1	.081	.83	.037	475
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.445	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	1.597	*****

GAS DATA SHEET #12

WEIGHT: 3.7 DATE: 11-30-12

UNIT: Jotul F45 RUN: 2 PAGE: 2 OF 2

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
180 2:25	4.3	.6	.1	.193	4.8	.605	15.2	078	.80	.036	475
185 30	4.2	.5	.1	.197	4.9	.603	15.1	073	.75	.036	475
190 35	4.1	.4	.1	.189	4.7	.607	15.4	.060	.62	.036	475
195 40	4.0	.3	.1	.190	4.8	.611	15.3	.064	.66	.035	475
200 45	3.9	.2	.1	.194	4.9	.607	15.2	.064	.66	.035	475
205 50	3.8	.1	.1	190	4.8	.610	15.3	067	.69	.034	500
210 55	3.7	0	.1	189	4.7	.612	15.3	072	.74	.034	500
215 3:08											
220											
225											
230											
235										.246	
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****		*****
240											
245											
250											
255											
260											
265											
270											
275											
280											
285											
290											
295											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****		*****
300											
305											
310											
315											
320											
325											
330											
335											
340											
345											
350											
355										1.843	
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****		*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	2043	*****

1.43

PREBURN DATA SHEET #13

UNIT: Jotul F45 RUN: 2 DATE: 11-30-2012 PAGE: 11 / 30 of 2012

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
0 10:10	5.7	—	468	693	659	361	667	532			78	-.049	PREBURN START: # 2.0 UP
5 15	5.3	.2	418	654	648	401	664	533			78	-.047	COAL BED SCALE RANGE:
10 20	5.1	.2	388	608	641	411	657	533			78	-.046	3.7 → 3.0
15 25	4.9	.2	356	548	626	414	634	531			78	-.043	PRIMARY AIR: 1"
20 30	4.8	.1	335	499	605	411	616	527			78	-.042	SECONDARY AIR: N/A
25 35	4.7	.1	320	470	587	406	597	523			79	-.041	FAN: Low
30 40	4.6	.1	309	450	571	402	570	518			78	-.040	PUMPS ON AT:
35 45	4.4	.2	298	431	556	397	564	512			77	-.039	CHECK WB/DB: N/A
40 50	4.3	.1	293	418	544	392	553	504			79	-.039	
45 55	4.2	.1	288	408	536	388	543	499			77	-.038	
50 1100	4.1	.1	282	399	527	386	535	496			77	-.037	
55 05	4.0		275	388	521	384	528	490			78	-.037	
*****	****	***	****	*****	*****	****	*****	*****	*****	*****	*****	****	
LO 10	3.9	.1	270	378	515	381	520	484			77	-.037	
15 15	3.8	.1	266	371	509	378	512	479			77	-.036	
20 20	3.8	0	263	366	504	374	506	473			76	-.036	
25 25	3.7	.1	259	358	500	374	501	470			78	-.036	
80 30													
85 35													
90 40													

Jotul- F45

Temperature Data Sheet 14

Run 2
11/30/12

Time	Stack	Top	LT Side	Back	Rt Side	Bottom	Firebox	Sec/Cat	Ambient	Tube Furn	Smpl Box	Smpl Out	C-Gas Box	C-Gas Out	SO2 Out
********	Chn 103	Chn 104	Chn 105	Chn 106	Chn 107	Chn 108	Chn 109	Chn 110	Chn 111	Chn 112	Chn 113	Chn 114	Chn 115	Chn 116	Chn 117
0	269	358	500	374	501	470	######	######	78	1469	247	59	247	29	29
5	339	357	481	394	480	462	######	######	79	1458	247	43	248	29	29
10	393	497	464	382	464	454	######	######	78	1448	248	43	248	30	29
15	448	610	455	373	458	445	######	######	77	1440	248	43	248	30	30
20	481	673	464	369	460	439	######	######	77	1432	246	43	247	31	30
25	505	715	479	368	475	433	######	######	78	1428	247	43	248	31	31
30	517	737	497	372	496	428	######	######	79	1425	248	43	248	32	32
35	515	741	518	349	521	425	######	######	80	1423	247	44	248	33	32
40	520	751	538	349	544	422	######	######	81	1422	248	44	248	34	33
45	520	753	552	355	566	422	######	######	81	1420	248	45	248	34	34
50	525	767	568	365	587	420	######	######	81	1419	248	45	248	35	34
55	525	772	584	378	605	418	######	######	81	1418	248	45	248	35	35
60	523	777	600	391	625	418	######	######	83	1417	248	46	248	36	35
65	523	782	612	403	640	415	######	######	82	1417	247	46	248	36	36
70	510	770	624	419	651	411	######	######	81	1417	245	47	247	37	36
75	469	719	636	437	657	410	######	######	81	1417	244	47	248	37	36
80	435	665	655	452	652	411	######	######	81	1417	244	47	248	37	36
85	403	610	654	460	638	409	######	######	81	1419	244	47	248	37	36
90	379	569	642	464	622	410	######	######	80	1420	244	47	248	37	36
95	361	534	628	464	607	411	######	######	80	1421	243	47	247	37	36
100	345	508	614	459	593	412	######	######	80	1421	243	48	245	37	36
105	324	475	596	453	578	413	######	######	79	1422	242	48	244	37	36
110	313	451	578	449	565	412	######	######	80	1421	241	48	243	37	36
115	303	433	565	446	553	409	######	######	80	1420	240	48	241	37	36
120	296	419	555	442	543	407	######	######	79	1418	239	49	239	37	36
125	291	408	549	438	534	403	######	######	78	1416	238	50	238	36	35
130	285	398	544	435	527	400	######	######	77	1414	238	50	237	36	35
135	281	391	541	433	520	395	######	######	78	1411	237	50	236	36	35
140	278	384	537	432	514	392	######	######	77	1410	236	50	235	36	35
145	275	378	534	431	509	387	######	######	77	1409	236	51	233	36	34
150	272	372	532	430	505	383	######	######	76	1408	236	51	233	35	34
155	271	368	530	431	501	377	######	######	76	1407	234	51	232	35	34
160	269	366	529	431	497	373	######	######	75	1405	234	51	231	35	34
165	268	364	528	429	493	368	######	######	76	1403	233	51	230	35	34
170	266	360	526	428	490	363	######	######	74	1402	233	50	229	35	33

175	261	356	522	425	485	361	######	######	74	1402	232	51	228	34	33
180	257	349	517	417	479	358	######	######	73	1402	232	51	230	34	33
185	255	346	512	409	472	355	######	######	73	1403	231	51	232	34	33
190	251	341	509	401	467	351	######	######	76	1403	235	51	234	34	33
195	248	336	505	396	462	349	######	######	76	1403	237	51	238	33	32
200	248	333	500	393	458	347	######	######	76	1402	238	51	240	33	32
205	246	331	495	392	455	344	######	######	76	1401	239	51	242	33	32
210	245	328	490	392	452	341	######	######	77	1400	240	52	243	33	32

TEMPERATURE DATA SHEET #14A

		TEST TIME	210		
STACK AVG	361	TOP AVG	510	LT SIDE AVG	546
BACK AVG	412	RT SIDE AVG	533	BOTTOM AVG	401
FIREBOX AVG	########	SEC/CAT AVG	########	AMBIENT AVG	78

END	400.7	
START	440.7	
	-40.0	DELTA T

CIRCLE: LOSS / GAIN

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 11-30-2012 Analyte : CO_2 (15-1)

Unit : Joul F45 Run # : 2

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 % CO_2 Cyl. Press. : 500 PSI

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

Span Cyl. # : 487905 Conc. : 12.20 % CO_2 Cyl. Press. : 1500 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % CO_2

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

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

PRE RUN Audit : by : Clp Lindsey Time : 0900 Temp : 67.0 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.013	.013	.051
SPAN	48.8	.488	12.20	48.8	.488	12.219	.019	.074

POST RUN Audit : by : Clp Lindsey Time : 1530 Temp : 77 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	-.001	-.012	-.012	-.049
SPAN	48.8	.488	12.20	48.4	.484	12.119	-.081	-.326

± 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 : 11-30-2012 Analyte : O_2 (15-2)

Unit : Jotul F45 Run # : 2

Zero Cyl. # : 168TAC 3A Conc. : 0.00 % O_2 Cyl. Press. : 490 PSI

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

Span Cyl. # : 487905 Conc. : 12.60 % O_2 Cyl. Press. : 1500 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 : Clp Watkins Time : 0900 Temp : 67 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.005	.005	.020
SPAN	12.60	.504	12.6	12.6	.504	12.615	.015	.058

POST RUN Audit : by : Clp Watkins Time : 1530 Temp : 77 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.005	.005	.020
SPAN	12.60	.504	12.6	12.6	.503	12.590	-.010	-.042

± 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 : 11-30-2012 Analyte : CO (15-3)

Unit : Total F-45 Run # : 2

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 % CO Cyl. Press. : 490 PSI

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

Span Cyl. # : CC487905 Conc. : 4.90 % CO Cyl. Press. : 1500 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 : Chp Watkins Time : 0900 Temp : 67 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.026	.026	.256
SPAN	49.0	.490	4.90	49.0	.490	4.912	.012	.122

POST RUN Audit : by : Chp Watkins Time : 1530 Temp : 77 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.001	.036	.036	.356
SPAN	49.0	.490	4.90	49.0	.490	4.912	.012	.122

± 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 : 11-30-2012 Analyte : SO_2 (15-4)

Unit : Jotul F45 Run # : 2

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 ppm SO_2 Cyl. Press. : 500 PSI

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

Span Cyl. # : CC82089 Conc. : 1250 ppm SO_2 Cyl. Press. : 1110 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 Wadsworth Time : 0900 Temp : 67 °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	6,273	6,273	.251
SPAN	50.0	.500	1250	50.0	,500	1251.3	1,300	,520

POST RUN Audit : by : Cp Wadsworth Time : 1530 Temp : 77 °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	1.293	1,293	,052
SPAN	50.0	.500	1250	49.9	,499	1248.8	-1,200	-,048

± 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 F45 RUN: 2 DATE: 11-30-2012

Thermocouple Check:

T/C # 1	— °F	T/C # 13	63.4 °F
T/C # 2	— °F	T/C # 14	63.0 °F
T/C # 3	64.0 °F	T/C # 15	63.1 °F
T/C # 4	59.3 °F	T/C # 16	54.8 °F
T/C # 5	57.9 °F	T/C # 17	50.5 °F
T/C # 6	57.8 °F	T/C # 18	67.2 °F
T/C # 7	57.8 °F	T/C # 19	— °F
T/C # 8	57.6 °F	T/C # 20	— °F
T/C # 9	— °F	T/C # 21	— °F
T/C # 10	— °F	T/C # 22	— °F
T/C # 11	57.6 °F	T/C # 23	— °F
T/C # 12	66.4 °F	T/C # 24	— °F

Thermocouple Readout:

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

ZERO .4 °F Adj. to 0.0 °F ZERO .1 °F Difference .005 %

SPAN 2001.0 °F Adj. to 2000.0 °F SPAN 2000.5 °F Difference .025 %

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 200.2 °F	400	= 400.0 °F
600	= 599.9 °F	800	= 799.9 °F	1000	= 999.9 °F
1200	= 1199.8 °F	1400	= 13996 °F	1600	= 1599.6 °F
1800	= 1800.0 °F	2000	= 2000.0 °F		

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

Scale Check Pre: 13.9 − 3.9 = 10.0

Post: 13.5 − 3.5 = 10.0

Stack Cleaned Prior to Test Run: YES ____ NO X

TABLE 1 ----- RAW DATA

CLIENT : Jotul TEST No. : 4

MODEL: F45 DATE:

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	562.500	0.150	78	0.47	9.30	375
5	564.000	0.120	80	0.52	7.50	425
10	565.337	0.130	80	0.35	14.00	400
15	566.757	0.090	80	0.64	15.50	475
20	567.953	0.080	80	0.85	15.60	525
25	569.035	0.006	81	1.00	15.20	600
30	569.993	0.060	81	0.88	14.80	575
35	570.992	0.130	81	0.17	14.80	400
40	572.428	0.150	81	0.09	13.30	375
45	573.959	0.150	82	0.10	12.70	375
50	575.496	0.150	84	0.08	12.40	375
55	577.045	0.150	84	0.04	11.00	375
60	578.594	0.140	86	0.06	10.70	375
65	580.154	0.140	86	0.07	10.10	375
70	581.714	0.140	86	0.09	8.80	375
75	583.274	0.140	86	0.13	8.00	375
80	584.834	0.140	86	0.14	7.70	375
85	586.394	0.140	86	0.21	7.10	375
90	587.954	0.130	86	0.39	6.40	400
95	589.416	0.130	86	0.48	6.00	400
100	590.879	0.130	86	0.54	5.60	400
105	592.341	0.130	86	0.53	5.50	400
110	593.804	0.130	86	0.54	5.40	400
115	595.267	0.130	86	0.57	5.20	400
120	596.729	0.130	86	0.58	5.00	400
125	598.192	0.130	86	0.59	5.00	400
130	599.654	0.130	86	0.60	4.90	400
135	601.117	0.130	86	0.59	4.70	400
140	602.580	0.130	86	0.54	4.70	400
145	604.042	0.130	86	0.53	4.70	400
150	605.505	0.130	86	0.48	4.70	400
155	606.967	0.130	86	0.50	4.40	400
160	608.430	0.130	86	0.58	4.00	400
165						

TABLE 2---RAW DATA

CLIENT : Jotul TEST No. 4

MODEL: F45 DATE:

METER CAL. FACTOR (Y) -------	0.935		Wt. WOOD BURNED(LB) -------	15.4	Lbs
BAROMETRIC PRESS.(Pb) -------	30.2	in Hg	WET,FUEL MOISTURE % -------	16.164	%
LEAK RATE POST (Lp) -------	0.000	cfm	Wt. PART. COLLECTED -------	0.1884	g
WATER VOL. (V1c) -------	76.1	Ml	METER VOLUME Vm -------	45.93	mcf
TEST TIME (MIN) -------	160	min	HC MOLE FRACTION -------	0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT : Jotul TEST No. 4

MODEL: F45 DATE:

AVG DELTA H	-------	0.13	in H2O	AVG PRCNT CO	-------	0.42	%
AVG METER TEMP. Tm	-------	84	deg F	AVG PRCNT CO2	-------	8.63	%
AVG PPM SO2	-------	410	PPM	AVG BAL CO2/CO	-------	20.44	%

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul TEST No. 4

MODEL: F45 DATE:

****

STD SAMPLE VOL. Vm(std) d) ------	42.08	dscf	STACK GAS FLOW Qsd -------	762.843 12.71	dscf/Hr & dscf/min
VOL. WATER VAPOR Vw(s td) -----	3.582	scf	PARTICULATE CONCTRT. C s ------	0.0045	g/dscf
PRCNT MSTR Bws -------	7.85	%	PARTC.EMISS. RATE E -------	3.42	g/Hr
BURN RATE BR -------	2.20	Kg/Hr	MOLES OF GAS PER Lb WOOD Nt ----	0.41	Lb-mole/Lb
CO EMISSION RATE -------	107.84 & 49.11	g/Hr g/Kgdry fuel	PART.EMISS. RATE ------	1.56	g/Kgdry fuel

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Jotul TEST No. : 4

MODEL: F45 DATE:

TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR		PROPRTN RATE VAR. AVERAGE	
5	520.3	98		100	
10	524.6	99			
15	524.4	99			
20	524.4	99			
25	523.9	99			
30	529.5	100			
35	529.3	100			
40	529.3	100			
45	528.6	99			
50	529.2	100			
55	532.4	100			
60	531.4	100			
65	534.2	100			
70	534.2	100			
75	534.2	100			
80	534.2	100			
85	534.2	100			
90	534.2	100			
95	534.0	100			
100	534.3	101			
105	534.0	100			
110	534.3	101			
115	534.3	101			
120	534.0	100			
125	534.3	101			
130	534.0	100			
135	534.3	101			
140	534.3	101			
145	534.0	100			
150	534.3	101			
155	534.0	100			
160	534.3	101			
165					

COMPUTER INPUT DATA SHEET #1

3,42

Client: Jotul North America

Address: 55 Hutcherson
Gorham, ME 04038

Phone: 1-800-797 5912 Fax: 1-207-591 6623

Run No.: 4 Date of Test: 12-5-2012 Burn Rate: 2.196

Model No.: F45 ☐ min ☐ min-1.25 ☐ fan

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

Dry Gas Meter Y Factor: .935 (0.000) (Data Sheet #2) Post Leak Rate: .000 (.000) (Data Sheet #2) cfm Time: 160 (000) (Data Sheet #2) min.

Dry Gas Meter Volume: 45.930 (00.000) (Data Sheet #2) cf

Stack Flow: 8.556 (00.000) (Data Sheet #2) dscfm Δ H: .128 (.000) (Data Sheet #2) in. H_2O

Maximum Vac.: 2.0 (0.0) (Data Sheet #2) Barometric Pressure: 30.20 (00.00) (Data Sheet #2) in. Hg

H_2O Captured: 76.1 (00.0) (Data Sheet #3) g

Front Half Catch % Of Total: 36.9 (00.0) (Data Sheet #6) % Total Particulate Catch: .1884 (0.0000) (Data Sheet #6) g

Flue Gas Moisture: 7.8467 (00.000) (Data Sheet #7) %

Particulate Emission: .0691 (0.0000) (Data Sheet #7) gr/dscf

Relative Humidity: 3.5 (00.0) (Data Sheet #8) % RH Ambient Moisture: 1.4 (0.00) (Data Sheet #8) % H_2O

Preburn Fuel Wt.: 33.3 (00.0) (Data Sheet #8) lbs. Coal Bed Wt.: 3.3 (00.0) (Data sheet #8) lbs. Test Fuel Wt.: 15.4 (00.0) (Data sheet #8) lbs.

Heat Output (EPA Default): 2679.8 (00,000.0) (Data Sheet #8) BTU/hr

Kindling Fuel % Moisture (wet): 12.204 (00.000) (Data Sheet #10) % Pretest Fuel % Moisture (wet): 17.446 (00.000) (Data Sheet #10) %

Test Fuel % Moisture (dry): 19.280 (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove]) % Test Fuel % Moisture (wet): 16.164 %

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

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

Average Ambient Temperature: 78 (00) (Data Sheet #14) °F Stove Temperature Change: -65.0 (+/- 000.0) (Data Sheet #14) °F

Test start = 1200
End = 1440

meter temp = 544

METER BOX DATA SHEET PAGE # 2

Page: 1 of 2

UNIT: Total F45 RUN: 4 DATE: 12-5-2012

Meter Box: 5H Y Factor: .935

Leak checks: 15 " Hg @ 1,600 cfm _____ " Hg @ _____ cfm

15 " Hg @ 1,600 cfm _____ " Hg @ _____ cfm

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

ROTO: PRESS: .18			SAMPLING RATIO: 31			: 1	BP: 30.20		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1200	562.500	——	9,334	.15	78	375	78	2.0
5	05	564.000	——	8,206	.12	80	425	80	2.0
10	10	565.337	565.337	8,719	.13	80	400	80	2.0
15	15	566.757	566.757	7.342	.09	80	475	80	2.0
20	20	567.953	567.953	6.643	.08	80	525	80	2.0
25	25	569.035	569.035	5.802	.06	81	600	81	2.0
30	30	569.993	569.993	6.054	.06	81	575	81	2.0
35	35	570.992	570.992	8.702	.13	81	400	81	2.0
40	40	572.428	572.428	9,283	.15	81	375	81.	2.0
45	45	573.959	573.959	9.265	.15	82	375	82.	2.0
50	50	575.496	575.496	9.231	.15	84	375	84	2.0
55	55	577.045	577.045	9.231	.15	84	375	84	2.0
ROTO PRESS: .18			TOTALS:	97.812	1.42	972	BP.: 30.20		
60	1300	578.594	578.594	9,198	.14	86	375	86	2.0
65	05	580.154	580.154	9.198	.14	86	375	86	2.0
70	10	581.714	581.714	9.198	.14	86	375	86	2.0
75	15	583.274	583.274	9.198	.14	86	375	86	2.0
80	20	584.834	584.834	9.198	.14	86	375	86	2.0
85	25	586.394	586.394	9.198	.14	86	375	86	2.0
90	30	587.954	587.954	8.623	.13	86	400	86	2.0
95	35	589.416	589.416	8.623	.13	86	400	86	2.0
100	40	590.879	590.879	8.623	.13	86	400	86	2.0
105	45	592.341	592.341	8.623	.13	86	400	86	2.0
110	50	593.804	593.804	8.623	.13	86	400	86	2.0
115	55	595.267	595.267	8.623	.13	86	400	86	2.0
			TOTALS:	106.926	1.62	1032	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	204.738	3.04	2004	AVG. BP:		

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METER BOX DATA SHEET PAGE # 2

Page: 2 of 2

UNIT: John F45 RUN: 4 DATE: 12-5-2012

Meter Box: SH Y Factor: .935

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: 31 : 1 BP: 30.20

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1400	596.729	596.729	8.623	.13	86	400	86	2.0
125	.05	598.192	598.192	8.623	.13	86	400	86	2.0
130	10	599.654	599.654	8.623	.13	86	400	86	2.0
135	15	601.117	601.117	8.623	.13	86	400	86	2.0
140	20	602.580	602.580	8.623	.13	86	400	86	2.0
145	25	604.042	604.042	8.623	.13	86	400	86	2.0
150	30	605.505	605.505	8.623	.13	86	400	86	2.0
155	35	606.967	606.967	8.623	.13	86	400	86	2.0
160	40	608.430	608.430	8.623	.13	86	400	86	2.0
165									
170									
175				77.607	1.17	774			
ROTO PRESS:			TOTALS:				BP.:		
180									
185									
190									
195									
200									
205									
210									
215									
220									
225									
230						2778			
235				282.345	4.21	84			
			TOTALS:			+460	MAX VACC =		2.0
TOTAL Cu Ft		45.930	TOTALS:	8.556	.128	544	AVG. BP:		30.20

1.33

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : F45 RUN : 4 DATE : 12-5-12

SCALE CHECK	LEVEL	ZEROED
INITIAL :	√	√
FINAL :	√	√

SCALE	WEIGHT
295.0 g	295.0
590.0 g	590.0
885.0 g	885.0

IMPINGER	#1	#2	#3	#4
FINAL WT	657.5	574.4	485.5	897.0
INITIAL WT	597.0	572.0	484.8	884.5
NET WT GRAMS	60.5	2.4	.7	12.5

TOTAL CATCH : 76.1 **GRAMS H_2O**

FRONT HALF

FILTER #	LLF	
FINAL WT g	.6810	
INITIAL WT g	.6272	
NET WT g	.0538	

BEAKER #	76
DESC.	ACETONE
FINAL WT g	103.8148
INITIAL WT g	103.7983
NET WT g	.0165
VOL. DESC. ml	75

BACK HALF

FILTER #	LLB	
FINAL WT g	.3107	
INITIAL WT g	.2836	
NET WT g	.0271	

BEAKER #	77	78	79	80	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	107.4495	94.4983	97.6232	109.1286	
INITIAL WT g	107.3791	94.4894	97.6105	109.1212	
NET WT g	.0704	.0089	.0127	.0074	(.0201)
VOL. DESC ml	125	75	150	100	(250)

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 2-15-12 Time : 1200 By : CP

Manufacturer S & S Grade : # 25 Glass Front Size : 11 cm Lot No. : 393580

Back Size: 8.2 cm Lot No. : 464241

	DATE: 2-20-12	BY: AV	DATE: 2-23-12	BY: CP	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
61F	0.6288	1330	.6285	1005		
62F	0.6320	1331	.6320	1006		
63F	0.6300	1332	.6298	1007		
64F	0.6272	1333	.6268	1008		
65F	0.6314	1334	.6311	1009		
66F	0.6271	1335	.6272	1010	← R-4	
67F	0.6314	1336	.6310	1011		
68F	0.6296	1337	.6295	1012		
69F	0.6302	1338	.6304	1013		
70F	0.6307	1339	.6307	1014		
61B	0.2826	1320	.2827	1015		
62B	0.2805	1321	.2805	1016		
63B	0.2824	1322	.2824	1017		
64B	0.2811	1323	.2811	1018		
65B	0.2825	1324	.2827	1019		
66B	0.2835	1325	.2836	1020	← R4	
67B	0.2845	1326	.2846	1021		
68B	0.2845	1327	.2847	1022		
69B	0.2846	1328	.2846	1023		
70B	0.2836	1329	.2837	1024		

Checked by: Armando Date: 2-23-2012 Time: 1245

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
2-20-12	1200	CP		70	48
2-23-12	1000	CP		73	47

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 2-9-2012 Time : 1000 By : CP

	DATE: 2-15-12	BY: AV	DATE: 2-20-12	BY: AV	DATE: 2-24-12	BY: AV
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
76	103.7979	1137	103.7983	1245	✓	
77	107.3788	1138	107.3791	1246	✓	
78	94.4891	1139	94.4894	1247	✓ R-4	
79	97.6101	1140	97.6105	1248	✓	
80	109.1207	1145	109.1212	1249	✓	
81	101.4599	1146	101.4601	1250	✓	
82	97.4708	1147	97.4709	1251	✓	
83	98.3220	1148	98.3224	1252	✓	
84	105.5463	1149	105.5464	1253	✓	
85	97.9877	1150	97.9882	1254	✓	
86	104.7404	1151	104.7408	1255	✓	
87	105.9156	1152	105.9161	1256	✓	
88	99.9990	1153	99.9993	1257	✓	
89	120.6686	1154	120.6690	1258	✓	
90	106.4001	1155	106.4004	1259	✓	
91	95.0477	1156	95.0482	1300	✓	
92	96.6762	1157	96.6764	1301	✓	
93	107.8808	1158	107.8816	1302	107.8820	1022 ✓
94	106.3620	1159	106.3622	1303	✓	
95	107.4074	1200	107.4080	1304	107.4083	1023 ✓
96	103.9804	1201	103.9808	1305	✓	
97	99.9821	1202	99.9826	1306	✓	
98	105.0212	1203	105.0216	1307	✓	
99	104.9325	1204	104.9330	1308	✓	
100	106.7388	1205	106.7392	1309	✓	

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH	
2-15-12	1120	CW	-	70	44	Checked by : C. Weinberg
2-20-12	1200	CW	-	70	48	Date : 2-24-12
2-24-12	1015	CW	-	78	46	Time : 1045

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : F45 RUN : 4 DATE : 12-5-12 Page : 1 of 1

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
76	12-6	1400	CP	103.8146	12-8	1742	CP	103.8148	12-9	1406	CP				
77	12-6	1400	CP	107.4490	12-8	1743	CP	107.4495	12-9	1407	CP				
78	12-6	1400	CP	94.4981	12-8	1744	CP	94.4983	12-9	1408	CP				
79	12-6	1400	CP	97.6227	12-8	1745	CP	97.6232	12-9	1409	CP				
80	12-6	1400	CP	109.1281	12-8	1746	CP	109.1286	12-9	1410	CP				

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
LF	12-5	1425	CP	.6864	12-6	1410	CP	.6805	12-8	1740	CP	.6810	12-9	1405	CP
LB	12-5	1425	CP	.3112	12-6	1412	CP	.3107	12-8	1741	CP				

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	12-6-12	1400	CP	66	49
2	12-9-12	1730	CP	65	48
3	12-9-12	1400	CP	66	49
4					
5					

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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 10-10-12 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	.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	10.0000	.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	10-23-12	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	1030	74	47
99.9998	10.0000	1.0000	.0999	CR	11-6-12	1080	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	.9994	.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	1400	62	49
100.0002	10.0001	.9997	.1000	CR	12-10-12	1500	62	49

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	41
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	.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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 4-13-2011 Through 1-13-2012	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0000	10.0001	1.0000	.0998	CP	4-13-11	1030	66	49
100.0001	10.0002	1.0000	.0999	CP	4-15-11	1330	75	48
100.0004	10.0000	.9999	.0998	CP	4-19-11	1600	74	44
100.0003	10.0000	1.0000	.0999	CP	4-20-11	1815	72	46
100.0000	10.0001	.9999	.1000	CP	6-16-11	0900	76	39
99.9997	9.9999	.9998	.0999	CP	6-18-11	1530	74	44
99.9996	10.0002	1.0000	.0999	CP	6-20-11	1600	73	47
100.0000	10.0000	.9998	.0999	CP	6-21-11	1400	73	47
100.0000	10.0000	1.0001	.0999	CP	6-22-11	1200	72	46
99.9999	9.9998	1.0000	.1000	CP	6-23-11	1700	76	49
100.0000	10.0002	1.0000	.0999	CP	6-24-11	1400	75	48
100.0000	10.0000	1.0000	.0999	CP	6-27-11	1230	78	46
100.0001	10.0002	.9999	.0998	CP	6-30-11	1030	78	46
99.9995	10.0000	.9999	.0999	CP	7-1-11	1030	70	48
99.9999	9.9999	1.0000	.1000	CP	7-2-11	1145	75	45
100.0000	9.9999	.9999	.0999	CP	7-5-11	1000	73	47
99.9999	10.0001	1.0000	.0999	CP	7-6-11	0930	76	49
100.0000	9.9997	1.0000	.0997	CP	9-22-11	1700	77	46
100.0000	10.0001	1.0000	.0999	CP	9-24-11	1200	77	49
100.0000	9.9998	1.0001	.1000	CP	9-25-11	1300	76	49
100.0000	9.9999	1.0001	.0998	CP	9-27-11	1000	77	49
99.9996	9.9999	1.0000	.0998	CP	9-29-11	0840	72	42
99.9997	9.9998	.9999	.1000	CP	9-30-11	1000	70	48
99.9996	9.9998	1.0000	.0999	CP	10-1-11	1520	70	45
99.9998	10.0002	1.0000	.0997	CP	10-2-11	1430	74	47
99.9995	10.0001	1.0000	.0999	CP	10-5-11	1510	71	49
100.0000	9.9999	1.0000	.0998	CP	10-6-11	1000	78	40
100.0000	9.9999	1.0000	.0999	CP	10-9-11	1130	75	49
100.0000	10.0001	1.0000	.0998	CP	10-16-11	1540	68	47
100.0000	10.0000	1.0000	.0998	CP	11-9-11	1230	72	46
100.0000	10.0002	.9998	.0998	CP	11-11-11	0815	70	48
99.9999	10.0000	1.0000	.0996	CP	11-15-11	1200	75	48
99.9995	10.0001	.9999	.0999	CP	11-16-11	1400	70	44
99.9999	10.0001	.9999	.0998	CP	11-20-11	1600	73	43
99.9998	9.9999	.9999	.0999	CP	11-21-11	1715	74	47
100.0000	10.0000	1.0000	.0999	CP	11-22-11	1600	65	48
100.0000	10.0000	1.0000	.0999	CP	1-9-12	1030	70	48
100.0000	9.9999	1.0001	.1000	CP	1-11-12	1720	65	48
100.0000	10.0001	1.0000	.0997	CP	1-13-12	1030	72	46

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

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

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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

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

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

BLANK PROCESSING DATA SHEET # 5

UNIT : JOTOL F45 RUN : 41 DATE : 12-5-2012

BLANKS DONE : 8-31-2010

BEAKER	A	B	C
	200 ml ACETONE	75 ml DICHLOR	200 ml WATER
	FISHER OPTIMA LOT # 023283	FISHER OPTIMA LOT # 061390	DWNA, Inc Sparkletts Distilled
FINAL WEIGHT	108.9019	106.3074	106.9680
TARE WEIGHT	108.9001	106.3058	106.9640
NET WEIGHT	.0018	.0016	.0040

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

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

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

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

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

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

TARE QC

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

FINAL QC

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

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT: Total F45 RUN: 4 DATE: 12-5-2012

BLANK CALCULATIONS

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

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

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

FRONT HALF CATCH

FILTERS: .0538 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0538 g

BEAKERS: .0165 (Total Catch) g - 75 (ml Acetone) (.000009 g) (Blank Value / ml Acetone) = .0158 g

TOTAL FRONT HALF CATCH : .0696 g

BACK HALF CATCH

FILTERS: .0271 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0271 g

BEAKERS:

Acetone: .0704 (Total Catch) g - 125 (ml Acetone) (.000009 g) (Blank Value / ml Acetone) = .0693 g

Extract: .0089 (Total Catch) g - 75 (ml Dichloromethane) (.000021 g) (Blank Value / Dichloromethane) = .0073 g

Water: .0201 (Total Catch) g - 250 (ml Water) (.000020 g) (Blank Value / Water) = .0151 g

TOTAL BACK HALF CATCH : .1188 g

TOTAL CATCH : .1884 g

% FRONT HALF : 36.9 %

CALCULATIONS DATA SHEET # 7

UNIT : Jotul F45 RUN : 4 DATE : 12-5-2012

1) $Vm(std) = \dfrac{(45.930\ Vm)(17.64)(.935\ mcf)\left(30.20\ "Hg + \frac{.128\ "H_2O}{13.6}\right)}{(544\ TmA)} = \dfrac{42.0678}{000.0000}$ dscf

2) $Vw(std) = (.04707)(76.1\ ml\ H_2O) = \dfrac{3.5820}{00.0000}$ scf

3) $Asw = \dfrac{(3.5820\ scf)}{(3.5820\ scf + 42.0678\ dscf)} = \dfrac{.0785}{.0000}$ Bws × 100 = $\dfrac{7.8467}{00.0000}$ % H_2O

4) $Cs = \dfrac{(.1884\ g.)}{(42.0678\ dscf)}(15.43) = \dfrac{.0691}{0.0000}$ gr / dscf

5) Estimated g / hr = $\dfrac{(.1884\ g.)}{(42.0678\ dscf)}\left(\dfrac{8.556}{00.0000}\ dscfm\right)(60) = \dfrac{2.2991}{00.0000}$ 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 F45 RUN: 4 DATE: 12-5-2012

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

Wet Bulb / Dry Bulb

Pre : WB: 65 DB: 86 = 30.0 % RH 1.3 % H_2O

Post : WB: 66 DB: 87 = 46.0 % RH 1.5 % H_2O

Average: 3.5 % 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: 3.2

Preburn Fuel Weight: 16.0 + 14.1 Total: 30.1

Kindling & Preburn Fuel Weight (wood only) (lbs): **Total:** 33.3

Coal Bed Wt Range (lbs): 3.8 - 3.1 **Scale:** 3.8 - 3.1

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

Lower : .20 x fuel weight : Always round UP to nearest tenth **Actual Coal Bed Weight:** 3.3

Maximum Coal Bed Removal (lbs): ((3.8 (Upper) + 3.1 (Lower)) ÷ 2) .25 = .8 (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"	17	3	7.2	46.8
4" x 4"	17	2	8.2	53.2

Test Fuel Weight: 15.4 lbs

Estimated Dry Burn Rate:

$$\frac{15.4 - (15.4 \times .16164)}{2.2046} \times \frac{60}{\underset{\text{TIME}}{160}} = 2.196 \text{ kg / hr}$$

Estimated BTU's/hr: 19,140 x $\frac{63}{100}$ x $\frac{2.196}{\text{DBR}}$ = 26479.8 BTU's/hr

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

WOOD STOVE OPERATING DATA PAGE #9

Unit : Jotul F45 Run : 4 Date : 12-5-2012

FIRE STARTED: 0800

WARM UP AND PREBURN:

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

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

CHARCOAL BED PREPARATION :

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

TEST:

DOOR wide open during loading 0 min. 45 sec.

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

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

FAN:

ON / (OFF) during warm-up

(ON) / OFF first ALL minutes of test

Fan speed set at High

(ON) / OFF during preburn

(ON) / OFF balance of test run

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

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

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

All Grades WCLB rules:

WARM UP INFORMATION:

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

1st warm up / pre-burn fuel charge (16.0 lbs.) added at 0809

2nd warm up / pre-burn fuel charge (14.1 lbs.) added at 1033

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

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

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

TEST DATA SHEET #10

Unit : Jotul F45 Run : 4 Date : 12-5-2012

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

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

Time Test Fuel moisture reading taken : 1030

pc #	Dimen.	Use	TOP	BOTTOM	SIDE	Avg Corrected
1	2"×4"×8'	K	13.9	14.0	13.9	13.9
2						
3						
4	2"×4"×8'	P	21.1	22.6	22.4	22.0
5	2"×4"×8'	P	18.8	19.0	19.0	18.9
6	2"×4"×8'	P	22.7	22.9	22.0	22.5
7	2"×4"×8'	P				(63.4)
8	2"×4"×8'	P				
9						
10						
11						
12	2"×4"×17"	T	18.0	18.2	18.1	18.1
13	"	T	20.9	20.8	20.8	20.8
14	"	T	22.0	19.3	22.0	21.1
15	4"×4"×17"	T	19.8	17.4	17.8	18.3
16	"	T	18.1	18.1	18.0	18.1
17						(96.4)
18						
19						
20	Spacers	T	20.6	19.4	20.3	20.1

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	13.900 %	21.133 %	19.280 %
Wet Moisture % :	12.204 %	17.446 %	16.164 %

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

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

GAS DATA SHEET #12

WEIGHT: 3.3 DATE: 12-5-2012

UNIT: Jotul F45 RUN: PAGE: 1 OF

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
0 12:00	18.7	15.4	—	.211	5.3	.599	15.0	.045	.47	-.042	375
5 05	18.0	14.7	.7	.300	7.5	.511	12.8	050	.52	-.041	425
10 10	16.8	13.5	1.2	.561	14.0	.260	6.5	032	.35	-.052	400
15 15	15.8	12.5	1.0	.618	15.5	.188	4.7	.062	.64	-.053	475
20 20	14.4	11.1	1.4	.623	15.6	.176	4.4	.083	.85	-.054	525
25 25	13.1	9.8	1.3	.607	15.2	.184	4.6	.098	1.0	-.054	600
30 30	11.8	8.5	1.3	.592	14.8	.204	5.1	.086	.88	-.054	575
35 35	10.7	7.4	1.1	.591	14.8	.232	5.8	.014	.17	-.054	400
40 40	9.6	6.3	1.1	532	13.3	.296	7.4	.006	.09	-.054	375
45 45	8.9	5.6	.7	.508	12.7	.320	8.0	.007	.10	-.053	375
50 50	8.2	4.9	.7	.497	12.4	.332	8.3	.005	.08	-.052	375
55 55	7.6	4.3	.6	.440	11.0	.392	9.8	.001	.04	-.052	375
JBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.615	*****
60 100	7.1	3.8	.5	.427	10.7	.399	10.0	.003	.06	-.051	375
5 05	6.6	3.3	.5	.403	10.1	.401	10.0	.004	.07	-.052	375
10 10	6.2	2.9	.4	.350	8.8	.472	11.8	.006	.09	-.050	375
15 15	5.9	2.6	.3	.318	8.0	.506	12.7	.010	.13	-.049	375
20 20	5.6	2.3	.3	.308	7.7	.518	13.0	.011	.14	-.049	375
25 25	5.3	2.0	.3	.283	7.1	.539	13.5	.018	.21	-.048	375
30 30	5.2	1.9	.1	.257	6.4	.560	14.0	.036	.39	-.047	400
35 35	5.0	1.7	.2	.240	6.0	.572	14.3	.046	.48	-.046	400
100 40	4.8	1.5	.2	.223	5.6	.582	14.6	.052	.54	-.045	400
5 45	4.7	1.4	.1	.220	5.5	.590	14.8	.051	.53	-.045	400
10 50	4.5	1.2	.2	.215	5.4	.594	14.9	.052	.54	-.044	400
15 55	4.4	1.1	.1	.206	5.2	.601	15.0	.055	.57	-.043	400
BTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.569	*****
20 2:00	4.3	1.0	.1	.199	5.0	.608	15.2	.056	.58	-.043	400
65	4.1	.8	.2	.199	5.0	.607	15.2	.057	.59	-.042	400
10	4.0	.7	.1	.196	4.9	.611	15.3	.058	.60	-.041	400
15	3.9	.6	.1	.189	4.7	.620	15.5	.057	.59	-.041	400
20	3.8	.5	.1	.186	4.7	.622	15.6	.052	.54	-.041	400
25	3.6	.3	.2	.186	4.7	.622	15.6	.051	.53	-.040	400
30	3.5	.2	.1	.186	4.7	.625	15.6	.046	.48	-.040	400
35	3.4	.1	.1	.176	4.4	.635	15.9	.048	.50	-.040	400
40	3.3	0	.1	.158	4.0	.648	16.2	.056	.58	-.039	400
										(-.367)	
										(-1.551)	
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****		*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.047	*****

÷33

.563

PREBURN DATA SHEET #13

UNIT: Jotul F45 RUN: DATE: 12-5-2012 PAGE: 1 of 1

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
0 10 35	16.1"	—	361	472	550	313	536	438			68	-.042	PREBURN START: # 12.5 UP
5 40	14.6	1.5	432	502	521	312	516	441			65	-.045	COAL BED SCALE RANGE:
10 45	12.8	1.8	502	589	517	311	510	444			66	-.049	3.8 → 3.1
15 50	11.1	1.7	552	679	527	319	510	445			67	-.051	PRIMARY AIR: WIDE OPEN
20 55	9.5	1.6	570	728	546	336	524	452			68	-.052	SECONDARY AIR: N/A
23 1100	8.1	1.4	588	763	575	349	550	457			69	-.053	FAN: HIGH
30 05	6.9	1.2	604	798	618	354	582	464			70	-.054	PUMPS ON AT:
35 10	5.9	1.0	601	798	667	362	615	460			68	-.055	CHECK WB/DB: N/A
40 15	5.3	.6	573	774	693	370	644	468			69	-.054	
45 20	4.9	.4	504	699	696	368	665	469			69	-.052	
50 25	4.4	.5	469	639	694	376	666	485			73	-.050	
55 30	4.2	.2	448	602	689	382	660	489			74	-.049	
*****	****	***	****	*****	*****	****	*****	*****	*****	*****	*****	****	
LD 35	4.0	.2	423	564	676	393	647	488			75	-.047	553
65 40	3.8	.2	397	523	559	398	633	486			73	-.046	
70 45	3.7	.1	382	495	642	393	617	483			74	-.045	526
75 50	3.5	.2	371	476	625	384	601	475			74	-.045	
80 55	3.4	.1	355	453	607	374	584	470			73	-.043	
85 1200	3.3	.1	348	434	593	318	574	468			74	-.042	
90													

Jotul - F45

Temperature Data Sheet 14

Run 4
12/5/12

Time	Stack	Top	LT Side	Back	Rt Side	Bottom	Firebox	Sec/Cat	Ambient	Tube Furn	Smpl Box	Smpl Out	C-Gas Box	C-Gas Out	SO2 Out
*********	Chn 103	Chn 104	Chn 105	Chn 106	Chn 107	Chn 108	Chn 109	Chn 110	Chn 111	Chn 112	Chn 113	Chn 114	Chn 115	Chn 116	Chn 117
0	348	434	593	368	574	466	######	######	74	1463	247	58	233	34	35
5	380	437	560	331	545	460	######	######	74	1455	248	40	233	34	35
10	547	638	547	297	531	452	######	######	74	1447	248	42	236	34	35
15	587	735	547	284	541	446	######	######	74	1441	247	42	238	35	36
20	598	782	567	286	571	444	######	######	74	1438	247	42	241	35	36
25	601	803	594	297	603	441	######	######	75	1436	246	42	243	36	36
30	607	821	622	315	638	439	######	######	77	1433	247	42	244	37	37
35	609	822	653	333	668	435	######	######	78	1429	247	43	245	37	38
40	583	795	683	351	692	432	######	######	78	1426	248	42	247	38	38
45	562	764	717	366	710	432	######	######	79	1425	247	42	248	38	39
50	545	742	734	379	720	430	######	######	79	1426	247	43	248	39	39
55	524	714	750	388	724	430	######	######	79	1428	248	44	248	39	39
60	511	693	758	395	719	431	######	######	80	1430	248	45	246	39	39
65	507	689	752	403	710	430	######	######	79	1431	248	45	245	39	39
70	484	661	738	406	698	430	######	######	80	1434	248	45	245	39	39
75	461	617	727	403	683	432	######	######	80	1437	248	45	244	39	39
80	443	586	712	398	668	431	######	######	79	1439	248	46	243	39	39
85	429	561	696	395	654	432	######	######	81	1441	246	47	242	39	39
90	411	532	678	392	641	427	######	######	80	1442	244	47	239	39	39
95	395	506	659	389	626	425	######	######	80	1445	244	47	237	39	38
100	383	487	643	387	613	423	######	######	78	1447	243	47	235	38	38
105	370	465	625	386	601	420	######	######	79	1447	242	47	232	38	38
110	361	448	611	387	589	416	######	######	79	1444	240	47	230	38	38
115	350	432	597	388	578	411	######	######	79	1444	240	47	232	38	38
120	342	418	585	386	568	408	######	######	78	1443	239	46	234	38	37
125	338	409	575	381	559	404	######	######	78	1443	239	47	235	37	37
130	334	401	567	376	550	400	######	######	78	1443	238	47	237	37	37
135	328	393	560	372	542	396	######	######	77	1443	238	47	236	37	37
140	323	387	554	369	534	391	######	######	77	1443	237	47	234	37	37
145	319	380	547	365	525	387	######	######	76	1441	237	47	233	36	36
150	316	374	539	363	517	383	######	######	76	1439	236	48	231	36	36
155	311	368	532	360	510	377	######	######	76	1437	236	48	230	36	36
160	301	357	524	355	501	373	######	######	76	1437	236	50	230	36	36

TEMPERATURE DATA SHEET #14A

		TEST TIME	160		
STACK AVG	440	TOP AVG	565	LT SIDE AVG	629
BACK AVG	365	RT SIDE AVG	609	BOTTOM AVG	422
FIREBOX AVG	########	SEC/CAT AVG	########	AMBIENT AVG	78

END	421.8	
START	486.8	
	-65.0	DELTA T

CIRCLE: LOSS / GAIN

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 12-5-2012 Analyte : CO_2 (15-1)

Unit : JOVI F45 Run # : 4

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 % CO_2 Cyl. Press. : 490 PSI

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

Span Cyl. # : 487905 Conc. : 12.20 % CO_2 Cyl. Press. : 1500 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 : Chp Wedding Time : 1000 Temp : 66 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.013	.013	.051
SPAN	48.8	.488	12.20	48.8	.488	12.219	.019	.074

POST RUN Audit : by : Chp Wedding Time : 1530 Temp : 74 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.2	.002	.063	.063	.251
SPAN	48.8	.488	12.20	.48.7	.487	12.194	-.006	±.026

± 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 : 12-5-2012 Analyte : O_2 (15-2)

Unit : Jotul F45 Run # : 4

Zero Cyl. # : 168TAC 3A Conc. : 0.00 % O_2 Cyl. Press. : 490 PSI

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

Span Cyl. # : 487905 Conc. : 12.60 % O_2 Cyl. Press. : 1500 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % O_2

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

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

PRE RUN Audit : by : Cp Watkins Time : 1000 Temp : 66 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.005	.005	.020
SPAN	12.60	.504	12.6	12.6	.504	12.615	.015	.058

POST RUN Audit : by : Cp Watkins Time : 1530 Temp : 74 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.001	.030	.030	.120
SPAN	12.60	.504	12.6	12.6	.504	12.665	.065	.258

± 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 : 12-5-2012 Analyte : CO (15-3)

Unit : Total F45 Run # : 4

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 % CO Cyl. Press. : 490 PSI

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

Span Cyl. # : CC487905 Conc. : 4.90 % CO Cyl. Press. : 1500 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 : 1000 Temp : 66 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.026	.026	.256
SPAN	49.0	.490	4.90	49.0	.490	4.912	.012	.122

POST RUN Audit : by : [signature] Time : 1530 Temp : 74 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.001	.036	.036	.356
SPAN	49.0	.490	4.90	49.0	.490	4.912	.012	.122

± 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 : 12-5-2012 Analyte : SO_2 (15-4)

Unit : Jotul F45 Run # : 4

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 ppm SO_2 Cyl. Press. : 490 PSI

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

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

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 2500 ppm SO_2

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

PRE RUN Audit : by : Cp Wadsworth Time : 1000 Temp : 66 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	6.273	6.273	.251
SPAN	50.0	.500	1250	50.0	.500	1251.3	1.300	.520

POST RUN Audit : by : Cp Wadsworth Time : 1530 Temp : 74 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.001	8.763	8.763	.351
SPAN	50.0	.500	1250	49.9	.499	1248.8	-1.200	-.048

± 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 F45 RUN: 4 DATE: 12-5-2012

Thermocouple Check:

T/C # 1	— °F	T/C # 13	57.8 °F
T/C # 2	— °F	T/C # 14	56.4 °F
T/C # 3	58.2 °F	T/C # 15	58.1 °F
T/C # 4	52.9 °F	T/C # 16	49.1 °F
T/C # 5	52.2 °F	T/C # 17	46.2 °F
T/C # 6	52.0 °F	T/C # 18	61.7 °F
T/C # 7	52.2 °F	T/C # 19	— °F
T/C # 8	51.9 °F	T/C # 20	— °F
T/C # 9	— °F	T/C # 21	— °F
T/C # 10	— °F	T/C # 22	— °F
T/C # 11	51.3 °F	T/C # 23	— °F
T/C # 12	62.6 °F	T/C # 24	— °F

Thermocouple Readout:

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

ZERO -.4 °F Adj. to 0.0 °F ZERO 0 °F Difference 0 %

SPAN 1999.6 °F Adj. to 2000.0 °F SPAN 2001.0 °F Difference .050 %

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 200.3 °F	400	= 400.0 °F
600	= 600.0 °F	800	= 799.9 °F	1000	= 999.9 °F
1200	= 1199.9 °F	1400	= 1399.6 °F	1600	= 1599.7 °F
1800	= 1800.0 °F	2000	= 2000.0 °F		

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

Scale Check Pre: 14.0 − 4.0 = 10.0

Post: 13.0 − 3.0 = 10.0

Stack Cleaned Prior to Test Run: YES ____ NO X

TABLE 1 ----- RAW DATA

CLIENT : Jotul TEST No. : 5

MODEL: F45 DATE:

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	609.500	0.150	78	0.67	5.50	550
5	611.000	0.500	79	0.46	5.00	300
10	613.804	0.130	79	0.40	4.20	600
15	615.205	0.140	79	0.42	5.80	575
20	616.667	0.150	79	0.39	6.90	550
25	618.195	0.150	80	0.43	6.60	550
30	619.729	0.180	80	0.38	8.30	500
35	621.416	0.180	80	0.24	7.50	500
40	623.104	0.180	80	0.22	8.00	500
45	624.791	0.180	81	0.24	11.30	500
50	626.484	0.180	81	0.28	9.70	500
55	628.177	0.180	81	0.29	11.00	500
60	629.871	0.200	82	0.29	11.60	475
65	631.570	0.200	82	0.16	11.70	475
70	633.270	0.200	82	0.16	11.10	475
75	634.969	0.180	83	0.18	10.40	500
80	636.675	0.180	83	0.16	10.40	500
85	638.381	0.200	83	0.11	11.30	475
90	640.177	0.180	83	0.12	11.40	500
95	641.883	0.180	83	0.11	10.60	500
100	643.589	0.180	83	0.14	8.80	500
105	645.294	0.160	83	0.16	8.60	525
110	646.919	0.140	84	0.22	8.00	550
115	648.476	0.140	84	0.26	7.40	550
120	650.033	0.120	84	0.38	6.80	600
125	651.460	0.120	84	0.43	6.60	600
130	652.888	0.110	84	0.42	6.80	625
135	654.258	0.100	84	0.59	6.60	650
140	655.575	0.080	84	0.97	5.50	725
145	656.757	0.080	84	1.03	5.20	750
150	657.899	0.080	84	1.11	5.20	725
155	659.080	0.090	84	1.15	5.00	700
160	660.304	0.090	84	1.20	5.00	700
165	661.527	0.090	84	1.25	4.90	700
170	662.751	0.100	84	1.16	5.00	675
175	664.020	0.100	84	1.15	4.90	675

180	665.289	0.100	84	1.16	4.90	675
185	666.557	0.100	84	1.16	4.90	675
190	667.826	0.100	84	1.07	5.00	675
195	669.095	0.100	84	1.04	5.00	675
200	670.364	0.100	84	1.01	4.90	675
205	671.633	0.100	84	0.83	5.10	675
210	672.901	0.100	84	1.05	5.00	675
215	674.170	0.100	84	1.03	5.10	675
220	675.439	0.100	84	0.94	5.20	675
225	676.708	0.100	84	1.14	5.00	675
230	677.977	0.100	84	1.23	4.80	675
235	679.245	0.100	84	1.01	4.80	675
240	680.514	0.100	84	1.08	4.60	675
245	681.783	0.100	84	1.14	4.10	675
250	683.052	0.100	84	1.10	4.10	675
255	684.321	0.100	84	1.09	4.10	675
260	685.590	0.100	84	1.06	4.10	675
265	686.858	0.100	84	1.03	4.00	675
270	688.127	0.100	84	1.02	4.00	675
275	689.396	0.100	84	1.00	4.00	675
280	690.665	0.100	84	0.99	4.00	675
285	691.934	0.100	84	0.99	4.00	675
290	693.202	0.100	84	0.95	4.00	675
295	694.471	0.100	84	0.90	4.00	675
300	695.740	0.100	84	0.90	4.00	675
305	697.009	0.100	84	0.80	4.00	650
310	698.326	0.100	84	0.77	3.90	650
315	699.644	0.100	84	0.78	3.90	650
320	700.962	0.100	84	0.75	3.80	650

TABLE 2---RAW DATA

CLIENT : Jotul TEST No. 5

MODEL: F45 DATE:

METER CAL. FACTOR (Y) -------	0.935		Wt. WOOD BURNED(LB) -------	15.4	Lbs
BAROMETRIC PRESS.(Pb) -------	30.04	in Hg	WET,FUEL MOISTURE % -------	15.612	%
LEAK RATE POST (Lp) -------	0.000	cfm	Wt. PART. COLLECTED -------	0.266	g
WATER VOL. (V1c) -------	122.7	Ml	METER VOLUME Vm -------	91.462	mcf
TEST TIME (MIN) -------	320	min	HC MOLE FRACTION -------	0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT : Jotul TEST No. 5

MODEL: F45 DATE:

AVG DELTA H	-------	0.13	in H2O	AVG PRCNT CO	-------	0.71	%
AVG METER TEMP. Tm	-------	83	deg F	AVG PRCNT CO2	-------	6.26	%
AVG PPM SO2	-------	612	PPM	AVG BAL CO2/CO	-------	8.78	%

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul TEST No. 5

MODEL: F45 DATE:

STD SAMPLE VOL. Vm(std) d) ------	83.53	dscf	STACK GAS FLOW Qsd -------	479.957	dscf/Hr
				&	
				8.00	dscf/min
VOL. WATER VAPOR Vw(s td) -----	5.775	scf	PARTICULATE CONCTRT. C s ------	0.0032	g/dscf
PRCNT MSTR Bws -------	6.47	%	PARTC.EMISS. RATE E -------	1.53	g/Hr
BURN RATE BR -------	1.11	Kg/Hr	MOLES OF GAS PER Lb WOOD Nt ----	0.51	Lb-mole/Lb
CO EMISSION RATE -------	114.61	g/Hr	PART.EMISS. RATE ------	1.38	g/Kgdry fuel
	&				
	103.72	g/Kgdry fuel			

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Jotul TEST No. : 5

MODEL: F45 DATE:

TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR	PROPRTN RATE VAR. AVERAGE
5	759.8	98	100
10	774.6	100	
15	773.4	100	
20	773.4	100	
25	772.5	99	
30	774.8	100	
35	774.7	100	
40	775.2	100	
45	774.0	100	
50	776.0	100	
55	776.0	100	
60	775.8	100	
65	738.5	95	
70	738.9	95	
75	737.8	95	
80	779.1	100	
85	779.1	100	
90	779.2	100	
95	779.1	100	
100	779.1	100	
105	778.6	100	
110	778.5	100	
115	780.7	100	
120	780.7	100	
125	780.5	100	
130	781.0	101	
135	780.5	100	
140	780.3	100	
145	781.1	101	
150	780.7	100	
155	780.4	100	
160	781.0	100	
165	780.3	100	
170	781.0	100	
175	780.8	100	
180	780.8	100	

185	780.2	100
190	780.8	100
195	780.8	100
200	780.8	100
205	780.8	100
210	780.2	100
215	780.8	100
220	780.8	100
225	780.8	100
230	780.8	100
235	780.2	100
240	780.8	100
245	780.8	100
250	780.8	100
255	780.8	100
260	780.8	100
265	780.2	100
270	780.8	100
275	780.8	100
280	780.8	100
285	780.8	100
290	780.2	100
295	780.8	100
300	780.8	100
305	780.8	100
310	780.3	100
315	780.9	100
320	780.9	100

COMPUTER INPUT DATA SHEET #1

1,53

Client: Jotul North America

Address: 55 Hotcherson
Gorham, ME 04038

Phone: 1-800-797-5912 Fax: 1-207-591-6623

Run No.: 5 Date of Test: 12-7-2012 Burn Rate: 1.105

Model No.: F45 ☐ min ☐ min-1.25 ☒ fan

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

Dry Gas Meter Y Factor: .935 (0.000) (Data Sheet #2) Post Leak Rate: .000 (.000) cfm (Data Sheet #2) Time: 320 (000) min. (Data Sheet #2)

Dry Gas Meter Volume: 91.462 (00.000) (Data Sheet #2) cf

Stack Flow: 5.795 (00.000) (Data Sheet #2) dscfm Δ H: .131 (.000) (Data Sheet #2) in. H_2O

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

H_2O Captured: 122.7 (00.0) (Data Sheet #3) g

Front Half Catch % Of Total: 35.9 (00.0) (Data Sheet #6) % Total Particulate Catch: .2660 (0.0000) (Data Sheet #6) g

Flue Gas Moisture: 6.4706 (00.000) (Data Sheet #7) %

Particulate Emission: .0492 (0.0000) (Data Sheet #7) gr/dscf

Relative Humidity: 43.0 (00.0) (Data Sheet #8) % RH Ambient Moisture: 1.4 (0.00) (Data Sheet #8) % H_2O

Preburn Fuel Wt.: 31.6 (00.0) (Data Sheet #8) lbs. Coal Bed Wt.: 3.1 (00.0) (Data sheet #8) lbs. Test Fuel Wt.: 15.4 (00.0) (Data sheet #8) lbs.

Heat Output (EPA Default): 13324.3 (00,000.0) (Data Sheet #8) BTU/hr

Kindling Fuel % Moisture (wet): 12.229 (00.000) (Data Sheet #10) % Pretest Fuel % Moisture (wet): 16.759 (00.000) (Data Sheet #10) %

Test Fuel % Moisture (dry): 18.500 (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove]) % Test Fuel % Moisture (wet): 15.412 %

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

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

Average Ambient Temperature: 74 (00) (Data Sheet #14) °F Stove Temperature Change: -55.9 (+/- 000.0) (Data Sheet #14) °F

Test start = 1110
End = 1630

meter temp: 543

METER BOX DATA SHEET PAGE # 2

Page: 1 of 3

UNIT: Jotul F45 RUN: 5 DATE: 12-7-2012

Meter Box: 5H Y Factor: .935

Leak checks: 15 " Hg @ 1,000 cfm _____ " Hg @ _____ cfm

15 " Hg @ 1,000 cfm _____ " Hg @ _____ cfm

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

ROTO: PRESS: .18			SAMPLING RATIO: 21 : 1				BP: 30.04		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1110	609.500	—	6.331	.15	78	550	78	2.0
5	15	611.000	—	11.585	.50	79	300	79	3.0
10	20	613.804	613.804	5.792	.13	79	600	79	2.0
15	25	615.205	615.205	6.044	.14	79	575	79	2.0
20	30	616.667	616.667	6.319	.15	79	550	79	2.0
25	35	618.195	618.195	6.307	.15	80	550	80	2.0
30	40	619.729	619.729	6.938	.18	80	500	80	2.0
35	45	621.416	621.416	6.938	.18	80	500	80	2.0
40	50	623.104	623.104	6.938	.18	80	500	80	2.0
45	55	624.791	624.791	6.925	.18	81	500	81	2.0
50	1200	626.484	626.484	6.925	.18	81	500	81	2.0
55	05	628.177	628.177	6.925	.18	81	500	81	2.0
ROTO PRESS: .18			TOTALS:	83.967	2.30	957	BP.: 30.04		
60	1210	629.871	629.871	7.276	.20	82	475	82	2.0
65	15	631.570	631.570	7.276	.20	82	475	82	2.0
70	20	633.270	633.270	7.276	.20	82	475	82	2.0
75	25	634.969	634.969	6.900	.18	83	500	83	2.0
80	30	636.675	636.675	6.900	.18	83	500	83	2.0
85	35	638.381	638.381	7.263	.20	83	475	83	2.0
90	40	640.177	640.177	6.900	.18	83	500	83	2.0
95	45	641.883	641.883	6.900	.18	83	500	83	2.0
100	50	643.589	643.589	6.900	.18	83	500	83	2.0
105	55	645.294	645.294	6.571	.16	83	525	83	2.0
110	1300	646.919	646.919	6.261	.14	84	550	84	2.0
115	05	648.476	648.476	6.261	.14	84	550	84	2.0
			TOTALS:	82.684	2.14	995	MAX VACC =		2.0
TOTAL Cu Ft.			TOTALS:	166.651	4.44	1952	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 2 of 3

UNIT: Jotul F45 RUN: 5 DATE: 12-7-2012

Meter Box: SH Y Factor: .935

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: 21 : 1				BP: 30.04		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1310	650.033	650.033	5.739	.12	84	600	84	20
125	15	651.460	651.460	5.739	.12	84	600	84	2.0
130	20	652.888	652.888	5.510	.11	84	625	84	2.0
135	25	654.258	654.258	5.298	.10	84	650	84	2.0
140	30	655.575	655.575	4.750	.08	84	725	84	2.0
145	35	656.757	656.757	4.591	.08	84	750	84	2.0
150	40	657.899	657.899	4.750	.08	84	725	84	2.0
155	45	659.080	659.080	4.919	.09	84	700	84	2.0
160	50	660.304	660.304	4.919	.09	84	700	84	2.0
165	55	661.527	661.527	4.919	.09	84	700	84	2.0
170	1400	662.751	662.751	5.101	.10	84	675	84	2.0
175	05	664.020	664.020	5.101	.10	84	675	84	2.0
ROTO PRESS: .18			TOTALS:	61.336	1.14	1008	BP.: 30.04		
180	1410	665.289	665.289	5.101	.10	84	675	84	2.0
185	15	666.557	666.557	5.101	.10	84	675	84	2.0
190	20	667.826	667.826	5.101	.10	84	675	84	2.0
195	25	669.095	669.095	5.101	.10	84	675	84	2.0
200	30	670.364	670.364	5.101	.10	84	675	84	2.0
205	35	671.633	671.633	5.101	.10	84	675	84	2.0
210	40	672.901	672.901	5.101	.10	84	675	84	2.0
215	45	674.170	674.170	5.101	.10	84	675	84	2.0
220	50	675.439	675.439	5.101	.10	84	675	84	2.0
225	55	676.708	676.708	5.101	.10	84	675	84	2.0
230	1500	677.977	677.977	5.101	.10	84	675	84	2.0
235	05	679.245	679.245	5.101	.10	84	675	84	2.0
			TOTALS:	61.212	1.20	1008	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	122.548	2.36	2016	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 3 of 3

UNIT: Total F45 RUN: 5 DATE: 12-7-12

Meter Box: 5H Y Factor: .935

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

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

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

ROTO: PRESS: .18 SAMPLING RATIO: 21 : 1 BP: 30.04

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
240	1510	680.514	680.514	5.101	.10	84	675	84	2.0
245	15	681.783	681.783	5.101	.10	84	675	84	2.0
250	20	683.052	683.052	5.101	.10	84	675	84	2.0
255	25	684.321	684.321	5.101	.10	84	675	84	2.0
260	30	685.590	685.590	5.101	.10	84	675	84	2.0
265	35	686.858	686.858	5.101	.10	84	675	84	2.0
270	40	688.127	688.127	5.101	.10	84	675	84	2.0
275	45	689.396	689.396	5.101	.10	84	675	84	2.0
280	50	690.665	690.665	5.101	.10	84	675	84	2.0
* 285	55	691.934	691.934	5.101	.10	84	675	84	2.0
290	1600	693.202	693.202	5.101	.10	84	675	84	2.0
295	05	694.471	694.471	5.101	.10	84	675	84	2.0
ROTO PRESS:		.18	TOTALS:	61.212	1.20	1008	BP.: 30.04		
300	1610	695.740	695.740	5.101	.10	84	675	84	2.0
305	15	697.009	697.009	5.298	.10	84	650	84	2.0
310	20	698.326	698.326	5.298	.10	84	650	84	2.0
315	25	699.644	699.644	5.298	.10	84	650	84	2.0
320	30	700.962	700.962	5.298	.10	84	650	84	2.0
325				26.293	.150	420			
330				87.505	1.70	1428			
335									
340									
345									
350						5396			
355				376.704	8.50				
			TOTALS:			83	MAX VACC =		3.0
TOTAL Cu Ft.		91.462	TOTALS:	5.795	.131	543	AVG. BP:		30.04

1.65

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : F45 RUN : 5 DATE : 12-7-12

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

SCALE	WEIGHT
295.0 g	295.0
590.0 g	590.0
885.0 g	885.0

IMPINGER	#1	#2	#3	#4
FINAL WT	708.3	582.2	486.8	913.8
INITIAL WT	610.6	577.7	484.1	896.0
NET WT GRAMS	97.7	4.5	2.7	17.8

TOTAL CATCH : 122.7 GRAMS H_2O

FRONT HALF

FILTER #	67F	
FINAL WT g	.6932	
INITIAL WT g	.6310	
NET WT g	.0622	

BEAKER #	81
DESC.	ACETONE
FINAL WT g	101.4941
INITIAL WT g	101.4601
NET WT g	.0340
VOL. DESC. ml	75

BACK HALF

.2751

FILTER #	67B	
FINAL WT g	.3103	
INITIAL WT g	.2846	
NET WT g	.0257	

BEAKER #	82	83	84	85	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	97.5650	98.3296	105.5748	98.0117	
INITIAL WT g	97.4709	98.3224	105.5464	97.9882	
NET WT g	.0941	.0072	.0284	.0235	(.0519)
VOL. DESC ml	125	75	150	135	(285)

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 2-15-12 Time : 1200 By : CP

Manufacturer S & S Grade : # 25 Glass Front Size : 11 cm Lot No. : 393580

Back Size: 8.2 cm Lot No. : 4642341

	DATE: 2-20-12	BY: AV	DATE: 2-23-12	BY: CP	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
61F	0.6288	1330	.6285	1005		
62F	0.6320	1331	.6320	1006		
63F	0.6300	1332	.6298	1007		
64F	0.6272	1333	.6268	1008		
65F	0.6314	1334	.6311	1009		
66F	0.6271	1335	.6272	1010		
67F	0.6314	1336	.6310	1011	← R.5	
68F	0.6298	1337	.6295	1012		
69F	0.6302	1338	.6304	1013		
70F	0.6307	1339	.6307	1014		

61B	0.2826	1320	.2827	1015		
62B	0.2805	1321	.2805	1016		
63B	0.2824	1322	.2824	1017		
64B	0.2811	1323	.2811	1018		
65B	0.2825	1324	.2827	1019		
66B	0.2835	1325	.2836	1020		
67B	0.2845	1326	.2846	1021	← R.5	
68B	0.2845	1327	.2847	1022		
69B	0.2846	1328	.2846	1023		
70B	0.2836	1329	.2837	1024		

Checked by: Armando Date: 2-23-2012 Time: 1245

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
2-20-12	1200	CP		70	48
2-23-12	1000	CP		73	47

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 2-9-2012 Time : 1000 By : CP

	DATE: 2-15-12	BY: AV	DATE: 2-20-12	BY: AV	DATE: 2-24-12	BY: AV
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
76	103.7979	1137	103.7983	1245	-	
77	107.3788	1138	107.3791	1246	-	
78	94.4891	1139	94.4894	1247	-	
79	97.6101	1140	97.6105	1248	-	
80	109.1207	1145	109.1212	1249	-	
81	101.4599	1146	101.4601	1250	-	
82	97.4708	1147	97.4709	1251	-	
83	98.3220	1148	98.3224	1252	- RS	
84	105.5463	1149	105.5464	1253	-	
85	97.9877	1150	97.9882	1254	-	
86	104.7404	1151	104.7408	1255	-	
87	105.9156	1152	105.9161	1256	-	
88	99.9990	1153	99.9993	1257	-	
89	120.6686	1154	120.6690	1258	-	
90	106.4001	1155	106.4004	1259	-	
91	95.0477	1156	95.0482	1300	-	
92	96.6762	1157	96.6764	1301	-	
93	107.8808	1158	107.8816	1302	107.8820	1022
94	106.3620	1159	106.3622	1303	-	
95	107.4074	1200	107.4080	1304	107.4083	1023
96	103.9804	1201	103.9808	1305	-	
97	99.9821	1202	99.9826	1306	-	
98	105.0212	1203	105.0216	1307	-	
99	104.9325	1204	104.9330	1308	-	
100	106.7388	1205	106.7392	1309	-	

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH	
2-15-12	1120	CW	-	70	44	Checked by : C Wainwright
2-20-12	1200	CW	-	70	48	Date : 2-24-12
2-24-12	1015	CW	-	78	46	Time : 1645

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : F45 RUN : 5 DATE : 12-7-12 Page : 1 of 1

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
81	12-8	1800	CP	101.4945	12-9	1415	CP	101.4941	12-10	1510	CP				
82	12-8	1800	CP	97.5654	12-9	1416	CP	97.5630	12-10	1511	CP				
83	12-8	1800	CP	98.3299	12-9	1417	CP	98.3296	12-10	1512	CP				
84	12-8	1800	CP	105.5752	12-9	1418	CP	105.5748	12-10	1513	CP				
85	12-8	1800	CP	98.0122	12-9	1419	CP	98.0117	12-10	1514	CP				

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
67F	12-7	1800	CP	.6929	12-8	1748	CP	.6932	12-9	1412	CP				
67B	12-7	1800	CP	.3106	12-8	1749	CP	.3103	12-9	1413	CP				

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	12-9-12	1400	CP	66	49
2	12-10-12	1500	CP	66	49
3			CP		
4					
5					

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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 10-10-12 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	.0999	CD	10-10-12	1615	75	48
100.0000	10.0001	1.0001	.0999	CD	10-12-12	1230	77	46
99.9997	10.0000	.9999	.0999	CD	10-13-12	0830	77	49
100.0005	10.0000	.9999	.0999	CD	10-14-12	1030	78	46
100.0005	10.0002	.9999	.0998	CD	10-15-12	1000	78	48
100.0001	10.0002	1.0000	.1000	CD	10-16-12	1400	78	49
99.9996	9.9999	.9999	.1000	CD	10-17-12	0900	69	47
100.0000	9.9999	1.0006	.1000	CD	10-18-12	1330	78	37
100.0002	10.0000	.9999	.0999	CD	10-19-12	1130	78	46
100.0001	10.0001	.9999	.0999	CD	10-20-12	1400	78	48
99.9999	10.0001	.9998	.0999	CD	10-23-12	1800	65	43
100.0000	10.0001	1.0001	.0999	CD	10-24-12	1900	65	48
100.0000	9.9998	1.0000	.0998	CD	10-26-12	1750	70	48
100.0001	10.0000	1.0000	.0999	CD	10-28-12	1745	73	47
100.0000	10.0000	1.0000	.0999	CD	11-5-12	1030	74	47
99.9998	10.0000	1.0000	.0999	CD	11-6-12	1000	73	47
100.0000	10.0001	1.0000	.0999	CD	11-7-12	1030	73	47
100.0000	10.0000	1.0000	.1000	CD	11-8-12	0930	66	45
100.0000	9.9999	.9994	.0999	CD	11-12-12	1030	72	42
100.0000	10.0000	1.0000	.1000	CD	11-13-12	1000	71	45
100.0000	10.0000	1.0000	.0999	CD	11-29-12	0910	74	47
100.0000	10.0000	1.0000	.1000	CD	12-1-12	1800	66	49
100.0000	9.9999	1.0001	.0999	CD	12-2-12	1130	67	46
100.0000	10.0000	.9999	.0999	CD	12-3-12	0915	72	46
100.0004	10.0000	1.0000	.1001	CD	12-4-12	1700	69	47
99.9997	9.9999	.9999	.0999	CD	12-5-12	1045	74	44
99.9999	10.0000	1.0000	.0998	CD	12-6-12	1400	66	49
100.0000	9.9999	.9999	.0998	CD	12-7-12	1730	65	48
100.0002	10.0001	1.0000	.1000	CD	12-9-12	1400	62	49
100.0002	10.0001	.9997	.1000	CD	12-10-12	1500	66	49

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	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	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	.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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 4-13-2011 Through 1-13-2012	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0000	10.0001	1.0000	.0998	CP	4-13-11	1030	66	49
100.0001	10.0002	1.0000	.0999	CP	4-15-11	1330	75	48
100.0004	10.0000	.9999	.0998	CP	4-19-11	1600	74	44
100.0003	10.0000	1.0000	.0999	CP	4-20-11	1815	72	46
100.0000	10.0001	.9999	.1000	CP	6-16-11	0900	76	39
99.9997	9.9999	.9998	.0999	CP	6-19-11	1530	74	44
99.9996	10.0002	1.0000	.0999	CP	6-20-11	1600	73	47
100.0000	10.0000	.9998	.0999	CP	6-21-11	1400	73	47
100.0000	10.0000	1.0001	.0999	CP	6-22-11	1200	72	46
99.9999	9.9998	1.0000	.1000	CP	6-23-11	1100	76	49
100.0000	10.0002	1.0000	.0999	CP	6-24-11	1400	75	48
100.0000	10.0000	1.0000	.0999	CP	6-27-11	1230	78	46
100.0001	10.0002	.9999	.0998	CP	6-30-11	1030	78	46
99.9995	10.0000	.9999	.0999	CP	7-1-11	1030	70	48
99.9999	9.9999	1.0000	.1000	CP	7-2-11	1145	75	45
100.0000	9.9999	.9999	.0999	CP	7-5-11	1000	73	47
99.9999	10.0001	1.0000	.0999	CP	7-6-11	0930	76	49
100.0000	9.9997	1.0000	.0997	CP	9-22-11	1710	77	46
100.0000	10.0001	1.0000	.0999	CP	9-24-11	1700	77	49
100.0000	9.9998	1.0001	.1000	CP	9-25-11	1300	76	49
100.0000	9.9999	1.0001	.0998	CP	9-27-11	1000	77	49
99.9996	9.9999	1.0000	.0998	CP	9-29-11	0840	72	42
99.9997	9.9998	.9999	.1000	CP	9-30-11	1000	70	48
99.9996	9.9998	1.0000	.0999	CP	10-1-11	1520	70	45
99.9998	10.0002	1.0000	.0997	CP	10-2-11	1430	74	47
99.9995	10.0001	1.0000	.0999	CP	10-5-11	1510	71	49
100.0000	9.9999	1.0000	.0998	CP	10-6-11	1100	78	40
100.0000	9.9999	1.0000	.0999	CP	10-9-11	1130	75	49
100.0000	10.0001	1.0000	.0998	CP	10-16-11	1540	68	47
100.0000	10.0000	1.0000	.0998	CP	11-9-11	1230	72	46
100.0000	10.0002	.9998	.0998	CP	11-11-11	0815	70	48
99.9999	10.0000	1.0000	.0996	CP	11-15-11	1200	75	48
99.9995	10.0001	.9999	.0999	CP	11-16-11	1400	70	44
99.9999	10.0001	.9999	.0998	CP	11-20-11	1600	73	43
99.9998	9.9999	.9999	.0999	CP	11-21-11	1715	74	47
100.0000	10.0000	1.0000	.0999	CP	11-22-11	1600	65	48
100.0000	10.0000	1.0000	.0999	CP	1-9-12	1030	70	48
100.0000	9.9999	1.0001	.1000	CP	1-11-12	1720	65	48
100.0000	10.0001	1.0000	.0997	CP	1-13-12	1036	72	46

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

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

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
100.0000	10.0002	1.0000	.0998	CP	11-11	0846	67	42
100.0000	10.0000	1.0001	.1000	CP	11-15	0930	70	48
100.0000	10.0001	1.0000	.0999	CP	11-19	0930	65	48
100.0000	10.0000	1.0000	.1000	CP	11-23	1400	66	45
100.0000	9.9997	1.0000	.0998	CP	11-24	1400	65	48
100.0000	10.0000	.9999	.0998	CP	11-26	1100	67	46
100.0000	10.0001	1.0001	.0997	CP	12-14	1000	75	41
100.0001	10.0003	1.0000	.0999	CP	12-16	1100	75	48
100.0000	10.0002	1.0000	.0999	CP	12-18	1000	77	46
100.0000	10.0000	1.0000	.0999	CP	12-21	1100	66	49
100.0000	10.0004	1.0000	.0997	CP	12-22	1400	72	48
100.0000	10.0001	1.0000	.1001	CP	12-23	1100	76	38
100.0000	10.0000	.9999	.0999	CP	12-24	1000	67	46
100.0000	10.0001	1.0001	.0999	CP	12-25	1100	70	49
100.0000	10.0000	1.0000	.0999	CP	1-19-11	0930	66	49
100.0000	9.9999	1.0000	.0999	CP	1-21-11	1400	77	49
99.9996	10.0000	1.0000	.0998	CP	1-25-11	0900	75	48
100.0000	10.0002	1.0001	.1000	CP	1-26-11	1400	74	44
100.0000	10.0001	.9998	.0998	CP	1-27-11	1200	65	48
100.0000	10.0002	1.0000	.0999	CP	1-28-11	1630	70	48
100.0000	10.0001	1.0001	.0999	CP	1-29-11	1200	68	48
100.0000	10.0002	1.0000	.0999	CP	1-30-11	1500	66	49
100.0000	9.9999	1.0000	.0999	CP	2-15-11	0930	75	41
100.0000	10.0000	1.0001	.1000	CP	2-16-11	0930	66	49
100.0000	10.0002	1.0000	.0999	CP	2-22-11	1000	70	48
100.0000	10.0001	1.0002	.0999	CP	3-4-11	1200	69	47
100.0000	10.0004	.9999	.1000	CP	3-5-11	1000	70	48
100.0000	10.0001	1.0000	.0999	CP	3-8-11	1000	74	47
100.0000	10.0000	1.0000	.1000	CP	3-9-11	1600	67	46
100.0000	10.0002	0.9999	.0999	CP	3-10-11	1600	66	49
100.0000	10.0000	1.0000	.0999	CP	3-12-11	1530	73	47
100.0000	10.0001	.9999	.0998	CP	3-13-11	1200	65	48
100.0000	10.0001	1.0000	.0999	CP	3-29-11	1120	76	49
100.0000	10.0000	.9999	.0998	CP	3-30-11	0800	74	47
100.0000	10.0001	1.0000	.0999	CP	3-31-11	1000	70	48
100.0000	10.0002	.9998	.0999	CP	4-4-11	0830	74	47
100.0000	10.0003	1.0000	.1000	CP	4-5-11	1130	73	47
100.0000	9.9999	1.0001	.0999	CP	4-6-11	1030	77	49
100.0000	10.0000	9.9999	.1001	CP	4-7-11	1000	78	40

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

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

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

BLANK PROCESSING DATA SHEET # 5

UNIT : Jotol F45 RUN : 5 DATE : 12-7-2012

BLANKS DONE : 8-31-2010

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

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

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

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

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

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

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

TARE QC

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

FINAL QC

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

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT: Jotul F45 RUN: 5 DATE: 12-7-2012

BLANK CALCULATIONS

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

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

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

FRONT HALF CATCH

FILTERS: .0622 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0622 g

BEAKERS: .0340 (Total Catch) g - 75 (ml Acetone) (.000009 g) (Blank Value / ml Acetone) = .0333 g

TOTAL FRONT HALF CATCH : .0955 g

BACK HALF CATCH

FILTERS: .0257 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0257 g

BEAKERS:

Acetone: .0941 (Total Catch) g - 125 (ml Acetone) (.000009 g) (Blank Value / ml Acetone) = .0930 g

Extract: .0072 (Total Catch) g - 75 (ml Dichloromethane) (.000021 g) (Blank Value / Dichloromethane) = .0056 g

Water: .0519 (Total Catch) g - 265 (ml Water) (.000020 g) (Blank Value / Water) = .0462 g

TOTAL BACK HALF CATCH : .1705 g

TOTAL CATCH : .2660 g

% FRONT HALF : 35.9 %

CALCULATIONS DATA SHEET # 7

UNIT : JOTUL F45 RUN : 5 DATE : 12-7-2012

1) $Vm(std) = \dfrac{(91.462\ Vm)(17.64)(.935\ mcf)\left(30.04\text{ " Hg} + \frac{.131\text{ " } H_2O}{13.6}\right)}{(543\ TmA)} = \dfrac{83.4815}{000.0000}$ dscf

2) $Vw(std) = (.04707)(122.7\ ml\ H_2O) = \dfrac{5.7755}{00.0000}$ scf

3) $Asw = \dfrac{(5.7755\ scf)}{(5.7755\ scf + 83.4815\ dscf)} = \dfrac{.0647}{.0000}$ Bws × 100 = $\dfrac{6.4706}{00.0000}$ % H_2O

4) $Cs = \dfrac{(.2260\ g.)}{(83.4815\ dscf)}(15.43) = \dfrac{.0492}{0.0000}$ gr / dscf

5) Estimated g / hr = $\dfrac{(.2260\ g.)}{(83.4815\ dscf)}\left(\dfrac{5.687}{00.0000}\ dscfm\right)(60) = \dfrac{1.0872}{00.0000}$ 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 F45 RUN: 5 DATE: 12-7-2012

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

Wet Bulb / Dry Bulb

Pre : WB: 63 DB: 25 = 50.0 % RH 1.5 % H_2O

Post : WB: 61 DB: 79 = 36.0 % RH 1.3 % H_2O

Average: 43.0 % 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: 2.5

Preburn Fuel Weight: 15.6 + 13.5 Total: 29.1

Kindling & Preburn Fuel Weight (wood only) (lbs): **Total**: 31.4

Coal Bed Wt Range (lbs): 3.8 - 3.1 **Scale**: 3.8 - 3.1

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

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

Maximum Coal Bed Removal (lbs): ((3.8 (Upper) + 3.1 (Lower)) ÷ 2) .25 = 1.8 (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"	17	3	6.9	44.8
4" × 4"	17	2	8.5	55.2

Test Fuel Weight: 15.4 lbs

Estimated Dry Burn Rate:

$$\frac{15.4 - (15.4 \times .1562)}{2.2046} \times \frac{60}{\frac{320}{\text{TIME}}} = 1.105 \text{ kg / hr}$$

Estimated BTU's/hr: 19,140 × $\frac{63}{100}$ × $\frac{1.105}{\text{DBR}}$ = 133243 BTU's/hr

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

285.

WOOD STOVE OPERATING DATA PAGE #9

Unit : Jotul F45 Run : 5 Date : 12-7-2012

FIRE STARTED: 0720

WARM UP AND PREBURN:

PRIMARY AIR : Set wide open for all warm-up / preburn fuel charges. Then set to 1/2" at start of preburn.

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

CHARCOAL BED PREPARATION :

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

TEST:

DOOR wide open during loading 0 min. 25 sec.

PRIMARY AIR : Opened full for first 5 min., then set to run setting of 1/2".

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

FAN:

ON / OFF during warm-up

ON / OFF first ALL minutes of test

Fan speed set at OFF

ON / OFF during preburn

ON / OFF balance of test run

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

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

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

All Grades WCLB rules:

WARM UP INFORMATION:

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

1st warm up / pre-burn fuel charge (15.6 lbs.) added at 0732

2nd warm up / pre-burn fuel charge (13.5 lbs.) added at 0900

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

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

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

TEST DATA SHEET #10

Unit : Jotul F45 Run : 5 Date : 12-7-2012

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

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

Time Test Fuel moisture reading taken : 1045

pc #	Dimen.	Use	TOP	BOTTOM	SIDE	Avg Corrected
1	2"×4"×8'	K	14.2	13.7	13.9	13.933
2						
3						
4	2"×4"×8'	P	22.6	22.4	23.0	22.7
5	2"×4"×8'	P	19.1	19.7	19.4	19.4
6	2"×4"×8'	P	18.2	18.4	18.2	18.3
7	2"×4"×8'	P				(20.4)
8	2"×4"×8'	P				
9						
10						
11						
12	2"×4"×17"	T	18.1	18.2	18.2	18.2
13	"	T	18.0	18.1	17.9	18.0
14	"	T	19.7	20.0	19.9	19.9
15	4"×4"×17"	T	18.2	18.2	18.3	18.2
16	"	T	18.1	18.2	18.2	18.2
17						(92.5)
18						
19						
20	Spacers	T	23.6	22.9	20.6	22.367

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	13.933 %	20.133 %	18.500 %
Wet Moisture % :	12.229 %	16.759 %	15.612 %

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

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

GAS DATA SHEET #12

WEIGHT: 3.1 DATE: 12-7-2012

UNIT: Jotul F45 RUN: 5 PAGE: 1 OF 2

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
0 10	18.5	15.4	—	.216	5.4	.587	14.7	065	.67	.032	575
15	18.2	15.1	.3	.199	5.0	.611	15.3	.044	.46	.037	300
10 20	17.8	14.7	.4	.165	4.2	.647	16.2	.037	.40	.037	600
25	17.4	14.3	.4	.230	5.8	.583	14.6	.039	.42	.041	575
0 30	16.8	13.7	.6	.274	6.9	539	135	036	.39	.042	550
25 35	16.3	13.2	.5	.263	6.6	.551	13.8	.041	.43	.043	550
0 40	15.9	12.8	.4	.331	8.3	.483	12.1	.035	.38	.044	500
45	15.4	12.3	.5	.300	7.5	.523	13.1	021	.24	.046	500
40 50	14.9	11.8	.5	.319	8.0	503	12.6	019	.22	.047	500
55	14.3	11.2	.6	.453	11.3	.372	9.3	.021	.24	.048	500
50 1200	13.8	10.7	.5	.389	9.7	.431	10.8	.025	.28	.048	500
05	13.2	10.1	.6	.440	11.0	.380	9.5	.026	.29	.050	500
JBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.515	*****
10	12.4	9.3	.8	.464	11.6	.356	8.9	.026	.29	.052	475
15	11.8	8.7	.6	.468	11.7	356	8.9	.013	.16	.052	475
20	11.3	8.2	.5	.443	11.1	.380	9.5	.013	.16	.052	475
25	10.8	7.7	.5	.414	10.4	.407	10.2	.015	.18	.052	500
30	10.2	7.1	.6	.415	10.4	.407	10.2	013	.16	.052	500
35	9.7	6.6	.5	.453	11.3	.376	9.4	.008	.11	.052	475
40	9.1	6.0	.6	.456	11.4	.372	9.3	.009	.12	.052	500
45	8.7	5.6	.4	.422	10.6	.403	10.1	008	.11	.051	500
50	8.2	5.1	.5	.353	8.8	.475	11.9	.011	.14	.050	500
55	7.9	4.8	.3	.345	8.6	.479	12.0	.013	.16	.049	525
100	7.5	4.4	.4	.318	8.0	.503	12.6	.019	.22	.047	550
05	7.3	4.2	.2	.295	7.4	.523	13.1	.023	.26	.047	550
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.608	*****
10	7.1	4.0	.2	.270	6.8	.543	13.6	035	.38	.045	600
15	6.8	3.7	.3	.264	6.6	.551	13.8	.041	.43	.045	600
20	6.6	3.5	.2	.272	6.8	.543	13.6	.039	.42	.043	625
25	6.4	3.3	.2	.265	6.6	.543	13.6	.057	.59	.042	650
30	6.3	3.2	.1	.218	5.5	.591	14.3	.095	.97	.041	725
35	6.1	3.0	.2	.206	5.2	583	14.6	.101	1.03	.040	750
40	6.0	2.9	.1	.206	5.2	.579	14.5	.109	1.11	.039	725
45	5.9	2.8	.1	.201	5.0	.567	14.7	.113	1.15	.038	700
50	5.8	2.7	.1	.198	5.0	.583	14.6	.118	1.20	.037	700
55	5.7	2.6	.1	.197	4.9	.587	14.7	.123	1.25	.037	700
200	5.6	2.5	.1	198	5.0	.583	14.6	.114	1.16	.036	675
05	5.5	2.4	.1	197	4.9	591	14.8	113	1.15	.036	675
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.479	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	1.602	*****

GAS DATA SHEET #12

WEIGHT: 3.1 DATE: 12-7-12

UNIT: Jotul F. 45 RUN: 5 PAGE: 2 OF 2

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
180 10	5.4	2.3	.1	.196	4.9	.587	14.7	.114	1.16	-.035	675
185 15	5.3	2.2	.1	.197	4.9	.587	14.7	.114	1.16	-.035	675
190 20	5.2	2.1	.1	.200	5.0	587	14.7	.105	1.07	-.035	675
195 25	5.1	2.0	.1	.200	5.0	.591	14.8	.102	1.04	-.035	675
200 30	5.1	2.0	0	.196	4.9	.595	14.9	.099	1.01	-.035	675
205 35	5.0	1.9	.1	.205	5.1	.595	14.9	.081	.83	-.035	675
210 40	4.9	1.8	.1	.200	5.0	.591	14.8	.103	1.05	-.035	675
215 45	4.8	1.7	.1	.202	5.1	.587	14.7	.101	1.03	-.035	675
220 50	4.7	1.6	.1	.208	5.2	.587	14.7	.092	.94	-.035	675
225 55	4.6	1.5	.1	.201	5.0	.587	14.7	.112	1.14	-.035	675
230 300	4.5	1.4	.1	.192	4.8	.591	14.8	.121	1.23	-.035	675
235 05	4.4	1.3	.1	.190	4.8	.599	15.0	.099	1.01	-.034	675
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.419	*****
240 10	4.3	1.2	.1	.184	4.6	.603	15.1	.106	1.08	-.034	675
245 15	4.2	1.1	.1	.162	4.1	.623	15.6	.112	1.14	-.034	675
250 20	4.1	1.0	.1	.164	4.1	.623	15.6	.108	1.10	-.033	675
255 25	4.0	.9	.1	.163	4.1	.623	15.6	.107	1.09	-.033	675
260 30	4.0	.9	0	.162	4.1	.623	15.6	.104	1.06	-.032	675
265 35	3.9	.8	.1	.161	4.0	.631	15.8	.101	1.03	-.032	675
270 40	3.8	.7	.1	.161	4.0	.631	15.8	.100	1.02	-.032	675
275 45	3.7	.6	.1	.161	4.0	.631	15.8	.098	1.01	-.032	675
280 50	3.7	.6	0	.161	4.0	.631	15.8	.097	.99	-.032	675
285 55	3.6	.5	.1	.160	4.0	.631	15.8	.097	.99	-.032	675
290 400	3.6	.5	0	.161	4.0	.635	15.9	.093	.95	-.032	675
295 05	3.5	.4	.1	.158	4.0	.635	15.9	.088	.90	-.032	675
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.390	*****
300 10	3.4	.3	.1	.158	4.0	.635	15.9	.088	.90	-.032	675
305 15	3.3	.2	.1	.160	4.0	.639	16.0	.078	.80	-.032	650
310 20	3.3	.2	0	.157	3.9	.643	16.1	.075	.77	-.032	650
315 25	3.2	.1	.1	.154	3.9	.643	16.1	.076	.78	-.031	650
320 30	3.1	0	.1	.153	3.8	.651	16.3	.073	.75	-.031	650
325										.158	
330											
335								page	total	.967	
340											
345											
350											
355											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	2.569	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.040	*****

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AVG

PREBURN DATA SHEET #13

UNIT: Jotul F45 RUN: 5 DATE: 12-7-2012 PAGE: 1 of 1

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
0/10:10	4.6	—	484	741	600	317	590	470			73	-.05	PREBURN START: # 18 UP
5/15	4.3	.3	370	625	603	350	582	477			72	-.045	COAL BED SCALE RANGE:
10/20	4.1	.2	327	548	587	358	566	477			73	-.042	3.8 → 3.1
15/25	4.0	.1	303	500	567	360	574	474			73	-.040	PRIMARY AIR: 1/2"
20/30	3.9	.1	287	466	552	359	531	469			72	-.038	SECONDARY AIR: N/A
25/35	3.8	.1	273	437	535	355	516	464			73	-.037	FAN: OFF
30/40	3.7	.1	263	414	520	352	502	458			73	-.036	PUMPS ON AT:
35/45	3.6	.1	258	403	507	351	492	455			72	-.035	CHECK WB/DB: N/A
40/50	3.5	.1	246	390	494	349	481	451			72	-.035	
45/55	3.4	.1	238	377	483	346	473	445			73	-.035	
50/11:00	3.3	.1	235	370	473	344	465	440			73	-.035	
55/05	3.2	.1	230	362	465	341	459	434			73	-.035	
*****	****	***	****	*****	*****	****	*****	*****	*****	*****	*****	****	
LD/10	3.1	.1	234	350	459	339	454	431			73	-.032	
15													
20													
25													
30													
35													
40													

Jotul - F45

Temperature Data Sheet 14

Run 5
12/7/12

Time	Stack	Top	LT Side	Back	Rt Side	Bottom	Firebox	Sec/Cat	Ambient	Tube Furn	Smpl Box	Smpl Out	C-Gas Box	C-Gas Out	SO2 Out
********	Chn 103	Chn 104	Chn 105	Chn 106	Chn 107	Chn 108	Chn 109	Chn 110	Chn 111	Chn 112	Chn 113	Chn 114	Chn 115	Chn 116	Chn 117
0	234	350	459	339	454	431	######	######	73	1534	235	56	248	34	36
5	306	356	442	353	439	422	######	######	73	1514	234	39	248	34	35
10	257	360	420	336	424	414	######	######	73	1498	234	39	247	34	35
15	266	389	400	321	410	408	######	######	72	1484	233	38	247	34	36
20	289	448	387	309	401	400	######	######	72	1471	233	39	247	34	36
25	287	448	379	302	395	393	######	######	72	1461	232	38	246	35	36
30	305	488	375	297	389	386	######	######	72	1452	231	39	246	35	36
35	309	492	377	297	386	378	######	######	73	1446	230	39	245	36	37
40	319	526	378	296	385	371	######	######	72	1439	230	39	244	36	37
45	356	587	391	299	392	364	######	######	73	1432	230	39	244	36	37
50	351	593	413	308	410	358	######	######	72	1428	230	39	244	36	37
55	367	613	434	318	429	353	######	######	73	1425	231	39	245	36	38
60	384	642	455	330	448	348	######	######	73	1422	232	40	246	37	38
65	393	653	475	342	469	345	######	######	73	1419	232	40	246	37	38
70	389	643	494	355	489	343	######	######	74	1415	232	40	246	37	39
75	379	625	510	368	506	340	######	######	73	1411	231	40	246	37	39
80	378	620	524	380	520	339	######	######	74	1408	232	40	246	38	39
85	388	632	532	391	535	339	######	######	75	1406	232	41	246	38	39
90	394	647	542	402	549	337	######	######	75	1406	233	42	247	38	39
95	390	649	554	413	559	337	######	######	75	1406	233	41	247	38	40
100	370	618	561	424	565	337	######	######	75	1407	234	41	248	38	40
105	356	587	562	434	562	336	######	######	75	1408	234	42	248	38	40
110	341	559	561	443	556	336	######	######	76	1410	235	42	248	38	40
115	326	533	557	450	549	335	######	######	76	1413	235	43	248	38	40
120	313	502	550	454	541	335	######	######	76	1414	236	43	248	38	40
125	304	485	541	456	533	334	######	######	76	1415	236	43	248	38	40
130	298	473	533	456	526	334	######	######	76	1415	235	44	248	38	40
135	289	461	526	458	521	335	######	######	76	1416	235	44	248	38	40
140	273	433	519	458	515	336	######	######	76	1417	235	44	248	38	40
145	264	413	509	453	507	339	######	######	76	1418	234	44	247	38	40
150	256	398	499	449	499	342	######	######	76	1419	234	45	246	37	39
155	250	385	490	445	492	345	######	######	76	1420	234	46	246	37	39
160	243	374	483	441	485	347	######	######	76	1422	234	46	246	37	39
165	238	365	476	439	478	347	######	######	76	1422	233	46	245	37	39
170	235	357	471	437	472	348	######	######	76	1422	232	46	244	37	38

TEMPERATURE DATA SHEET #14A

		TEST TIME	320		
STACK AVG	268	TOP AVG	415	LT SIDE AVG	460
BACK AVG	400	RT SIDE AVG	451	BOTTOM AVG	340
FIREBOX AVG	########	SEC/CAT AVG	########	AMBIENT AVG	74

END	346.4	
START	402.3	
	-55.9	DELTA T

CIRCLE: LOSS / GAIN

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 12-7-2012 Analyte : CO_2 (15-1)

Unit : JOHN F45 Run # : 5

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 % CO_2 Cyl. Press. : 490 PSI

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

Span Cyl. # : 487905 Conc. : 12.20 % CO_2 Cyl. Press. : 1500 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 : Clyde Watling Time : 1045 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	.013	.013	.051
SPAN	48.8	.488	12.20	48.8	.488	12.219	.019	.074

POST RUN Audit : by : Clyde Watling Time : 1700 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	.063	.063	.251
SPAN	48.8	.488	12.20	48.6	.486	12.169	-.031	-.126

± 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 : 12-7-2012 Analyte : O_2 (15-2)

Unit : Jotul F45 Run # : 5

Zero Cyl. # : 168TAC 3A Conc. : 0.00 % O_2 Cyl. Press. : 490 PSI

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

Span Cyl. # : 487905 Conc. : 12.60 % O_2 Cyl. Press. : 1500 PSI

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 25.0 % O_2

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

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

PRE RUN Audit : by : Cp Watling Time : 1045 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	.005	.005	.020
SPAN	12.60	.504	12.6	12.6	.504	12.615	.015	.058

POST RUN Audit : by : Cp Watling Time : 1700 Temp : 73 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.005	.005	.020
SPAN	12.60	.504	12.6	12.6	.503	12.590	-.010	-.042

± 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 - 7 - 2012 Analyte : CO (15-3)

Unit : Total F-45 Run # : 5

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 % CO Cyl. Press. : 490 PSI

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

Span Cyl. # : 487905 Conc. : 4.90 % CO Cyl. Press. : 1500 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 : Clyde Watkins Time : 1045 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	.026	.026	.256
SPAN	49.0	.490	4.90	49.0	.490	4.912	.012	.122

POST RUN Audit : by : Clyde Watkins Time : 1700 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	.026	.026	.256
SPAN	49.0	.490	4.90	49.1	.491	4.922	.022	.221

± 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 : 12-7-2012 Analyte : SO_2 (15-4)

Unit : Jotul F45 Run # : 5

Zero Cyl. # : 168TAC 3-A Conc. : 0.00 ppm SO_2 Cyl. Press. : 490 PSI

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

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

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

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

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

Flow : 1.5 SCFH Measured by : Rotameter

EPA Span Value = 2500 ppm SO_2

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

PRE RUN Audit : by : CP Workman Time : 1045 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	6.273	6.273	.251
SPAN	50.0	.500	1250	50.0	.500	1251.3	1.300	.520

POST RUN Audit : by : CP Workman Time : 1700 Temp : 73 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.3	.003	13.743	13.743	.550
SPAN	50.0	.500	1250	50.0	.500	1251.3	1.300	.526

± 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 F45 RUN : 5 DATE : 12-7-2012

Thermocouple Check:

T/C # 1	— °F	T/C # 13	61.4 °F
T/C # 2	— °F	T/C # 14	61.8 °F
T/C # 3	63.0 °F	T/C # 15	60.0 °F
T/C # 4	56.1 °F	T/C # 16	50.8 °F
T/C # 5	53.2 °F	T/C # 17	47.0 °F
T/C # 6	53.0 °F	T/C # 18	65.9 °F
T/C # 7	53.8 °F	T/C # 19	— °F
T/C # 8	53.7 °F	T/C # 20	— °F
T/C # 9	— °F	T/C # 21	— °F
T/C # 10	— °F	T/C # 22	— °F
T/C # 11	54.8 °F	T/C # 23	— °F
T/C # 12	63.4 °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 0.0 °F Difference 0 %

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

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 200.3 °F	400	= 400.0 °F
600	= 600.0 °F	800	= 799.9 °F	1000	= 999.9 °F
1200	= 1199.8 °F	1400	= 1399.6 °F	1600	= 1599.6 °F
1800	= 1800.0 °F	2000	= 2000.0 °F		

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

Scale Check Pre : 14.0 − 4.0 = 10.0

Post : 13.0 − 3.0 = 10.0

Stack Cleaned Prior to Test Run : YES _____ NO X

Inspection Certificate

Phillips Morris Scale Company
Partners in Weighing Systems
934 Elliott Avenue W.
Seattle, WA 98119
Ph#(206)284-6090
Fax#(206)282-6612

Customer: LOKEE TESTING
Address: 13235 Prairie Circle
Sumner WA 98390
Technician: Patrick McLellan

Authorization Signature: _____

Date of Inspection: 11-26-02
Next Inspection Due: 5-03

Certification Type
- ✓ Standard
- __ ISO 9000
- __ MIL STD-45662

Equipment Tested

Indicator
Make: Weightronix
Model: WI-110
SR#: 16409
Class: III
Cap.: 1000 lbs

Base

Options Installed
Printer: _____
Score Board: _____
Computer: _____
Other: _____

Pre-test	Post-test	Manufacturer Tolerance
Ø	Ø	
	499.9	
998.7	1000.0	

Corner Test: P ✓ F __
Shift Test: P ✓ F ✓
Static Test: 2 min. __ ✓ 5 min. __

Weight Kit#: _____ NIST#: _____

Serial Numbers of Weights Used (or copy of certificate)

T23-13	T23-14			

Any changes to document or scale not authorized by Phillips & Morris Scale Company VOIDS this certificate.

WASHINGTON STATE DEPARTMENT OF **AGRICULTURE**

METROLOGY LABORATORY

Receipt Date:	January 29, 2002	State Test Number:	L2017-1
Test Date:	February 13, 2002	Group ID:	SHOP
Report Date:	February 13, 2002	Due Date:	February 13, 2004

CALIBRATION REPORT

Phillips Morris Scale Company
934 Elliott Ave. W
Seattle, WA 98119-3608
Contact: Todd Mackie
Phone: 206-284-6090
PO Number: 2-2-009237
SOP: 8

Item(s) Submitted:	See Table Below
Specification:	NIST HB 105-1, Class F
Condition:	Good
Temperature:	21.0 °C
Pressure:	762.0 mmHg
Humidity:	35 % RH
Technician ID:	DW

Description	Value / Range	Qty	Material	Manufacture	Serial Number
Test Weight	1000 lb	5	Cast Iron	Rice Lake	OFT0, OFT1, OFT2, ~~OFSY, OFSZ~~
Test Weight	500 lb	12	Cast Iron	Rice Lake	T23-13 to T23-16, T23-20, T23-24, T23-26, T23-28 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

NVLAP

NVLAP LAB CODE 200446-0

MAR 0 8 2002

W98MR42-01, 11/98

2747 29th Avenue Southwest ▼ Tumwater, Washington 98512 ▼ (360) 753-5042 ▼ (360) 586-4728 fax

Established 1974

QUALITY CONTROL SERVICES

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

,okee 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

ermanent Information Concerning this Equipment:

Comments/Info Concerning this Calibration:

echnician: D. Deleasa

Signature: D. Deleasa

ıstruments listed above were calibrated using standards traceable to the National Institute of Standards and Technology (NIST). Calibration data reflect results at the time and location of calibration. Calibration data should be reviewed to insure that the instrument is performing to its required accuracy.

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Lokee Testing Labs
13235 Prairie Circle East
Bonney Lake, WA 98390

Report Number: LOKT0137010004120612

CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Balance	Sartorius	A120S	37010004	N/A	Lab
Units	**Readability**	**SOP**	**Cal Date**	**Last Cal Date**	**Cal Due Date**
g	0.0001	QC012	6/12/12	12/8/11	12/2012

FUNCTIONAL CHECKS

ECCENTRICITY		LINEARITY		REPEATABILITY	
Test Wt:	Tol:	Test Wt:	Tol:	Test Wt:	Tol:
100	0.0003	50x2	0.0004	10	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	100.0000
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	9/28/11	9/2012	822/274334-07

ermanent Information Concerning this Equipment:

Comments/Info Concerning this Calibration:

echnician: D. Deleasa

Signature: D. Deleasa

struments listed above were calibrated using standards traceable to the National Institute of Standards and Technology (NIST). Calibration data reflect results at the time and location of calibration. Calibration data should be reviewed to insure that the instrument is performing to its required accuracy.

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ACCREDITED
Calibration Services
Certificate Number: 1550.01
Laboratory code: 115953

Lokee Testing Labs
13235 Prairie Circle East
Bonney Lake, WA 98390

Report Number: LOKT0137010004111208

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	12/8/11	6/9/11	6/2012

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	100.0000
70	69.9999	70.0000
50	49.9999	50.0000
20	20.0000	20.0000
10	10.0000	10.0000
5	5.0000	5.0000

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Weight Set	R.L./Troemner	1MG-25KG	A45	9/28/11	9/2012	822/274334-07

ermanent Information Concerning this Equipment:

Comments/Info Concerning this Calibration:

echnician: D. Deleasa

Signature: D. Deleasa

ıstruments listed above were calibrated using standards traceable to the National Institute of Standards and Technology (NIST). Calibration data reflect results at the time and location of calibration. Calibration data should be reviewed to insure that the instrument is performing to its required accuracy.

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Lokee Testing Labs
13235 Prairie Circle East
Bonney Lake, WA 98390

Report Number: LOKT0137010004110609

CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Balance	Sartorius	A120S	37010004	N/A	Lab
Units	**Readability**	**SOP**	**Cal Date**	**Last Cal Date**	**Cal Due Date**
g	0.0001	QC012	6/9/11	12/3/10	6/2012

FUNCTIONAL CHECKS

ECCENTRICITY	LINEARITY	REPEATABILITY
Test Wt: 100	Test Wt: 50x2	Test Wt: 100
Tol: 0.0003	Tol: 0.0004	Tol: 0.0001
As-Found: Pass: ☑ Fail: ☐	As-Found: Pass: ☑ Fail: ☐	As-Found: Pass: ☑ Fail: ☐
As-Left: Pass: ☑ Fail: ☐	As-Left: Pass: ☑ Fail: ☐	As-Left: Pass: ☑ Fail: ☐

CALIBRATION DATA

Standard	As-Found	As-Left
100	100.0002	99.9999
70	70.0001	70.0000
50	50.0001	50.0000
20	20.0000	20.0000
10	10.0000	10.0000
5	5.0000	5.0000

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Weight Set	R.L./Troemner	1MG-25KG	A45	10/18/10	10/2011	822/274334-07

'ermanent Information Concerning this Equipment:

Comments/Info Concerning this Calibration:

'echnician: D. Deleasa

Signature: D. Deleasa

ıstruments 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.

Established 1974

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Lokee Testing Labs
13235 Prairie Circle East
Sumner, WA 98390

Report Number: LOKT0137010004100616

CERTIFICATE OF CALIBRATION WITH DATA

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location
Balance	Sartorius	A120S	37010004	N/A	Lab
Units	**Readability**	**SOP**	**Cal Date**	**Last Cal Date**	**Cal Due Date**
g	0.0001	QC012	6/16/10	12/3/09	12/2010

FUNCTIONAL CHECKS

ECCENTRICITY		LINEARITY		REPEATABILITY	
Test Wt:	Tol:	Test Wt:	Tol:	Test Wt:	Tol:
100	0.0003	50x2	0.0004	100	0.0001
As-Found:		As-Found:		As-Found:	
Pass: ☑	Fail: ☐	Pass: ☑	Fail: ☐	Pass: ☑	Fail: ☐
As-Left:		As-Left:		As-Left:	
Pass: ☑	Fail: ☐	Pass: ☑	Fail: ☐	Pass: ☑	Fail: ☐

CALIBRATION DATA

Standard	As-Found	As-Left
100	99.9999	99.9999
70	70.0000	70.0000
50	50.0000	50.0000
20	20.0000	20.0000
10	10.0000	10.0000
5	5.0000	5.0000

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Cal Date	Cal Due Date	NIST ID
Weight Set	R.L./Troemner	1MG-25KG	A45	10/12/09	10/2010	822/274334-07

Permanent Information Concerning this Equipment:

Comments/Info Concerning this Calibration:

Technician: D. Deleasa **Signature:** D. Deleasa

Instruments listed above were calibrated using standards traceable to the National Institute of Standards and Technology (NIST). Calibration data reflect results at the time and location of calibration. Calibration data should be reviewed to insure that the instrument is performing to its required accuracy. Calibrations comply with ISO/IEC 17025 and ANSI/Z540-1-1994 quality standards.

Thermocouple Calibration Record Semi-Annual

Thermocouples Check against
Reference Thermometer serial number 9123454
Ice Water Bath 32.0
Boiling Water 212.0
Room Temperature 74
Barometric Pressure 30.10
DATE: 8-29-2012

TC	Location	Ice Bath Temp	Boiling Water Temp
1	Wet Bulb	32.1	211.9
2	Dry Bulb	32.0	211.7
3	Stack	32.3	211.9
4	Stove Top	32.0	212.1
5	Left Side	32.2	212.0
6	Back	32.1	211.3
7	Right Side	32.0	211.6
8	Bottom	32.0	212.1
9	Firebox	32.3	211.1
10	Secondary/Cat	32.4	211.8
11	Ambient	32.2	211.9
12	Tube Furnace	32.1	211.8
13	Sample Box	32.0	211.3
14	Impinger Out	32.1	211.9
15	C. Gas Box	32.2	211.9
16	C. Gas Out	32.3	211.8
17	SO2 Out	32.1	211.3
18	Upper Ambient	32.0	212.0
19			
20			
21			
22			
23	Calibrator	32.0	212.0
24	Oven	32.2	211.9

Thermocouple Readout Semi-Annual Calibration Data Sheet

Date: 8-28-2012
Ambient Temperature: 74
Technician: GP

Thermocouple Number: T/C Readout
Barometric Pressure: 30.10
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	249.8	.080
300	Omega	300.0	299.8	.067
400	Omega	400.0	399.7	.075
500	Omega	500.0	499.7	.060
600	Omega	600.0	599.6	.067
700	Omega	700.0	699.8	.029
800	Omega	800.0	799.7	.038
900	Omega	900.0	899.7	.033
1000	Omega	1000.0	999.6	.040
1200	Omega	1200.0	1199.6	.033
1400	Omega	1400.0	1399.7	.021
1600	Omega	1600.0	1599.7	.019
1800	Omega	1800.0	1899.6	.022
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: 8-28-2012

SO^2 INJECTION ROTAMETER FISHER SN 9123454

NIST Traceable

Actual	°C = °F	°F
0.0	32.0	32.0
18.0	64.4	64.4
32.2	90.0	90.0
45.6	82.1	87.1

DRY GAS METER THERMOCOUPLES

Actual	°C = °F	5H in	5H out	KK
0.0				
17.8	64.0	64.1	64.0	
31.4	88.5	88.6	88.5	
44.2	111.6	111.8	111.7	

SLING PSYCHROMETER

Actual	°C = °F	Wet Bulb	Dry Bulb
00	32.0	32.0	32.0
17.8	64.0	64.0	64.0
30.8	87.4	87.4	87.4
43.4	110.1	110.0	110.1

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	H
Console Serial Number	
DGM Model Number	
DGM Serial Number	

Calibration Conditions			
Date	Time	28-Aug-12	13:00
Barometric Pressure		30.1	in Hg
Theoretical Critical Vacuum[1]		14.2	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
15.0	0.4	332.000	337.000	81	85	GX-40	0.2333	81	83	25
10.3	0.5	337.000	342.000	85	86	GX-48	0.3392	83	85	24
7.9	0.6	342.000	347.000	86	85	GX-55	0.4457	85	86	22
6.0	0.6	347.000	352.000	84	84	GX-63	0.5870	85	86	21
4.5	0.7	352.000	357.000	84	83	GX-73	0.8091	86	87	18

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	
4.896	0.326	4.525	0.302	0.924	-0.011	0.302	2.426	1.286
4.874	0.472	4.522	0.438	0.928	-0.007	0.438	1.376	0.237
4.875	0.614	4.561	0.574	0.935	0.001	0.574	0.916	-0.223
4.890	0.815	4.539	0.756	0.928	-0.006	0.756	0.607	-0.532
4.895	1.088	4.688	1.042	0.958	0.023	1.042	0.371	-0.768
				0.935	Y Average		1.139	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	P_m	$V_{m(i)}$	$V_{m(f)}$	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

SO_2 ROTAMETER CALIBRATION

Last Cal. : 1-4-2012 By : CP Date : 8-28-12 By : CP

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

Barometric Pressure : 30.10 " Hg Temperature : 75

RUN #	50 CC/MINUTE DIGICAL VOLUME	100 CC/MINUTE DIGICAL VOLUME	150 CC/MINUTE DIGICAL VOLUME
1	56.1	120.3	173.7
2	56.0	120.2	174.0
3	55.9	120.5	173.1
4	55.7	119.7	173.5
5	56.1	121.2	174.2
6	56.0	120.7	173.0
7	56.2	120.2	172.9
8	56.3	121.0	172.9
9	55.7	120.5	173.7
10	56.0	120.2	173.9
AVERAGE	56.0 cc/min	120.5 cc/min	173.5 cc/min

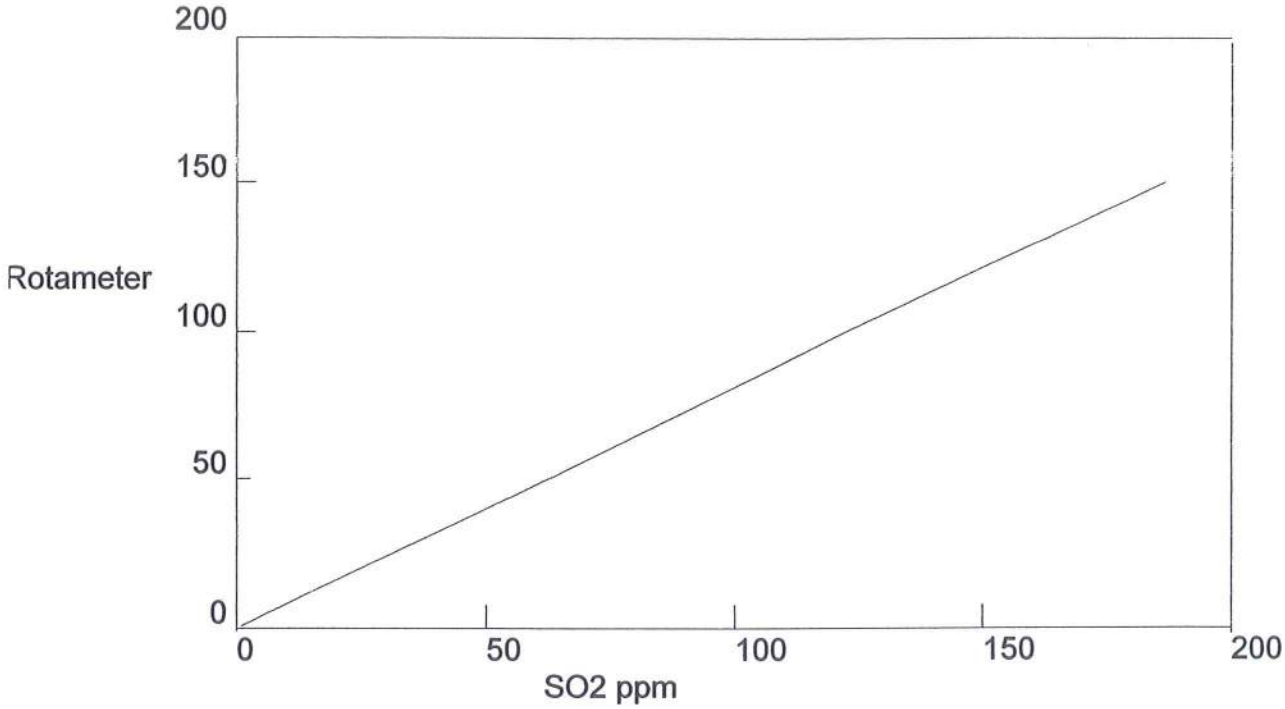
SETTING	cc/min
0	0.0
50	56.0
100	120.5
150	173.5

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

100 CC / MINUTE = 85.7

SO2 Rotameter

08/28/12



Regression Output:

Constant	-0.25
Std Err of Y Est	3.335416016
R Squared	0.9987013745
No. of Observations	4
Degrees of Freedom	2
X Coefficient(s)	1.17
Std Err of Coef.	0.0298328678

range-analyze-regression

0	0
50	56
100	120.5
150	173.5

TRACER GAS TRAIN RESPONSE TIME

DATE: 8-28-12

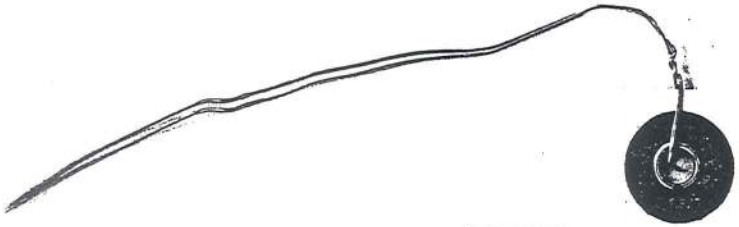
Elapsed Time	SO_2 Conc. (v.)	SO_2 Conc. (v.)	SO_2 Conc. (v.)
00 sec	.515	.514	.515
15	.299	.305	.305
30	.185	.188	.185
45	.135	.136	.138
60	.087	.090	.088
75	.065	.065	.063
90	.042	.044	.041
105	.025	.025	.028
120	.017	.018	.017
135	.011	.012	.011
150	.007	.007	.006
165	.003	.004	.003
180	.001	.002	.001
Initial Response	12	12	12
95 % Response	104	104	105
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	.499	.501	.501	.000	.000	.001	.491	.500	.500
15	.485	.482	.480	.431	.440	.438	.250	.240	.240
30	.342	.345	.340	.742	.743	.745	.050	.045	.050
45	.148	.150	.150	.801	.811	.810	.019	.018	.015
60	.082	.080	.083	.827	.824	.824	.007	.006	.004
75	.039	.037	.038	.824	.826	.825	.002	.002	.001
90	.020	.021	.022	.827	.828	.827	Ø	Ø	Ø
105	.013	.014	.014						
120	.007	.008	.007						
135	.004	.005	.002						
150	.002	.002	.001						
165	.001	.001	.000						
180	Ø	Ø							
Initial Response	14	14	14	8	9	8	7	6	6
95 % Response	85	85	85	60	60	58	40	40	40
Flow Rate	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5

ORSAT ANALYSIS DATA SHEET DATE : 8-28-12

Gas	1	2	3	AVE	CONC	TANK ID
CO_2	ϕ	ϕ	ϕ	ϕ	ϕ	16STPC 3A
O_2	ϕ	ϕ	ϕ	ϕ	ϕ	
CO	ϕ	ϕ	ϕ	ϕ	ϕ	
CO_2						487905
O_2						NEW 11-01-07
CO						Exp 10-31-2012
CO_2	21.0	21.1	21.1	21.1	21.1	CA 06641
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	6.2	6.2	6.22	CC-12730
O_2	6.2	6.3	6.2	6.23	6.25	
CO	2.0	2.0	2.0	2.0	1.98	
CO_2						
O_2						
CO						



LOW SPAN

AIR LIQUIDE

GASES FOR RESEARCH AND DEVELOPMENT

CYL # CC-12731 CGA 590

PRES 1665 VOL 130 c.f

TEST # 07203 DATE 03-13-03

Analytical Method GC/Paramagnetic

	Requested	Analyzed
Hydrogen		
Nitrogen	Bal.	Bal.
Argon		
Air		
Carbon Monoxide	2%	1.98%
Methane		
Oxygen	6.25%	6.25%
Helium		
Carbon Dioxide	6.25%	6.22%

SIGNED

AIR LIQUIDE

1451 THORNE RD.
TACOMA, WA 98421
TEL: (253) 383-3637

THE ONLY LIABILITY OF THIS COMPANY FOR GAS WHICH FAILS TO COMPLY WITH THE ANALYSIS SHALL BE REPLACEMENT THEREOF BY THE COMPANY WITHOUT EXTRA COST.

DO NOT REMOVE THIS TAG

AIR LIQUIDE™

CERTIFICATE OF ANALYSIS

Customer : Pacifice Rim Oxygen Service
P.O. Number : 200159
Document # : 23639406-1A
Mix/Lot # : SFS103795
Item Number : SFS103795
Valid Until : 4 January, 2012

Specification : CUSTOM CERTIFIED
Phase : GAS
Cyl. Size : 30AL Valve : CGA 590
Pressure : 1667
Volume : 120 SCF

Cylinder Number: **CAO6641**

Component	Requested Concentrations MOLE	Actual Concentration MOLE	% Analytical Uncertainty	Equipment Used Scale	Analyt. Inst.	Calibration Standard
NITROGEN	Balance	Balance		2		
CARBON MONOXIDE	8.6 %	8.63 %		2	4620	PQ
OXYGEN	21 %	20.9 %		2	4620	TB
CARBON DIOXIDE	21 %	21.1 %		2	4620	PD

7001-30AL

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

Comments:-

Dewpoint calculated to 40° F, unless otherwise stated. Improper storage or use may affect the accuracy of this standard. Reported impurities are approximate and should not be used for calibration purposes.

Prepared by _____ Date: 5-Jan-2007

8832 Dice Road -- Santa Fe Springs, CA 90670
Phone (562) 945-1383 **Fax** (562) 696-7903
ISO: 9001-2000

A-L WELDING PRODUCTS

A Division of Pacific Rim Oxygen Services, Inc.
15700 Nelson Road South • Tukwila, Washington 98188
Telephone (425) 228-2218 • Fax (425) 228-2397

Certificate of Analysis

Customer: AL Welding Products
Product: 5% CO. 12.5% CO2, 12.5% O2, balance Nitrogen
Grade: Certified Standard
Cylinder Number: 487905
Product Code: 2505COOXCDNTHC
Lot Number: K3171302

11-01-07

CGA 590
Pressure: 1650 psig
Contents: 175 ft^3

Mixture Analysis

Component	Specification	Concentration	Analytical Method
Oxygen	12.5%	12.6%	MTIGC-TCD
CO2	12.5%	12.2%	Varian
CO	5.0%	4.9%	MTIGC-TCD
Nitrogen	Balance	Balance	MTI GC-TCD

I certify the above referenced cylinder was analyzed and found to contain the listed concentrations.

Thomas M Chesser, Chemist

11-01-07
Date

Scott Specialty Gases

500 WEAVER PARK RD,LONGMONT,CO 80501 Phone: 303-442-4700 Fax: 303-772-7673

CERTIFICATE OF ANALYSIS: Interference-Free™ Multi-Component EPA Protocol Gas

Customer
ENERGY & ENV MEASUREMENT

C/O ED WADINGTON
3730 N. PELLEGRINO DR.
TUCSON,AZ 85749

Assay Laboratory

SCOTT SPECIALTY GASES
500 WEAVER PARK RD
LONGMONT,CO 80501

Project No.: 08-34135-001
P.O. No.: VERBAL

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure #G1; September, 1993.

Cylinder Number: ALM052285 Certification Date: 4/21/97 Exp. Date: 4/21/2000
Cylinder Pressure***: 1996 PSIG

COMPONENT	CERTIFIED CONCENTRATION		ANALYTICAL ACCURACY**
SULFUR DIOXIDE *	506	PPM	+/- 1% NIST Traceable
NITROGEN		BALANCE	

*** Do not use when cylinder pressure is below 150 psig.
** Analytical accuracy is inclusive of usual known error sources which at least include precision of the measurement processes. Product certified as +/- 1% analytical accuracy is directly traceable to NIST standards.
* This Protocol has been certified using corrected NIST SO2 standard values, per EPA guidance dated 7/24/96 and will not correlate with Uncorrected Protocols.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 1661	9/27/98	ALM059505	488.5 PPM	SO2/N2

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	LAST DATE CALIBRATED	ANALYTICAL PRINCIPLE
FTIR System/8220/AAB9400251	03/20/97	Scott Enhanced FTIR

ANALYZER READINGS

(Z = Zero Gas R = Reference Gas T = Test Gas r = Correlation Coefficient)

SULFUR DIOXIDE *

First Triad Analysis			Second Triad Analysis			Calibration Curve	
Date: 04/14/97	Response Unit: PPM		Date: 04/21/97	Response Unit: PPM		Concentration = A + B·R + C·R² + D·R³ + E·r	
Z1 = 0.3847	R1 = 487.72	T1 = 505.77	Z1 = 0.3241	R1 = 488.29	T1 = 505.43	r = 0.999990	
R2 = 488.79	Z2 = 1.6201	T2 = 505.89	R2 = 488.83	Z2 = 1.6098	T2 = 505.76	Constants:	A = 0.000000
Z3 = 1.6428	T3 = 505.78	R3 = 488.99	Z3 = 0.8340	T3 = 505.74	R3 = 488.69	B = 1.000000	C = 0.000000
Avg. Concentration:	505.8	PPM	Avg. Concentration:	505.8	PPM	D = 0.000000	E = 0.000000

Special Notes:

ANALYST: Devon VonFeldt
Devon VonFeldt

SO2 concentration analysis
08/28/12

Vm(std)	1.500			
mcf	1.004		dscf=	1.500
Hg	30.11			
DH	0.12			
temp	75	528	ppm =	515
ml BA ++	180			
Normality	0.0101			
			Run1	501
			Run 2	507
			Run3	515
Tank I.D. #	ALMO52285			
			avg.	508

AIR LIQUIDE™

CERTIFICATE OF ANALYSIS

Customer : Pacific Rim Oxygen Service Inc
P.O. Number : 200160
Document # : 23540983-1A
Mix/Lot # : SFS103340
Item Number : SFS103340
Valid Until : 2 January, 2010

Specification : CUSTOM CERTIFIED
Phase : GAS
Cyl. Size : 30AL
Valve : CGA 660
Pressure : 2000
Volume : 144 SCF

Cylinder Number: **CC82089**

Component	Requested Concentrations MOLE	Actual Concentration MOLE	% Analytical Uncertainty	Equipment Used Scale	Analyt. Inst.	Calibration Standard
NITROGEN	Balance	Balance		4		
SULFUR DIOXIDE	1250 PPM	1250 PPM	+/- 2%	4	4503	GL
6154-30AL						

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

Comments:

Dewpoint calculated to 40° F, unless otherwise stated. Improper storage or use may affect the accuracy of this standard.
eported impurities are approximate and should not be used for calibration purposes.

Prepared by _____ Date: 3-Jan-2007

8832 Dice Road -- Santa Fe Springs, CA 90670
Phone (562) 945-1383 **Fax** (562) 696-7903
ISO: 9001-2000

Scott Specialty Gases

500 WEAVER PARK RD,LONGMONT,CO 80501 Phone: 303-442-4700 Fax: 303-772-7673

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
08/28/12

Vm(std)	1.500			
mcf	1.004		dscf=	1.500
Hg	30.11			
DH	0.12			
temp	75	535	ppm =	1778
ml BA ++	621			
Normality	0.0101			

Run1	1781
Run 2	1767
Run3	1778
avg.	1775

Tank I.D. # ALMO49127

CO_2 ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Date: 11-25-12

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

Calibration by: C Wudington

Cal Gas Flow: 1.5 SCFH

Measured by: Rotameter

BP: 29.97

Instrument ID: PRINCO

Temp: 61

Instrument ID: TR

Cylinders:

1. # 168TAC 3-A Concentration: 00.00 % CO_2 Cyl. Press.: 500 PSI
   Certified by: AIR LIQUIDE Date: 04-19-04
2. # 487905 Concentration: 12.20 % CO_2 Cyl. Press.: 1500 PSI
   Certified by: AIR LIQUIDE Date: 11-1-07
3. # CA06641 Concentration: 21.1 % CO_2 Cyl. Press.: 1410 PSI
   Certified by: AIR LIQUIDE Date: 1-5-2007
4. # CC-12731 Concentration: 6.22 % CO_2 Cyl. Press.: 1150 PSI
   Certified by: AIR LIQUIDE Date: 03-13-03

Analyzer: **Calibrated Range:** 0-25.0 % **Output:** 0-1.0 V.
Flow: 1.5 SCFH **Measured by:** Rotameter

Calibration Results

Point #	CYL. #	% CO2	EXPECTED METER	EXPECTED DVM	ACTUAL METER	ACTUAL DVM	ADJ. METER	ADJ. DVM
1	1	0.00	00.0	.000	00.0	.000	00.0	.000
2	2	12.20	48.8	.488	50.0	.500	48.8	.488
3	3	21.1	84.4	.844	84.3	.843		
4	4	6.22	24.9	.249	24.7	.247		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 12.519

CO_2 Linear Regression Results:

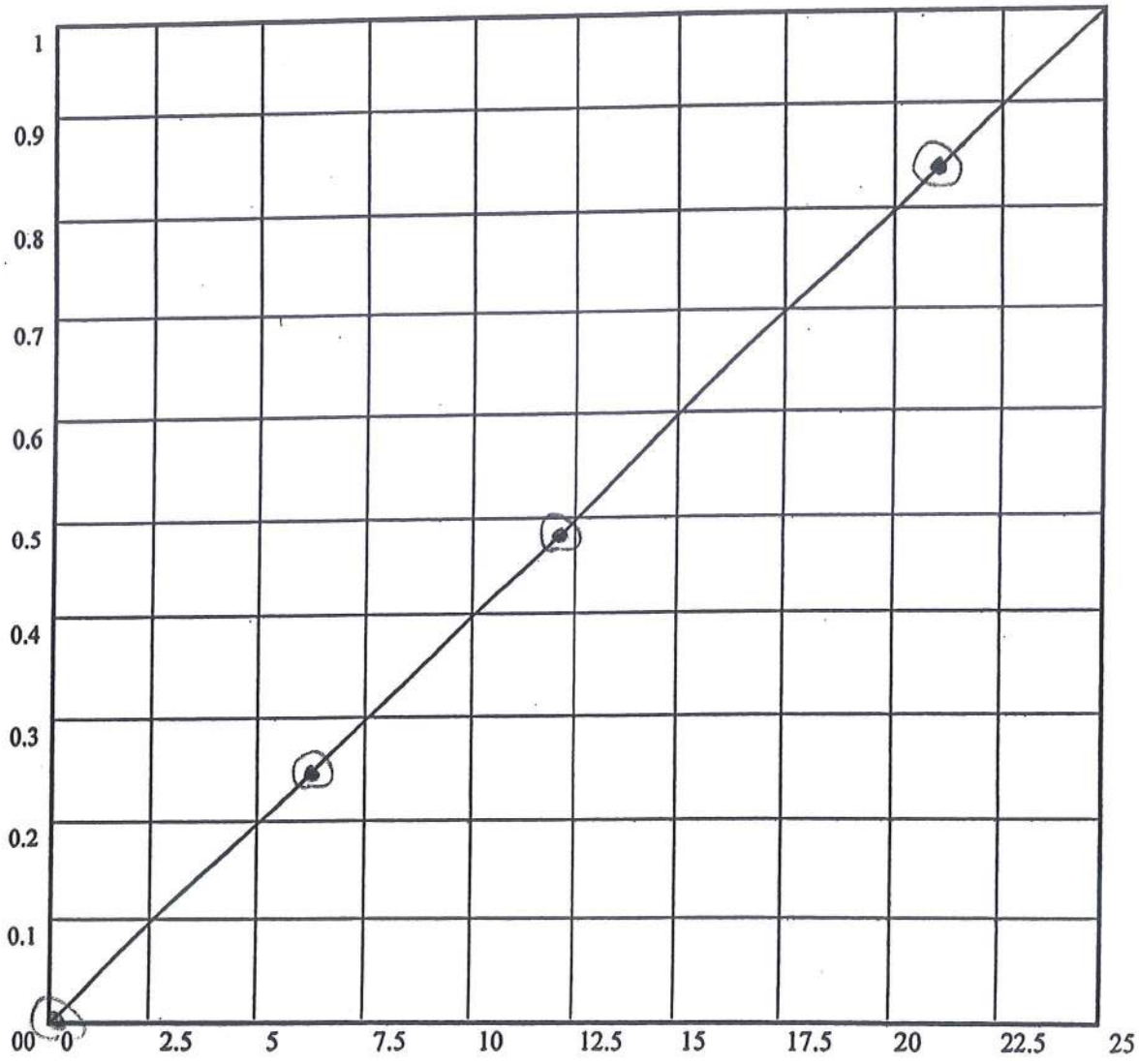
Y = MX +B

Slope (M) = -.0005111

Y Intercept (B) = .0399809

Correlation Coefficient (r) = .9999972

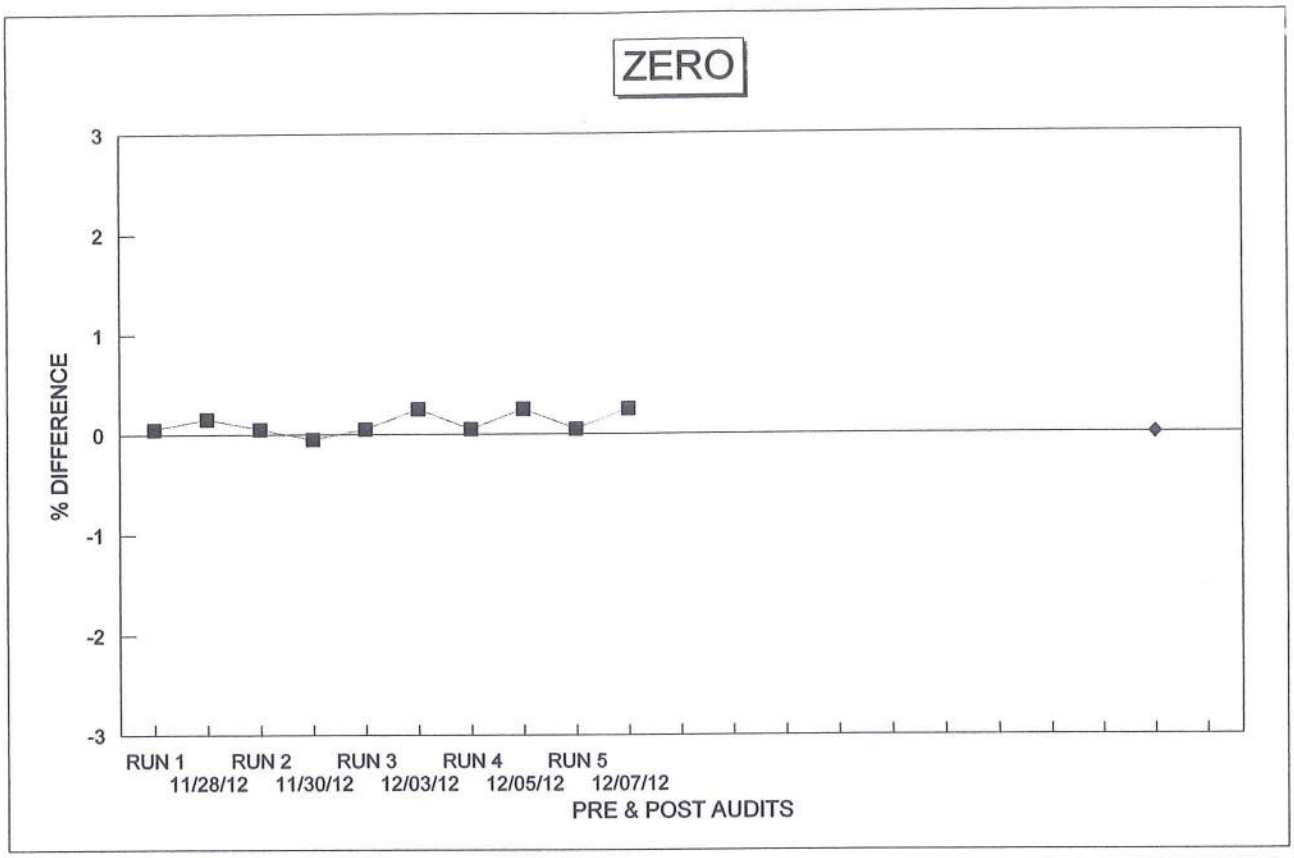
r^2 = .9999943



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

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

HIGH VOLTS	.843	= 21.075 - 21.1	= -.025	=	-.100
LOW VOLTS	.247	= 6.175 - 6.22	= -.045	=	-.180


ZERO
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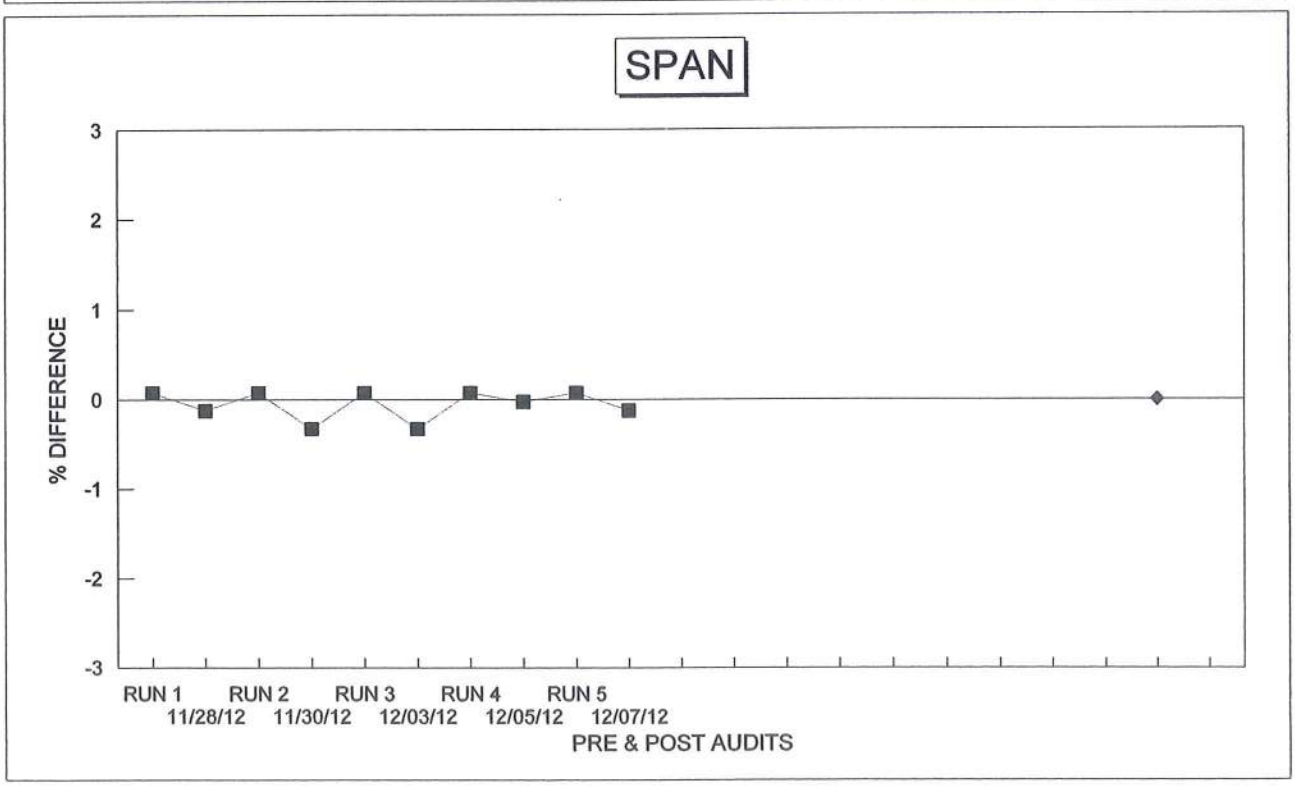
% DIFFERENCE
RUN 1
11/28/12
RUN 2
11/30/12
RUN 3
12/03/12
RUN 4
12/05/12
RUN 5
12/07/12
PRE & POST AUDITS


SPAN
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% DIFFERENCE
RUN 1
11/28/12
RUN 2
11/30/12
RUN 3
12/03/12
RUN 4
12/05/12
RUN 5
12/07/12
PRE & POST AUDITS

O_2 ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Date: 11-25-17

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

Calibration by: C. Woodruff

Cal Gas Flow: 1.5 SCFH Measured by: Rotameter

BP: 29.97 Instrument ID: PRINCO

Temp: 61 Instrument ID: TR

Cylinders:

1. # 168TAC 3-A Concentration: 00.00 % O_2 Cyl. Press.: 500 PSI
   Certified by: AIR LIQUIDE Date: 04-19-04
2. # CA487905 Concentration: 12.0 % O_2 Cyl. Press.: 1500 PSI
   Certified by: AIR LIQUIDE Date: 11-1-07
3. # CA066641 Concentration: 20.9 % O_2 Cyl. Press.: 1410 PSI
   Certified by: AIR LIQUIDE Date: 1-5-2007
4. # CC-12731 Concentration: 6.25 % O_2 Cyl. Press.: 1150 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	12.5	.500	12.6	.504
3	3	20.9	20.9	.836	20.9	.835		
4	4	6.25	6.25	.250	6.2	.249		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 12.515

O_2 Linear Regression Results:

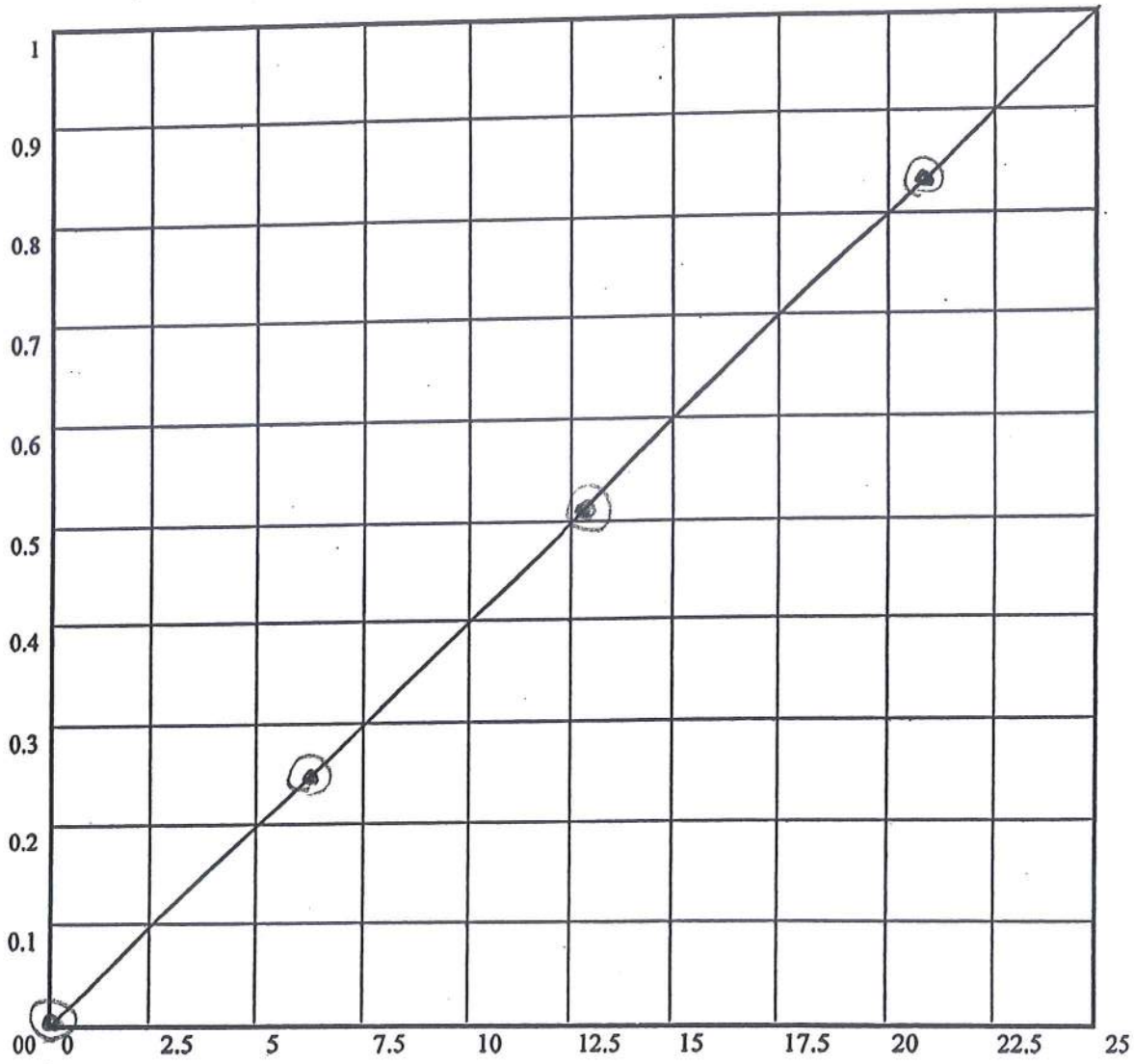
Y = MX +B

Slope (M) = -.0001983

Y Intercept (B) = .0399696

Correlation Coefficient (r) = .9999990

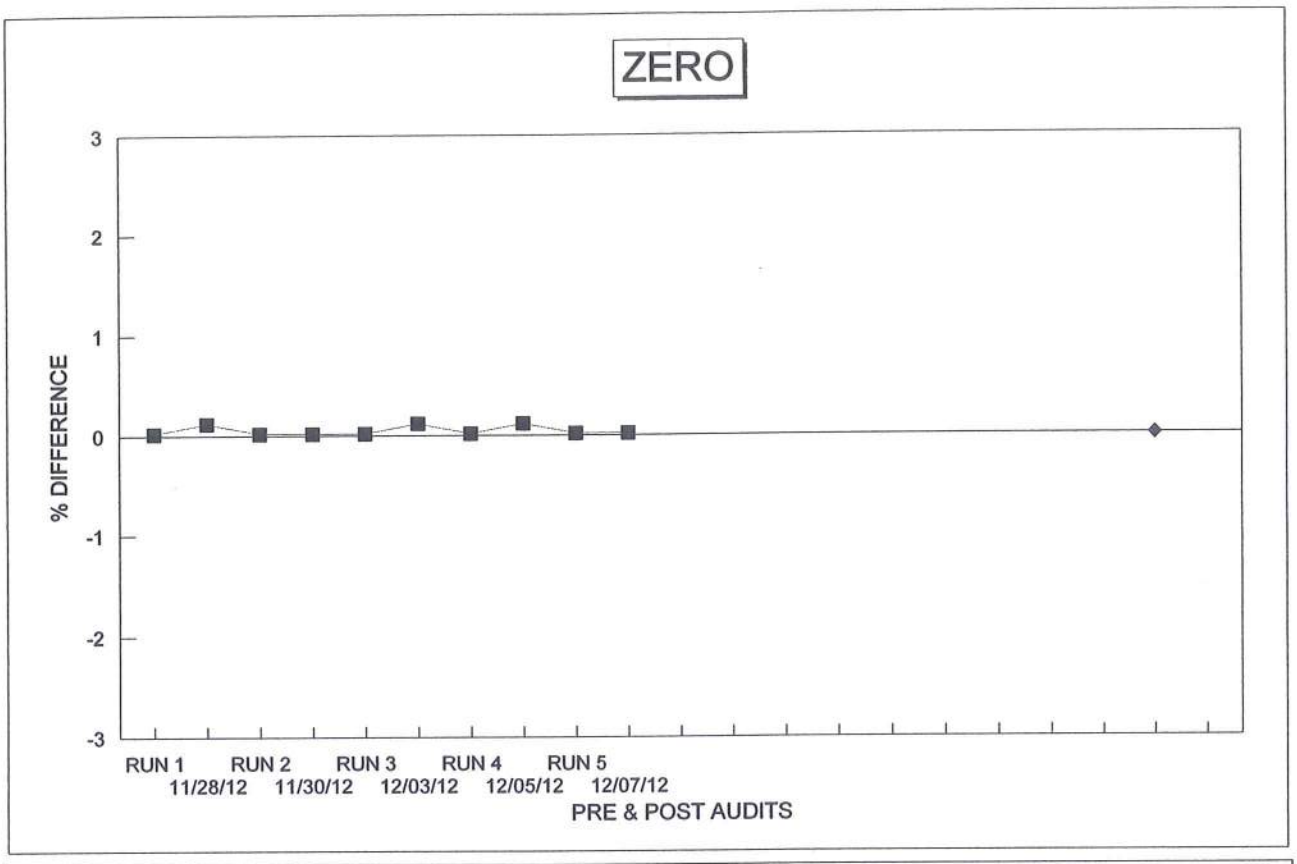
r^2 = .9999980



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

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

HIGH VOLTS	.835	= 20.875	20.9	= -.025	= -.100
LOW VOLTS	.249	= 6.225	6.25	= -.025	= -.100


ZERO
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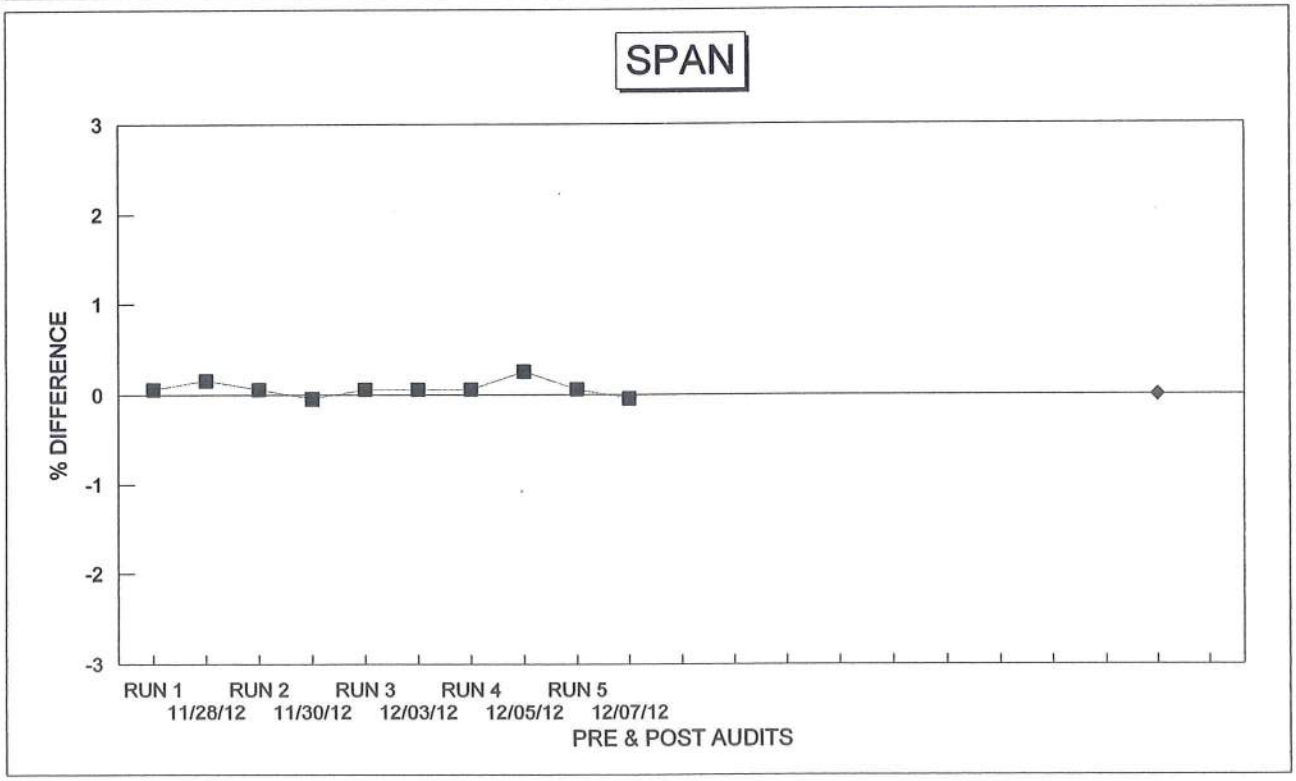
% DIFFERENCE
RUN 1
11/28/12
RUN 2
11/30/12
RUN 3
12/03/12
RUN 4
12/05/12
RUN 5
12/07/12
PRE & POST AUDITS


SPAN
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% DIFFERENCE
RUN 1
11/28/12
RUN 2
11/30/12
RUN 3
12/03/12
RUN 4
12/05/12
RUN 5
12/07/12
PRE & POST AUDITS

CO ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Date: 11-25-12

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

Calibration by: C Twining

Cal Gas Flow: 1.5 SCFH

Measured by: Rotameter

BP: 29.97

Instrument ID: PRINCO

Temp: 61

Instrument ID: TR

Cylinders:

1. # 168TAC 3-A Concentration: 00.00 % CO Cyl. Press.: 500 PSI
   Certified by: AIR LIQUIDE Date: 04-19-04
2. # 487905 Concentration: 4.90 % CO Cyl. Press.: 1500 PSI
   Certified by: AIR LIQUIDE Date: 11-1-09
3. # CA06641 Concentration: 8.63 % CO Cyl. Press.: 1410 PSI
   Certified by: AIR LIQUIDE Date: 1-5-2007
4. # CC-12731 Concentration: 1.98 % CO Cyl. Press.: 1150 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	00.2	.002	00.0	.000
2	2	4.90	49.0	.490	47.0	.470	49.0	.490
3	3	8.63	86.3	.863	86.3	.863		
4	4	1.98	19.8	.198	19.2	.192		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 5.012

CO Linear Regression Results:

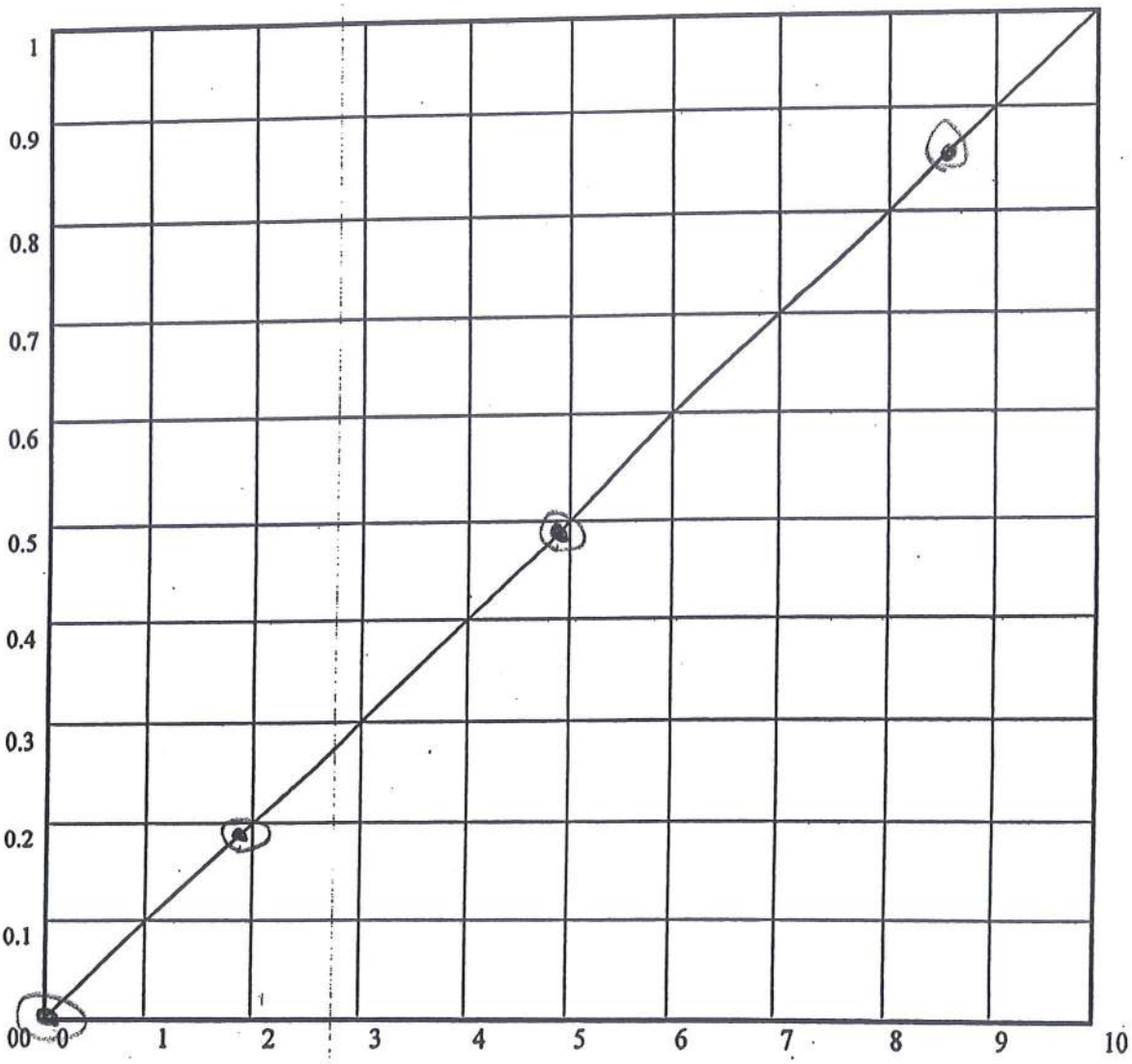
Y = MX +B

Slope (M) = .10025444

Y Intercept (B) = .10026694

Correlation Coefficient (r) = .9999718

r^2 = .9999437

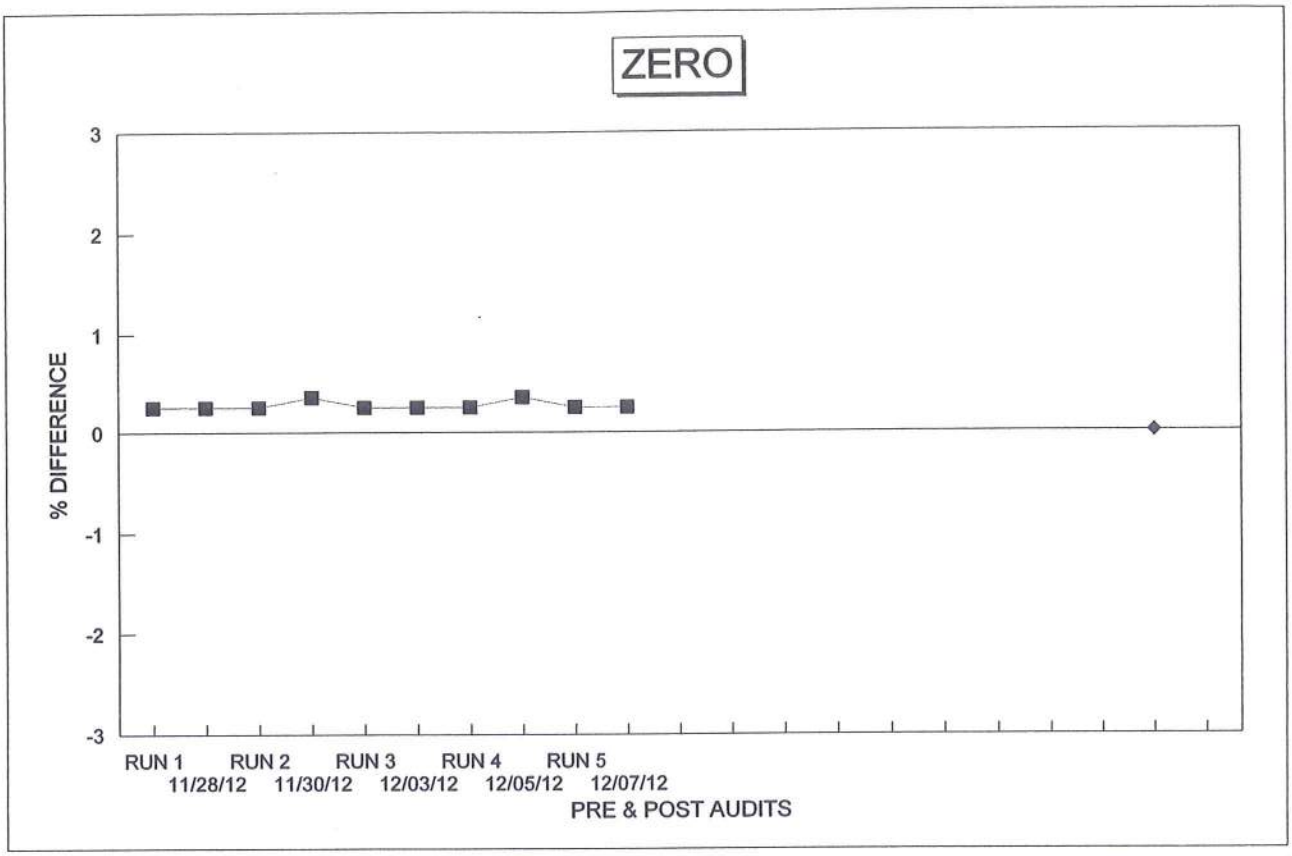


EPA Span Value = ± 2.0% of 10% CO = ± .2%

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

HIGH VOLTS .863 = 8.63 - 8.63 = Ø = Ø

LOW VOLTS .192 = 1.92 - 1.98 = -.060 = -.600


ZERO
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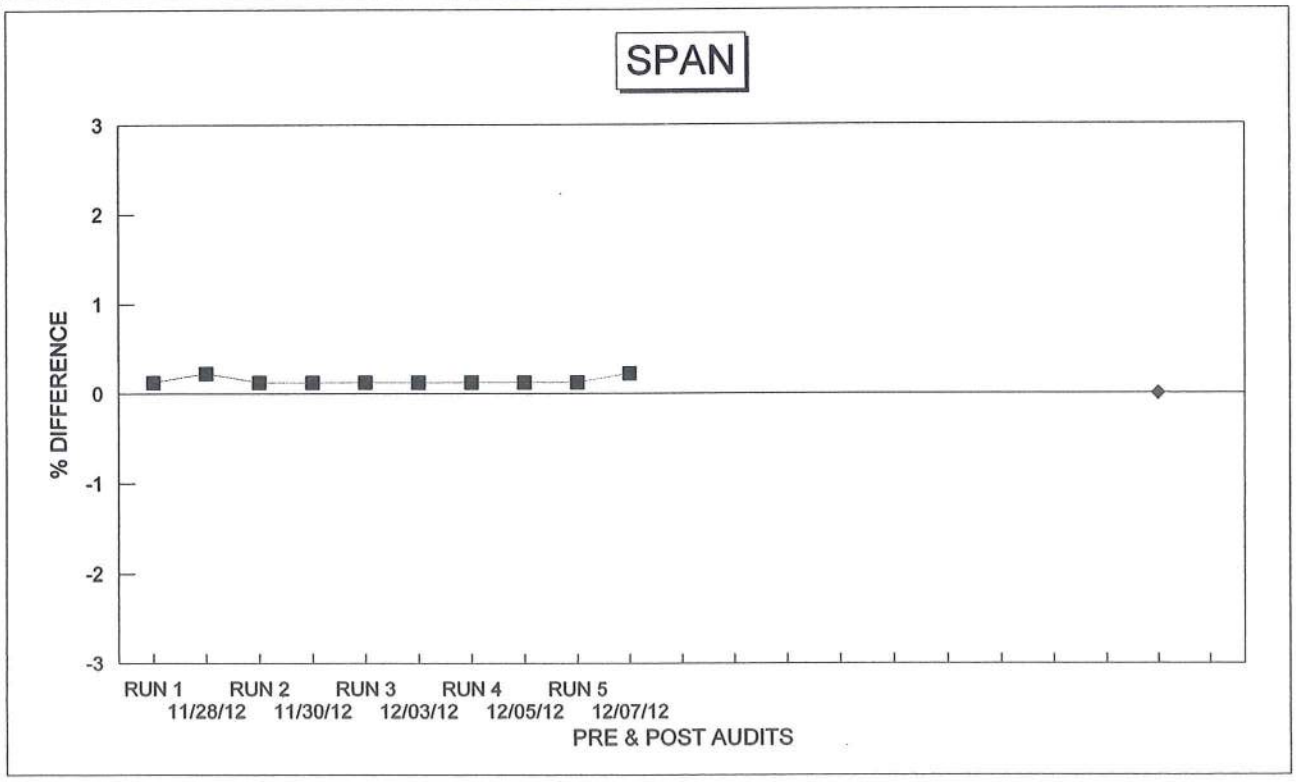
% DIFFERENCE
RUN 1 11/28/12
RUN 2 11/30/12
RUN 3 12/03/12
RUN 4 12/05/12
RUN 5 12/07/12
PRE & POST AUDITS


SPAN
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% DIFFERENCE
RUN 1 11/28/12
RUN 2 11/30/12
RUN 3 12/03/12
RUN 4 12/05/12
RUN 5 12/07/12
PRE & POST AUDITS

SO_2 ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Date: 11-25-12

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

Calibration by: C Weitzel

Cal Gas Flow: 1.5 SCFH Measured by: Rotameter

BP: 29.97 Instrument ID: PRINCO

Temp: 61 Instrument ID: TR

Cylinders:

1. # 168TAC 3A Concentration: 00.00 % SO_2 Cyl. Press.: 500 PSI
   Certified by: AIR LIQUIDE Date: 04-19-04
2. # CC82089 Concentration: 1250 % SO_2 Cyl. Press.: 1720 PSI
   Certified by: AIR LIQUIDE Date: 1-3-2007
3. # ALMO 49127 Concentration: 1770 % SO_2 Cyl. Press.: 710 PSI
   Certified by: SCOTT SPECIALTY GASES Date: 05-15-97
4. # ALMO 52285 Concentration: 506 % SO_2 Cyl. Press.: 710 PSI
   Certified by: SCOTT SPECIALTY GASES Date: 05-15-97

Analyzer: **Calibrated Range:** 0-2500 PPM **Output:** 0-1.0 V.
Flow: 1.5 SCFH **Measured by:** Rotameter

Calibration Results

Point #	CYL. #	PPM SO2	EXPECTED 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	1250	50.0	.500	49.4	.494	50.0	.500
3	3	1770	70.8	.708	70.9	.709		
4	4	506	20.2	.202	19.7	.197		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 1251.252

SO_2 Linear Regression Results:

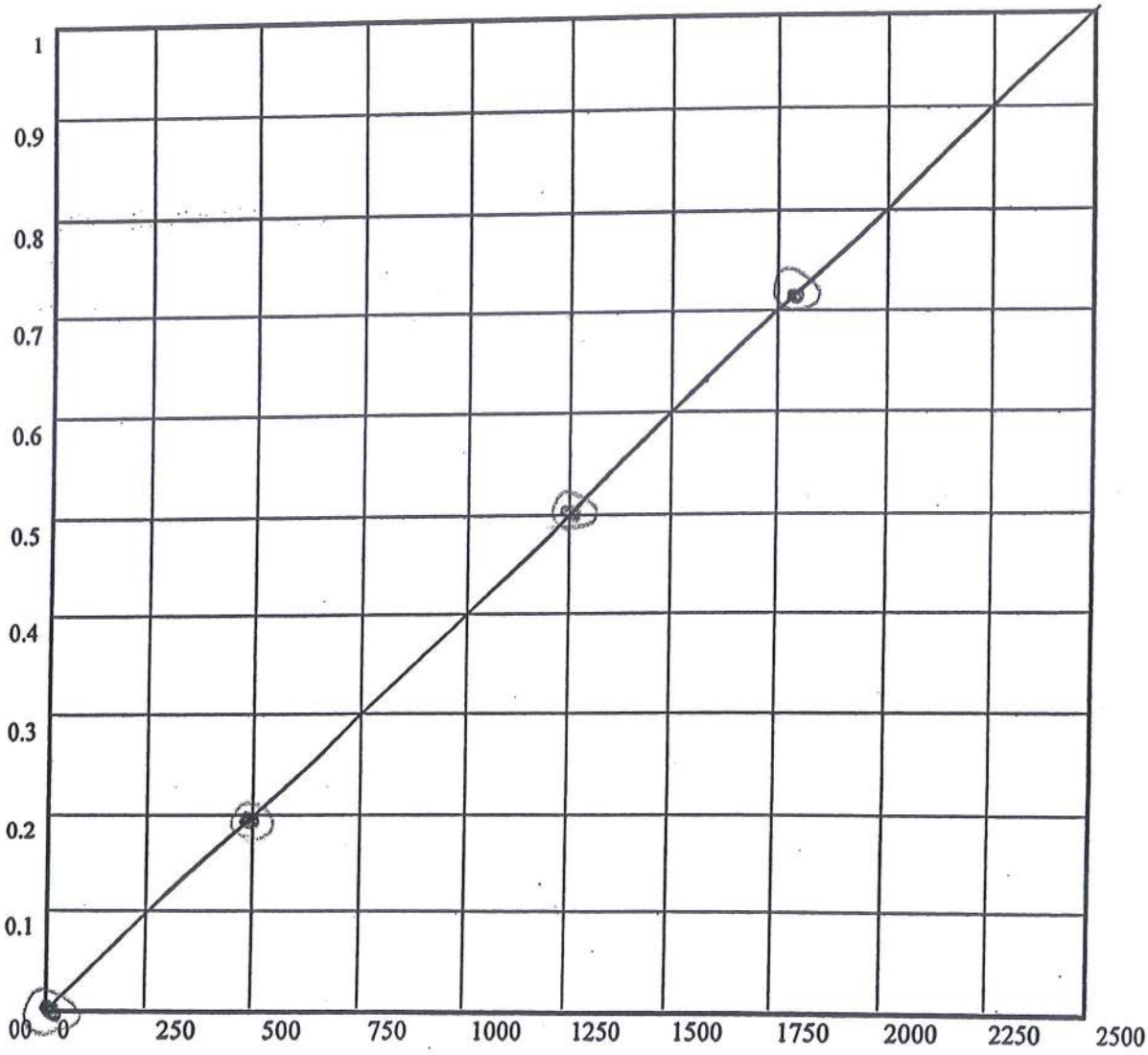
Y = MX +B

Slope (M) = -.0024946

Y Intercept (B) = .0004016

Correlation Coefficient(r) = .9999652

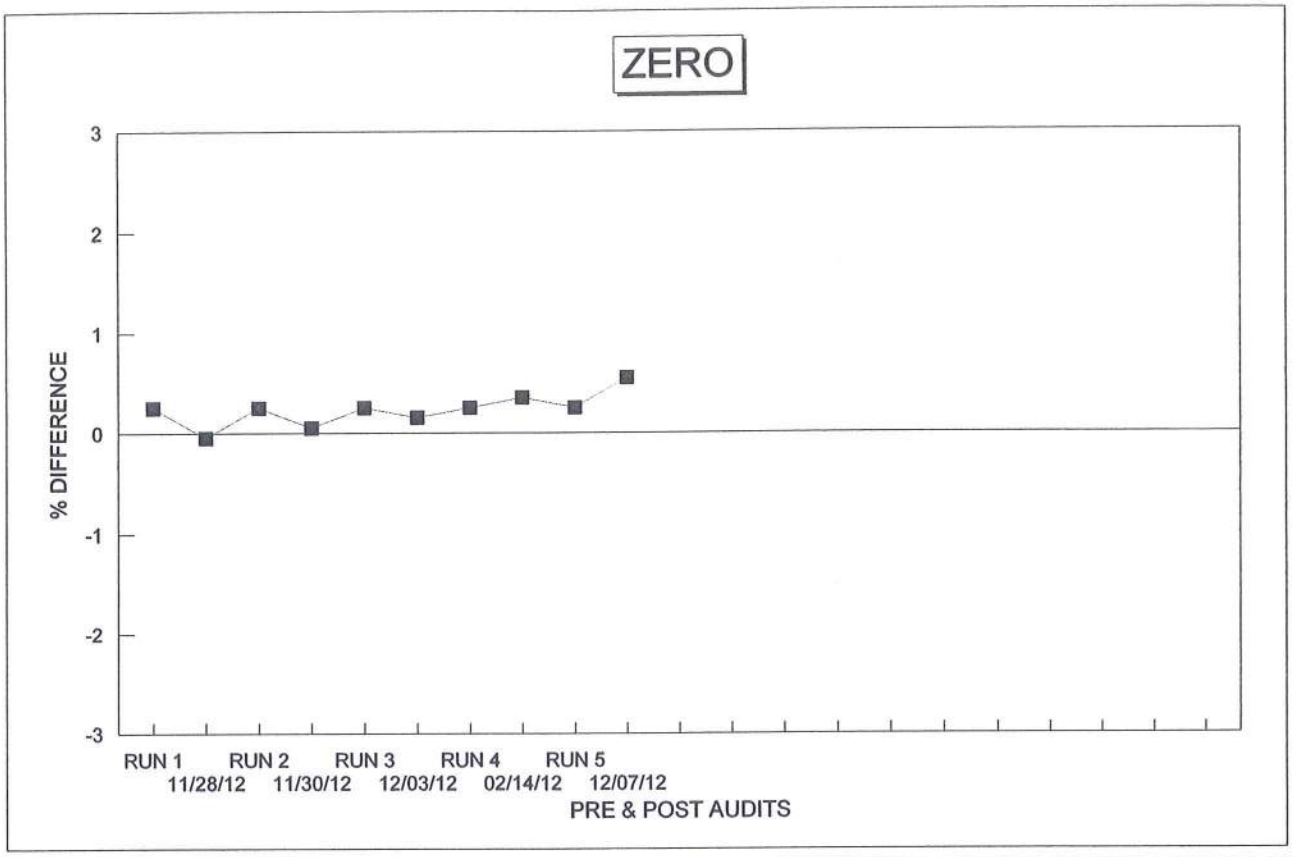
r^2 = .9999303



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

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

HIGH VOLTS	.709	= 1772.1 - 1770.0	= 2.1	=	.084
LOW VOLTS	.197	= 493.1 - 506.0	= -12.9	=	-.516


ZERO
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% DIFFERENCE
RUN 1
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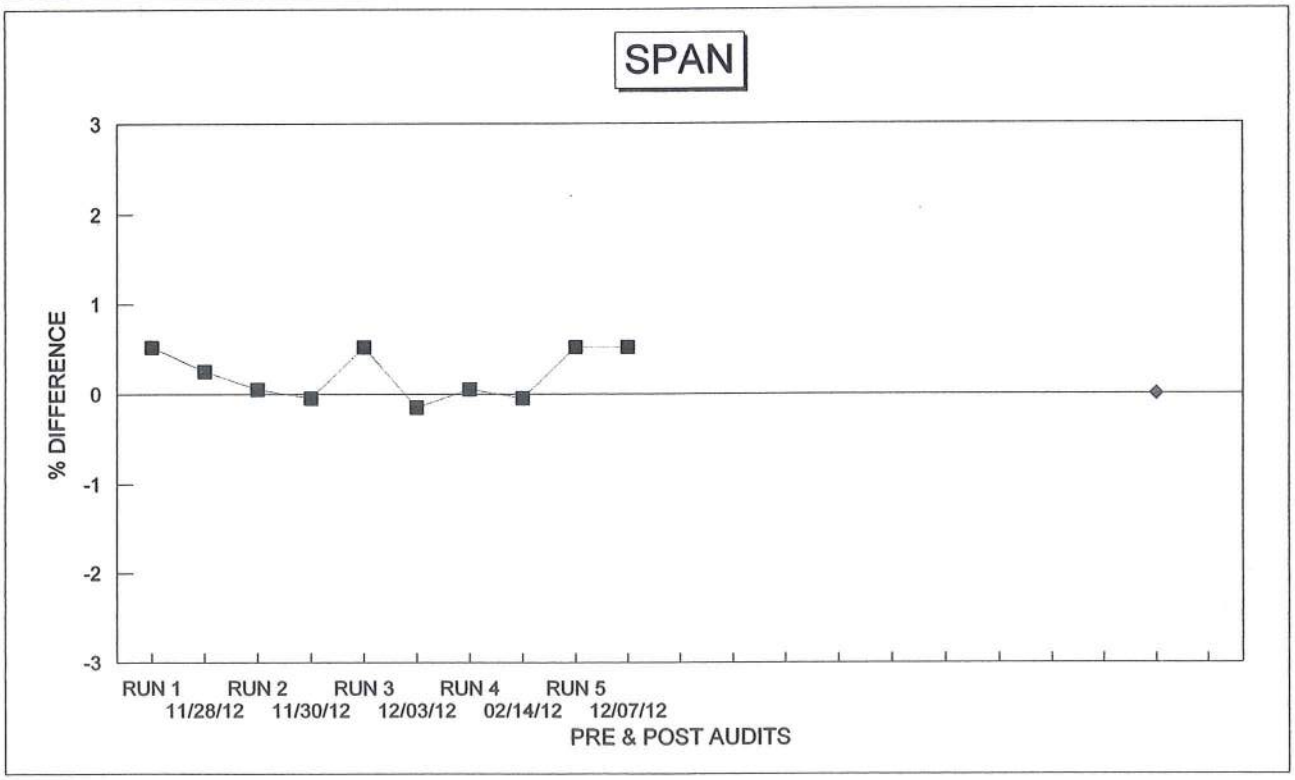
RUN 2
11/30/12
RUN 3
12/03/12
RUN 4
02/14/12
RUN 5
12/07/12
PRE & POST AUDITS


SPAN
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% DIFFERENCE
RUN 1
11/28/12
RUN 2
11/30/12
RUN 3
12/03/12
RUN 4
02/14/12
RUN 5
12/07/12
PRE & POST AUDITS

Certificate of Analysis

ANALYTICAL CONTROL LABORATORY ANALYSIS
METHYLENE CHLORIDE - OPTIMA

Catalog No. D151
Lot No. 035941

July 23, 2003

This is to certify that this lot was tested and found to comply with the specifications for this product. The following are the actual analytical results obtained:

TESTS		ACTUAL ANALYSIS
Assay		99.9%
Color		5 APHA
Description		Clear, Colorless Liquid
Free Halogens		Pass Test
Identification		Pass Test
Fluorescence Background (as Quinine Sulfate)		Not more than 1 ppb
Certified for EPA Test #1625		Pass Test
Pesticide Residue Analysis (as Heptachlor Epoxide)		Not more than 10ng/l
Density (g/ml) at 25°C		1.317 .
Optical Absorbance	At 254 nm	0.002
	At 240 nm	0.10
	At 233 nm	0.54
Refractive Index at 25°C		1.4209
Residue after Evaporation		0.4 ppm
Titratable Acid		0.00004 Meq/g.
Preservative (Amylene)		64 ppm
Water (H_2O)		0.008%

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

Approved By: Edgar E. Hess

Edgar E Hess
Q.C. Laboratory Manager

Certificate of Analysis

ANALYTICAL CONTROL LABORATORY ANALYSIS
METHYLENE CHLORIDE - OPTIMA

Catalog No. D151
Lot No. 035941

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

KEITHLEY

Keithley Instruments, Inc.
28775 Aurora Road
Cleveland, Ohio 44139
(440) 248-0400
Telefax: (440) 248-6168

Certificate of Calibration

Model 2700 **Serial No** 0872585 **Date** 13 Mar 2002

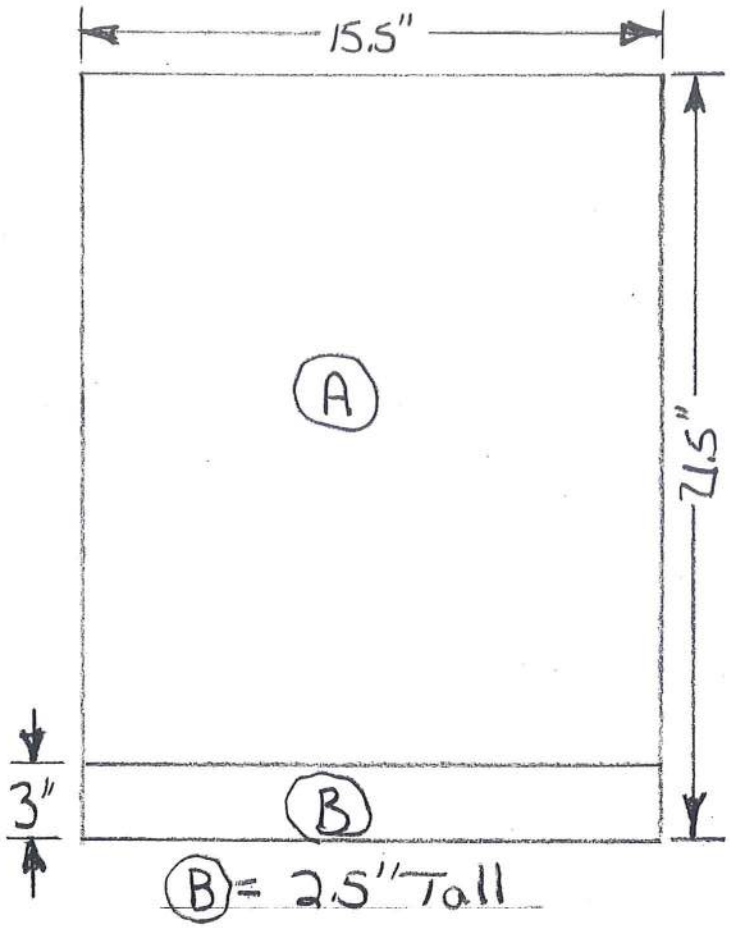
This notification serves to certify that the unit described above has been inspected and tested in accordance with specifications published by Keithley Instruments, Inc.

The accuracy and calibration of this instrument are traceable through reference standards that are compared, at planned intervals, to national standards maintained by the National Institute of Standards and Technology (NIST), by comparison to natural physical constants or self-calibrating ratio type measurements.

The measurement standards which support this calibration are calibrated on a schedule to maintain required accuracy level.

James A. Crane
Metrology Services

Firebox Volume and Fuel Load Calculations For the Jotul F45



B = 2.5" Tall

Baffle Height
Front \ Rear
13.75" \ 11.25"

$$A = 15.5'' \times \left(\frac{11.25'' + 13.75''}{2}\right) \times 21.5'' = 4165.625$$

$$- B = 2.5'' \times 3'' \times 15.5'' = -116.250$$

$$= 4049.375 in^3$$

$$= 2.343 ft^3$$

Fuel Load (lbs)

LOW	IDEAL	HIGH
14.8	16.404	18.0

Appendix A

EXAMPLE CALIBRATION/DATA FLOW

All individual test run raw data sheets are organized in a manner that would allow a data reviewer to follow the data as it is being calculated in a step by step fashion. In many cases, the equations used to calculate a specific required data are given on the raw data sheets themselves.

For example, the particulate emission rate in g/dscf is calculated on Data Sheet #7. However, the data used to derive this data begins on Data Sheet #2 (Meterbox Data Sheet) where the meter volume (cubic feet), average meter temperature (°F), average ΔH (in. H_2O), and average Barometric pressure (in. Hg) are recorded and averaged. Each of the averages for these parameters are used in equation 1 on P. 7 where the volume (MCF) is converted to dscf.

The moisture catch total (g. H_2O) on the Particulate Catch/Moisture Data sheet (p. 3) is transferred to P. 7 and the percent stack moisture is calculated in equations 2 and 3.

The gross and net gravimetric (g) particulate catches are determined and calculated on PP. 3-6. Pages 4-1, 4-2 and 4-3 show the initial (tare) constant weights for filters (p. 4-1) and beakers (p. 4-2) and the final constant weights (p. 4-3) for those filters and beakers used for each run. Final and tare weight data is transferred to P. 3 and the gross gravimetric (g) catch for each filter and beaker is calculated. On P. 5 the gravimetric catch for each blank is calculated. The gross gravimetric catch for each filter and beaker is transferred to P. 6 and the net gravimetric catch (g) is calculated, as well as front half and back half catch totals. The net gravimetric catch (g) is transferred to P. 7 and the grain loading/dscf is calculated in equation 4.

Some data sheet specific information is listed below on a page by page basis.

P. 8 The % ambient moisture is determined by interpolating from psychrometric charts which are contained in the State of Oregon Department of Environmental Quality's "Standard Method for Measuring the Emissions and Efficiencies of Woodstoves".

The % relative humidity is determined from the wet bulb/dry bulb temperature readings using the tables found in Section 3.1.2.4 of the State of Montana Air Quality Bureau's Quality Assurance Manual.

P. 10 The uncorrected moisture meter readings are corrected for pin insulation and may or may not be corrected for ambient (wood) temperatures. All corrections are based upon the correction equations or tables supplied by the moisture meter manufacturer. (These are standard, known corrections.)

P. 11 The moisture meter readings are corrected as discussed above.

P. 12 The gas concentrations shown for each gas monitored (CO_2, O_2, CO and SO_2) are determined by converting the analyzer's voltage output recorded on P. 12 to the concentration shown using the analyzer's current calibration curve. The SO_2 concentration is determined using the manufacturer's calibration curve and the current calibration curve.

The cal. W/B (calculated wet bulb) temperature is obtained by first determining the % moisture in the extracted flue gas stream using the temperature data from thermocouples 1 (Wet Bulb) and 2 (Dry Bulb). Then based upon the stack temperature (thermocouple 3) and the % moisture in the extracted gas stream, a calculated wet bulb temperature is determined. All data is derived from the psychrometric tables found in the State of Oregon's "Standard Method for Measuring the Emissions and Efficiencies of Woodstoves".

The following pages contain the equations used to generate the data on Tables 3-5 on the computer printouts:

Dry Gas Volume (standard):

$$V_{m(std)} = \frac{V_m * 17.65 * mcf * \left(P_{bar} + \frac{\Delta H}{13.6}\right)}{T_m}$$

Volume of Water:

$$V_{w(std)} = (0.04707)(ml\ H_2O)$$

Moisture Content:

$$B_{ws} = \left(\frac{V_w}{V_w + V_{m(std)}}\right) * 100$$

Dry Burn Rate:

$$Br = \left(\frac{Wwt - (Wwt * \%\ H_2O)}{2.2046}\right) * \frac{60}{\theta}$$

Carbon Balance (N_t):

$$Nt = \frac{K_3 Nc}{(YCO_2 + YCO + YHC)}$$

Stack Flow Rate (Q_{sd}):

$$Q_{sd} = K_4 N_t Br$$

Particulate Concentration (C_s):

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

Particulate Emission Rate (E):

$$E = C_s Q_{sd}$$

Proportional Rate Variation (Pr):

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

Where:

Br =	dry wood burn rate, kg/hr.
B_{ws} =	Water vapor in the gas stream, proportion by volume.
c_s =	Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, g/dscm (g/dscf).
E =	Particulate Emission Rate, g/hr.
ΔH =	Average pressure differential across the orifice meter (see Figure 5-2), mm H_20 (in. H_20).
K_3 =	1.0 lb/lb (English) 1000 g/kg (metric)
K_4 =	0.02406 dsm^3/g-mole(metric) 384.8 dscf/lb-mole (English)

m_n = Total amount of particulate matter collected, mg.

mcf = Dry gas meter correction factor.

N_c = Gram atoms of carbon/gram of dry fuel (lb/lb), equal to 0.0425.

N_t = Total dry moles of exhaust gas/Kg of dry wood burned.

P_r = Percent of proportional sampling rate.

Pbar = Barometric pressure at the sampling site, mm Hg (in. Hg).

Q_{sd} = Total gas flow rate, dscf/hr.

S_i = Concentration measured at the SO_2 analyzer for the "i^{th}" 5 minute interval, ppm.

S_1 = Concentration measured at the SO_2 analyzer for the first 5 minute interval, ppm

T_m = Absolute average DGM temperature (see Figure 5-2), °K (°R).

T_{std} = Standard absolute temperature, 293°K (528°R).

V_m = Volume of gas sample as measured by dry gas meter, dcm (dcf).

$V_{m(std)}$ = Volume of gas sample measured by the dry gas meter, corrected to standard conditions, dscm (dscf).

$V_{w(std)}$ = Volume of water vapor in the gas sample, corrected to standard conditions, scm (scf).

W_{wt} = Wet wood weight.

Y = Dry gas meter calibration factor.

Y_{CO} = Measured mole fraction of CO (dry).

Y_{CO2} = Measured mole fraction of CO_2 (dry).

Y_{HC} = Assumed mole fraction of HC (dry);
=0.0088 for catalytic woodheaters
=0.0132 for noncatalytic woodheaters
=0.0080 for pellet fired woodheaters

θ = Total sampling time, min.

13.6 = Specific gravity of mercury.

60 = Sec/min.

100 = Conversion to percent.

M5H PARTICULATE SAMPLING TRAIN

1. Probe

   3/8" seamless SS-20" long. Outlet end of probe is attached to a SS outlet fitting with a Sweglock SS union. The probe is unheated except for the portion that is in the stack and the heated filter box. The probe is sealed to the stack with a washer.

2. Filter Holder

   A 3" or 4" standard M5 filter holder. A SS filter support with gasket.

3. Filters

   3" or 4" fiber glass (#25 glass) manufactured by Schleicher and Schuell.

4. Front Half Filter Heater

   A box containing a fan for air circulation and a cone heater. The temperature in the box is monitored with a type K thermocouple and adjusted with a voltage regulator to maintain a temperature below 248 °F.

5. Desiccant

   Indicating silica gel, 6-20 mesh. The silica gel is changed as needed.

6. Filter (Back Half) Holder

   Same as front half 3" or 4" filter.

7. Impinger Gas

   Type K thermocouple threaded into the exit "arm" of the impinger. Ice is added to the cooler whenever necessary to maintain an exit gas temperature less than 68 °F.

8. Meterbox

   RAC Stack Sampler modified by EEMC

   Ranges: 0-1.0" inclined water manometer

   0-10.0" vertical water manometer

   Accuracy: Dry gas Meter 0-999.999 cu ft ±1.0%

   Temperatures are monitored using two type K thermocouples.

SAMPLING PROCEDURES AND INSTALLATION DESCRIPTION

This section is broken into two major parts. The first contains a brief description of the sampling and procedures used by LoKee Testing Laboratory when performing a test using EPA Methods 28, 28A and 5H. The second section contains a complete listing of all equipment in each of the major sampling trains and a diagram of each major train.

LoKee Testing Laboratory uses EPA M5H for the particulate sampling procedure and collects the required data so that efficiency of a unit can be calculated using the Oregon Method.

TEST FACILITY AND WOOD HEATER EQUIPMENT LIST

1. Flue Pipe

   The diameter of the 24 gauge black steel flue pipe used for each stove varies with the size of the stove's flue collar, e.g., 6" flue pipe is used with a 6" flue collar. The joint at the flue collar is sealed with mortar. The pipe is attached to the stove at the flue collar with three sheet metal screws. All sampling ports are sized for the sampling probes and sealed using washers.

2. Insulated Flue Pipe

   The diameter of the insulated flue pipe matches the diameter of the flue collar on the stove. The 6", 7" and 8" pipe meet the requirements of UL 103 HT. The SO_2 injection loop port is sealed with high temperature silicone sealant.

3. Liquid Seal

   The liquid (oil) seal used by LoKee varies in size with the flue pipe. The seals are made of 12 gauge steel. The liquid sealant is mineral oil. The cooler consists of 3/8" copper tubing which is coiled in the bottom of the lower half of the seal. Ambient air is pumped through this line when necessary to cool the seal.

4. Supports

   The lower half of the seal and the 24 gauge steel black flue pipe is supported by the stove. The upper half of the seal and the insulated flue pipe are hung from wooden supports.

5. Platform Scale

   Platform (30" X 30" deck)

   Manufacturer: Weightronics

   Model: platform: DS-014/SN 4479 readout: W1-110/SN 016409

   Type: Electronic

   Range: 0-1000 lb.

Capacity:	1000 lb.
Resolution:	±0.1 lb.
Accuracy:	±0.1%

6. Fuel Balance Scale

LoKee uses the platform scale listed above to weigh the fuel charges.

7. Fuel Storage Area

LoKee stores the fuel in a humidity and temperature regulated room.

8. Moisture Meter

LoKee has two moisture meters which it uses to determine wood moisture levels.

The primary meter is:

Manufacturer:	Delmhorst Instrument Co.	
Model:	RC-1C/SN 16152 with 26-E probe and #496 insulated pins.	
Type:	Electrical Resistance	
Resolution:	±0.1% moisture	
Ranges:	6-11%, 11-25%, 25-80%	
Accuracy:	Moisture	Content Accuracy
	6-12%	±0.5%
	12-20%	±1.0%
	20%-saturation point	±2.0%

Type of Calibration: The RC-1C is equipped with two potentiometers (Zero and Span) which are checked and adjusted on a daily basis. The unit is also checked with a calibration block.

Electrode and Pin Type: 26-E probe and #496 insulated pins

The backup moisture meter:

Manufacturer:	Delmhorst Instrument Co.	
Model:	G-30SN/2477 with 26-E probe and #496 insulated pins	
Type:	Electrical Resistance	
Resolution:	±0.1% moisture	
Accuracy:	Moisture	Content Accuracy
	6-12%	±0.5%
	12-20%	±1.0%
	20%-saturation point	±2.0%

Type of Calibration: Calibration is accomplished with an internal calibration point and a potentiometer. The calibration can also be checked against a calibration block.

Description of Operation: The pins are pounded into the wood to be sampled. The meter reading is recorded on Data Sheet #10 (Wood Moisture) or Data Sheet #11 (Density Determination). This is the uncorrected reading which is then corrected for pin insulation and, as needed, temperature using the correction tables for each parameter supplied by the manufacturer.

9. Temperature Monitors

The temperatures are monitored with Type K thermocouples. Each thermocouple's calibration is checked prior to use.

The thermocouple readout is an Omega Model 410B-K/SN 05/4475, with a range of -58 °F to 1999 °F (type K) and an accuracy of ±0.9 °C, which can be read at ±0.1 °F. EEMC reads and rounds to 1.0 °F. The single channel readout is interfaced with a manually operated selector switch that allows 24 channels to be monitored with the same readout. The thermocouples are attached to the test unit with sheet metal screws. The thermocouples monitoring internal stove temperature are sealed at the point of entry with sealant.

10. Draft Gauge

Manufacturer:	Dwyer
Model:	
Type:	Inclined Water Manometer
Range:	0-0.25" water
Resolution:	0.001" water
Accuracy:	±0.001" water (readability)

11. Anemometer

Manufacturer:	Dwyer
Model:	480 Vaneometer/SN S 222 D
Range:	0-400 FPM
Accuracy:	±5% of full scale from 0-1 FPM

12. Humidity Gauge

Manufacturer:	Bacharach
Model:	SAC
Type:	Sling Psychrometer
Range:	Wet Bulb: 30-110 °F
Dry Bulb:	30-110 °F
Resolution:	±1 °F
Accuracy:	±1 °F

13. Barometer

Manufacturer:	Princo Instruments, Inc.
Model:	NOVA 469

Type:	Mercury Barometer
Range:	20-32" Hg
Resolution:	0.01" Hg
Accuracy:	±0.01" when calibrated and installed as per the manufacturer's written operating instructions.

Equation 6.3.1a of the "Standard Methods for Measuring the Emissions and Efficiencies of Residential Wood Stoves" and equation #1 are programmed into a Hewlett Packard 15C calculator which first calculates stack gas flow rate and then the ΔH. The stack gas flow rate and ΔH are both recorded on Data sheet #2. The ΔH is used to set the flow rate through the dry gas meter at 5 minute intervals during the test.

In order to successfully maintain the correct sampling ratio, the following data is recorded on Data Sheet #2 (Meter Box Data Sheet): temperature (°F) at the SO_2 injection rotameter (Tr), pressure (inches H_2O) at the SO_2 injection rotameter (Pr), SO_2 injection rate (cc/min), barometric pressure (BP) (inches Hg), stack gas SO_2 concentration (ppm SO_2), sampling ratio (Sr), and the average dry gas meter temperature (°F). This data is entered into the HP15C, which is used to first calculate a stack gas flow rate (dscf) and then a ΔH for every sampling interval. The flow rate through the dry gas meter is adjusted and maintained by maintaining the appropriate ΔH.

CEM MONITORS

1. Calibration Gases

   LoKee uses vendor certified (±2.0%) calibration gases for each CEM. The concentrations purchased coincide with ranges specified in M5H. Upon receipt of the cylinder, the concentrations are verified with Method 3 (ORSAT) analysis.

2. Flow Regulators

   LoKee uses a variety of standard gas flow regulators to meter the flow of calibration gases from the cylinders.

3. Point of Injection

   Calibration gases are injected directly into the end of the probe. The line carrying the calibration gases from the cylinders is connected to the probe with a short piece of rubber tubing.

4. Sample Gas Conditioning System

   The combustion gas is conditioned with a train that is a duplicate of a M5H train. It contains the following components:

   SS probe

   Glass 4" M5H filter and holder in a heated box

4 1000 ml glass impingers

Glass 4" M5H filter and holder

Indicating silica gel

Type K thermocouple to monitor exit gas temperature

Thomas pump

5. Filters

The filters used are the same as EPA M5H filters.

6. Manifold and Exhaust

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

7. CO Analyzer

Horiba PIR 2000/SN 408005

Nondispersive infrared (NDIR)

The gas stream flow is controlled by a SS flowmeter downstream of the analyzer. The calibrated range used is 0-10.0% by volume. The resolution is 0.01% CO. The manufacturer's specification given for linearity is ±1.0%.

8. CO_2 Analyzer

Horiba PIR 2000/SN 407069

The CO_2 analyzer is also a NDIR and is operated in exactly the same manner as the CO analyzer. The range of the CO_2 analyzer is 0-25.0% CO_2.

COMBUSTION GAS ANALYZER TRAIN OPERATING INSTRUCTIONS

A. Pretest Preparation, Checks and Audit Procedures

1. Clean the probe with acetone and a brush. Seal the end of the probe for a leak check.
2. Remove the filter holder from the sample box and change the filter.
3. Empty water from all the impingers in the train. Clean all impingers and fill the first 2 with 100 ml of water.
4. Remove the second filter holder from the train and change the filter.
5. Visually check the indicating silica gel in the fourth impinger. If it is visibly impacted by water, replace the silica gel with dry silica gel.
6. Turn on the pump and perform a leak check on the entire train. This is done by placing the exhaust line in water. A successful leak check is accomplished when no bubbles are detected.
7. Slowly release the plug from the probe to prevent any back flushing.
8. Turn off the pump.

9. Turn on the heat in the sample box. Adjust Variac voltage controller so that temperature in the sample box does not exceed 248 °F.
10. Open the bypass valve on the pump.
11. Connect the probe to the zero/span gas delivery line.
12. Turn on the zero gas and adjust the flow rate to 1.5 SCFH.
13. Wait until the zero gas has completely flushed the train and a stable reading is obtained.
14. Record the zero gas readings of the DVM on Data Sheets #15.
15. Turn off the zero gas at the cylinder.
16. Disconnect the zero/span gas delivery line from the zero gas cylinder.
17. Connect the zero/span gas delivery line to the span gas source for each analyzer.
18. Turn on the span gas and adjust the flow rate to 1.5 SCFH. Wait until a stable reading is obtained on each analyzer. Repeat until all three analyzers are spanned properly.
19. Record the span gas readings of the DVM. Record the analyzer's output and all other pertinent information Data Sheets #15.
20. Turn off the span gas at the cylinder.
21. Disconnect the probe from the zero/span gas delivery line.
22. Insert the probe in the stack.
23. Close the bypass valve on the pumps.
24. Approximately 15-20 minutes before the actual start of the test, turn on the pump and adjust the flow through each analyzer until the flow rate is 1.5 SCFH.

B. Operation During Testing

1. Monitor the flow rate to the analyzers periodically to maintain a flow rate of 1.5 SCFH. Make any necessary adjustments.
2. Record data as follows:
   a. At the start of each 5 minute data cycle, record the scale weight, wet bulb/dry bulb, stack gas temperature and static pressure on Data Sheet #12 (Gas Data).
   b. Record the combustion gas (CO_2, O_2 and CO) analyzer data and the SO_2 analyzer data on Data Sheet #12.
   c. Record the remainder of the temperature data.

C. Post Test Checks and Audit Procedures

1. Remove the probe from the stack. (Be careful when handling the probe as it can be quite hot.)
2. Seal the end of the probe.
3. Perform a leak check on the entire train.
4. Slowly release the plug from the end of the probe to prevent any back flushing.
5. Turn off the pump.

6. Open the bypass valve on the pump.
7. Connect the probe to the zero/span gas delivery line.
8. Turn on the zero gas and adjust the flow rate through each analyzer to 1.5 SCFH.
9. Wait until the zero gas has completely flushed the train and a stable reading is obtained from each analyzer.
10. Record the zero gas reading. Record each analyzer's output and all other pertinent information on Data Sheets #15.
11. Turn off the zero gas at the cylinder.
12. Disconnect the zero/span gas delivery line from the zero gas cylinder.
13. Connect the zero/span gas delivery line to the span gas source for each analyzer.
14. Turn on the span gas and adjust until the flow rate through each analyzer to 1.5 SCFH. Wait until the span gas has completely flushed the train and a stable reading is obtained on each analyzer.
15. Record the span gas reading. Record each analyzer's output and all other pertinent information on Data Sheets #15.
16. Turn off the span gas at the cylinder.
17. Disconnect the probe from the zero/span gas delivery line.

D. Determination of the Combustion Gas Train's Response Time

1. The response time of the combustion gas analyzer train is to be determined using the following procedures. It is best to determine the combustion gas analyzer train response time during the "charcoal phase" of a test burn so that CO levels are relatively stable.
   a. Leak check the combustion gas (CEM) analyzer train.
   b. Zero the CO analyzer using ambient air.
   c. Calibrate the CO analyzer.
   d. Insert the probe for the combustion gas analyzer train in the stack.
   e. Sample flue gas until a stable reading is obtained.
   f. Remove the probe from the stack, note the exact CO concentration as measured on the DVM and start a stop watch at the exact time of removal.
   g. Observe the stop watch and DVM. Record the length of time to initial response, i.e., when the CO levels begin to decline.
   h. Continue observing the stop watch and DVM. Record the time when the analyzer's output equals zero (0.000 v).
   i. Repeat steps d-h 2 or 3 times to verify results.

E. Calibration and Audit Procedures for the Combustion Gas Analyzers

1. Calibrate by presenting zero and span gases to each analyzer at the probe and through the entire sampling train. (See Sections 6.7.2 and 6.9 [M5H].) Record the responses on the appropriate calibration forms.
2. Immediately prior to and after each test run, present the zero and span gases to the analyzers through the entire sampling train as is discussed in section C. Record each analyzer's response on Data Sheets #15.
3. Calculate the ± concentration difference and the actual percent difference as follows using the zero and span gas values obtained in #2 above. All calculations are to be based upon the actual gas concentrations involved.

$$\pm \text{ Concentration Difference} = \text{Actual Conc (\%)} - \text{Std Conc (\%)}$$

$$\text{Zero \% Difference} = \frac{\text{Act Conc (\% or ppm)} - \text{Std Conc (\% or ppm)}}{\text{Full Scale Value (\% or ppm)}} * 100$$

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

Then refer to Section 4.2 and 4.3 (M5H) to determine whether the audits are acceptable or not.

TRACER GAS (SO_2) EQUIPMENT

1. SO_2 Injection Probe

   A circular SS loop about 4" in diameter is positioned in the center of the stack. The loop extends outside the stack and is connected to the line leading from the SO_2 injection rotameter with Sweglock fittings. The loop is inserted in the stack at 9.5 ±0.5 ft above the top of the scale.

2. Rotameter

   A rotameter that has been calibrated with a bubble tube. The rotameter is all glass, stainless steel and Teflon. The rotameter has a flow control mechanism which is set to the calibrated flow.

3. Temperature

   The temperature at the injection rotameter is measured with a type K thermocouple.

4. Injection Gas

   Pure SO_2, 99.999% pure, released from the cylinder through a SS regulator and shut off valve.

5. Calibration Gases

LoKee uses vendor certified calibration gases with traceability established in accordance with EPA Protocol #1 as specified in Section 3.3.1 and verified using EPA Method 6.

6. Sample Probe

3/8" SS tubing inserted at 13.5 ±0.5 feet above the platform scale. No obstructions are in the stack between the injection and sample probes.

7. Combustor

Lindberg tube furnace, Model 55035/SN 800125, range 0-2000 °F. The temperature in the tube furnace is monitored with a type K thermocouple and controlled with a Variac voltage regulator. Power adjustments are made as necessary to maintain temperature at 1425 °F ±25 °F.

8. Sample Condenser

The sample condenser consists of 3 modified M5 impingers immersed in a freezer.

A filter assembly

The exit gas temperature is monitored with a type K thermocouple.

9. Filter

A standard EPA M5H 3" or 4" filter.

10. SO_2 Analyzer

Horiba, PIR 2000/SN 403019

Nondispersive infrared (NDIR)

The analyzer is operated as per the manufacturer's instructions at a flow rate of 1.5 SCFH. The calibration range is 0-2500 ppm SO_2 at a resolution of ±25.0 ppm. The manufacturer's specification for linearity is ±1.0%. The voltage response is displayed on a DVM which is converted to ppm using the manufacturer's calibration curves.

11. Flow Control

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

TRACER GAS TRAIN OPERATING INSTRUCTIONS

A. Pretest Preparation and Checks and Audit Procedures

1. Clean the probe with a brush. After cleaning, seal the end of the probe.

   Note: Do Not Use Acetone Or Other Organic Solvents To Clean The Probe Immediately Prior To Running A Test Or Conducting A Leak Check.

2. Turn on the tube furnace in order to insure that the unit is at the correct operating temperature (1425 °F) at the start of the test.
3. Remove all water and clean the impingers.
4. Change the filter.

5. Turn on the pump.
6. Perform a leak check on the entire tracer gas train. This is done by placing the SO_2 exhaust line in water. A successful leak check is accomplished when no bubbles are detected.
7. Slowly remove the plug from the end of the probe to prevent any back flushing.
8. Turn off the pump.
9. Bypass the pump.
10. Connect the probe to the zero/span delivery gas line.
11. Connect the zero/span gas delivery line to the zero gas cylinder and turn on the zero gas and adjust the flow until the flow rate through the SO_2 analyzer is 1.5 SCFH.
12. Wait until the zero gas has completely flushed the train.
13. Record the zero gas reading. Record the SO_2 analyzer's DVM output on Data Sheets #15.
14. Turn off zero gas at the cylinder.
15. Disconnect the zero/span gas delivery line from the zero gas cylinder.
16. Connect the zero/span gas delivery line to the span gas cylinder.
17. Turn on the span gas and adjust the flow until the flow rate through the SO_2 analyzer is 1.5 SCFH. Wait until the span gas has completely flushed the train and a stable reading is obtained on the analyzer.
18. Record the span gas reading. Record the analyzer's output and all other pertinent information on Data Sheets #15.
19. Turn off the span gas at the cylinder.
20. Disconnect the zero/span gas delivery line from the probe.
21. Insert the probe in the stack.
22. Close the bypass on the pump.
23. Approximately 15 to 20 minutes before the actual start of the test, turn on the SO_2 injection train and the pump for the tracer gas train.

B. Operation

1. Turn on the tube furnace to insure furnace is at approximately 1425 °F when the test begins.
2. Approximately 15-20 minutes before the actual start of the test, turn on the cylinder of pure SO_2.
3. Using the rotameter's current calibration, adjust the SO_2 flow rate to the calibrated level.
4. Turn on the pump in the tracer gas train. Adjust the flow rate through the SO_2 analyzer so that it remains at 1.5 SCFH.

5. Monitor the SO_2 concentrations in the stack and stack gas flow rates in order to establish a sampling ratio for the test and a correct ΔH at the start of the test.

6. At the start of the test and every 5 minutes thereafter, record the SO_2 analyzer output in volts and the stack gas SO_2 concentration in order to calculate the stack gas flow rate and determine the correct ΔH for the meter box.

   Also monitor and record the temperature at the Rotameter (Tr), pressure at the Rotameter (Pr), barometric pressure (BP) SO_2 injection rate (cc/min) and static pressure on Data Sheets #2 and #12.

C. Post Test Checks and Audit (Zero/Span) Procedures

1. Remove the probe from the stack. (Be careful when removing the probe from the stack as it can be quite hot.)
2. Plug the end of the probe.
3. Perform a leak check.
4. Slowly remove the plug from the end of the probe to prevent any back flushing.
5. Turn off the pump.
6. Bypass the pump.
7. Connect the probe to the zero/span gas delivery line.
8. Connect the zero/span gas delivery line to the zero gas cylinder. Turn on and adjust until the flow rate through the SO_2 analyzer is 1.5 SCFH.
9. Wait until the zero gas has completely flushed the train.
10. Record the zero gas reading. Record the SO_2 analyzer's DVM output on Data Sheet #15.
11. Turn off zero gas at the cylinder.
12. Disconnect the zero/span gas delivery line from the zero gas cylinder.
13. Connect the zero/span gas delivery line to the span gas cylinder.
14. Turn on the span gas and adjust the flow until the flow rate through the SO_2 analyzer is 1.5 SCFH. Wait until the span gas has completely flushed the train and a stable reading is obtained.
15. Record the span gas reading. Record the analyzer's output and all other pertinent information on Data Sheet #15.
16. Turn off the span gas at the cylinder.
17. Disconnect the zero/span gas delivery line from the probe.

D. Determination of Tracer Gas Train's Response Time

1. Zero and calibrate the SO_2 analyzer.
2. Prepare and leak check the tracer gas train as per A above.
3. Insert the probe in the stack which contains flue gas and SO_2 concentrations in the ranges normally encountered during wood stove testing.

4. Sample flue gas with SO_2 concentrations until a stable reading is obtained. It is best to determine the tracer gas train's response time during the "charcoal phase" of a test burn so that the SO_2 concentrations are as stable as possible.
5. Remove the probe from the stack, noting the exact SO_2 concentration as measured by the DVM and starting a stop watch at the exact time of removal.
6. Observe the stop watch and DVM. Record the length of time to the initial response, i.e., when the SO_2 levels begin to decline.
7. Continue observing the stop watch and DVM. Record the time when the SO_2 analyzer's output equals zero (0.000 v.).
8. Repeat steps 3-7 two or three times to verify results.

E. Calibration and Audit Procedures for the Tracer Gas (SO_2) Analyzer

1. Calibrate by presenting zero and span gases to the analyzer at the probe and through the entire sampling train. Record the responses on the appropriate calibration form.
2. Immediately prior to and after each test run, present the zero and span gases to the analyzer through the entire sampling train as is discussed in Sections A and C. Record the analyzer's response on Data Sheet #15.
3. Calculate the ± concentration differences and actual percent difference as follows using values obtained in #2 above as the expected response. All calculations are to be based upon the actual gas concentration involved.

$$\pm \text{ Concentration Difference} = \text{Actual Conc (\%)} - \text{Std Conc (\%)}$$

$$\text{Zero \% Difference} = \frac{\text{Act Conc (\% or ppm)} - \text{Std Conc (\% or ppm)}}{\text{Full Scale Value (\% or ppm)}} * 100$$

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

Then refer to Section 4.2 and 4.3 (M5H) to determine whether the audits are acceptable or not.

TEMPERATURE SENSING OPERATING INSTRUCTIONS

A. Operate the thermocouple readout selector switch and record the temperature for each thermocouple. All the temperature in the test facility should be approximately the same. Repair as necessary.

B. Check the operation and output of the thermocouple readout using the Omega NBS Traceable Thermocouple Simulator. The simulator is hooked up to thermocouple readout #23. Check the readout over its full range at 200 °F intervals. Record the data on Data Sheet #16.

C. One hour before the actual test start record stove temperatures (thermocouple readout #'s 4, 5, 6, 7 and 8), firebox (readout #9), post catalytic combustor or secondary burn chamber (readout #10), and room temperature (readout #11). Record the temperatures every 5 minutes until the start of the test on Data Sheet #13 (Preburn).

D. During the test record the temperatures every 5 minutes for each of the thermocouples on Data Sheets #12 and 14.

FUEL PREPARATION

A. No more than 4 hours prior to use, obtain 3 moisture readings from each piece of wood. Record all moisture readings on Data Sheet #10.

B. Obtain kindling by finely splitting pieces that otherwise cannot be used as test fuel. Weigh the kindling and record the weight on Data Sheet #8.

C. Obtain the pretest fuel by using 2 x 4's. The length of the pretest fuel can be no less than 1/3 the length of the test fuel. Weigh the pretest fuel prior to its being loaded in the stove. Record weights on Data Sheets #8 and #9.

D. Obtain the test fuel by cutting dimensional lumber (either 2 x 4's or 4 x 4's) so that the length is 5/6's the length of the longest usable dimension of the firebox. Use the mix of 2 x 4's and 4 x 4's specified in Section 4.3 M28. The test fuel shall be essentially free of knots, sap seams or rotten areas.

E. The spacers shall measure 1 x 5 x 1" (nominally). The spacers shall be free of knots, sap seams or rotten areas. Nail the spacers to the 2 x 4's and 4 x 4's as described in the regulations.

F. Take a photograph of the assembled fuel charge at a 90° angle from the photograph that will be taken when the fuel charge is loaded in the stove.

WOOD DENSITY DETERMINATION

A. When cutting the test fuel, cut a representative piece of 2 x 4 or 4 x 4 that is approximately 3 to 5-inches in length.

B. Take a moisture reading from the top, bottom and side of the piece. Record readings on Data Sheet #11. Determine the % moisture on a wet and dry basis.

C. Weight the piece on a balance.

D. Take measurements of width, depth and length at the four corners with a micrometer. Determine the volume of the piece. (Length x width x depth = Volume in cubic centimeters)

E. Dry the piece in an oven at 95-100 °C for a minimum of 24 hours.

F. Reweigh the piece on the balance.

G. Calculate % moisture on a dried basis.

$$\% \text{ moisture (dry basis)} = 1 - \frac{\text{dried weight}}{\text{wet weight}} * 100$$

H. Calculate the density.

$$\text{Density (g/cc)} = \frac{\text{dried weight (g)}}{\text{volume (cc)}}$$

BTU'S/LB DETERMINATION

A. When cutting the test fuel (only the test fuel, not the kindling, pretest fuel or spacers), collect a sawdust sample. Place in a clearly marked plastic bag.

B. Forward sample to a commercial laboratory for BTU contents analysis.

STOVE PREPARATION

A. Clean the stove.

B. Weigh the stove, record the weight on Data Sheet #8.

C. Add approximately 0.3 lb. of wadded newspaper to the stove. Record weight of newspaper on Data Sheet #8. Add 4-8 lb. of kindling to the stove, and record the weight of the kindling on Data Sheet #8.

D. Light the paper and kindling, leaving the stove's air draft control(s) wide open and the door cracked until well ignited.

E. Close door.

F. When between 50% - 75% of the weight of the kindling has been burned add the first pretest fuel charge.

G. Continue to add pretest fuel until the stove has thoroughly warmed up. As necessary, rake the coal bed prior to adding additional pretest fuel charges.

H. Remove all material from the firebox after two or more hours of burning on high. Obtain the dry empty stove weight and record on Data Sheet #8.

I. Set the stove's air draft control(s) at the desired setting a minimum of 1 hour before the test run is to begin.

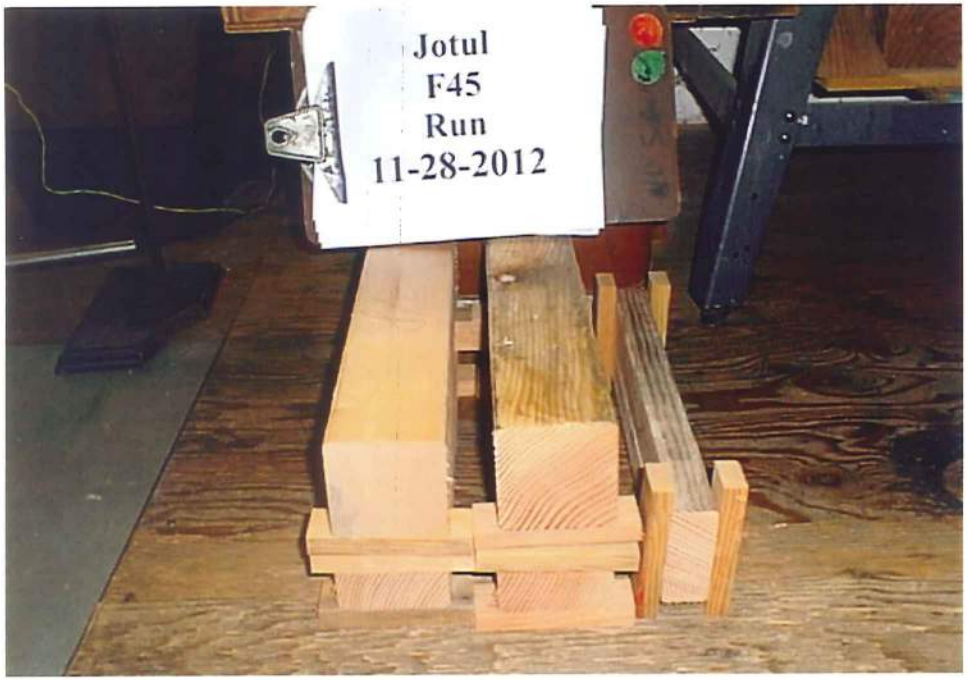
J. As necessary set the heat exchange blower(s) at the specified setting a minimum of one hour before the test is to begin.

K. Record the stove surface temperatures, firebox and post catalytic or secondary burn temperatures and scale weigh for a minimum of one hour before the test run begins. As necessary add fuel, rake the coal bed, level the coal bed and/or remove coals during the first 45 minutes of the hour immediately preceding the start of the test. Record all information concerning raking, fuel additions, etc. on Data Sheet #13.

L. If necessary, sometime during the last 15 minutes before the start of the test, open the door and brake up all large pieces and then rake and level the pretest fuel in the stove. At this time, level the coal bed as necessary to accommodate loading the fuel charge into the stove. Close the door. Total time door can be open during the last 15 minutes is 1 minute. No further manipulation of the stove is allowed during the 15 minutes immediately preceding the start of the test.

M. When the weight of the coal bed equals 20-25% of the weight of the test fuel charge, load the test fuel. Take a photograph of the fuel load in the stove immediately after loading the fuel. Leave the door open as per the manufacturer's instruction, but no longer than 5 minutes.

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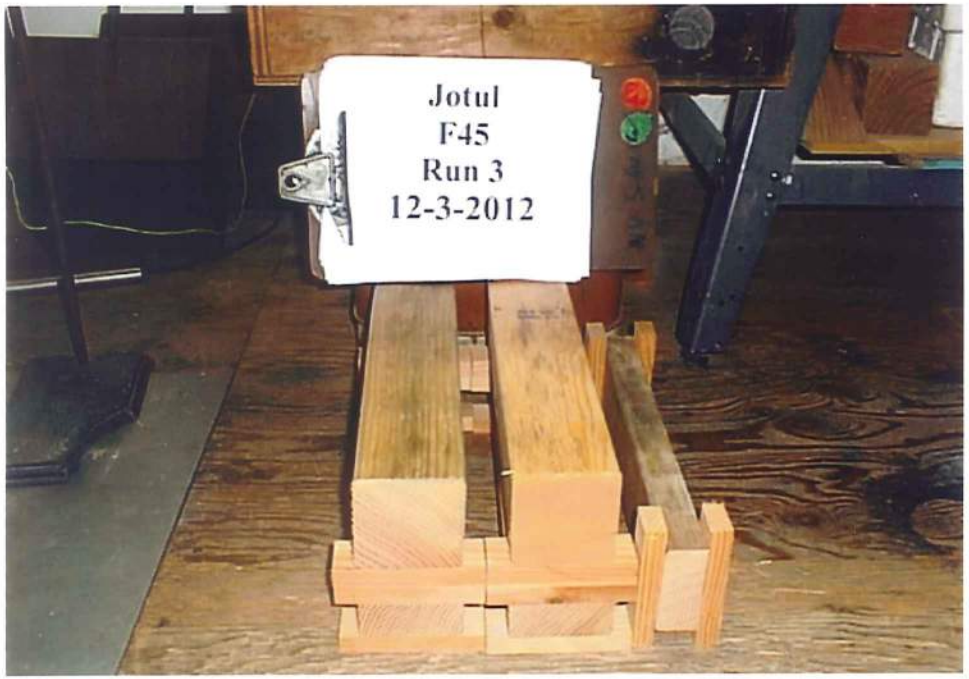
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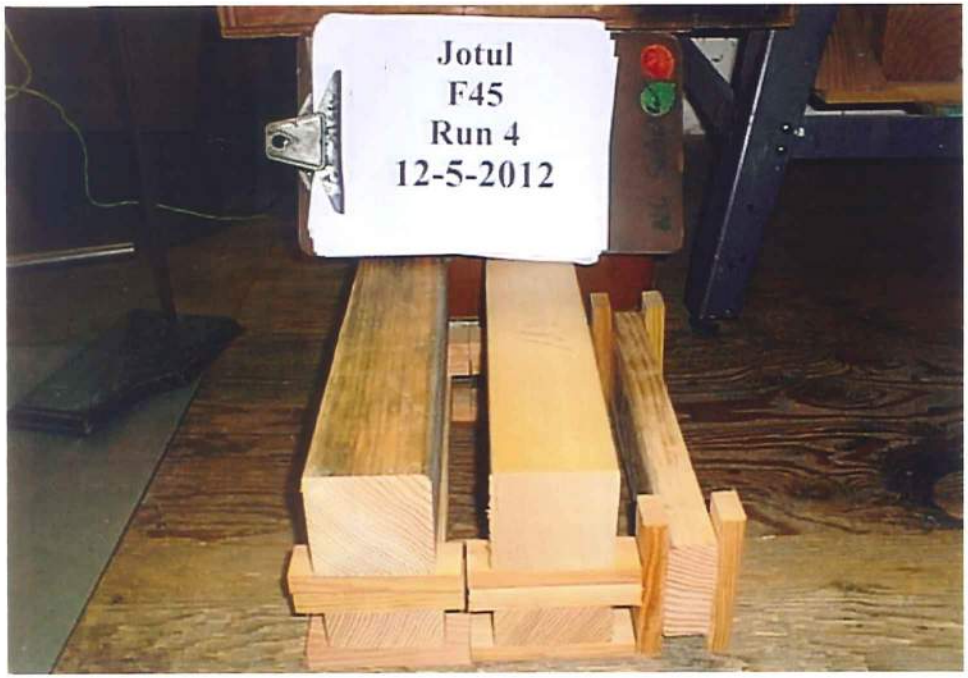
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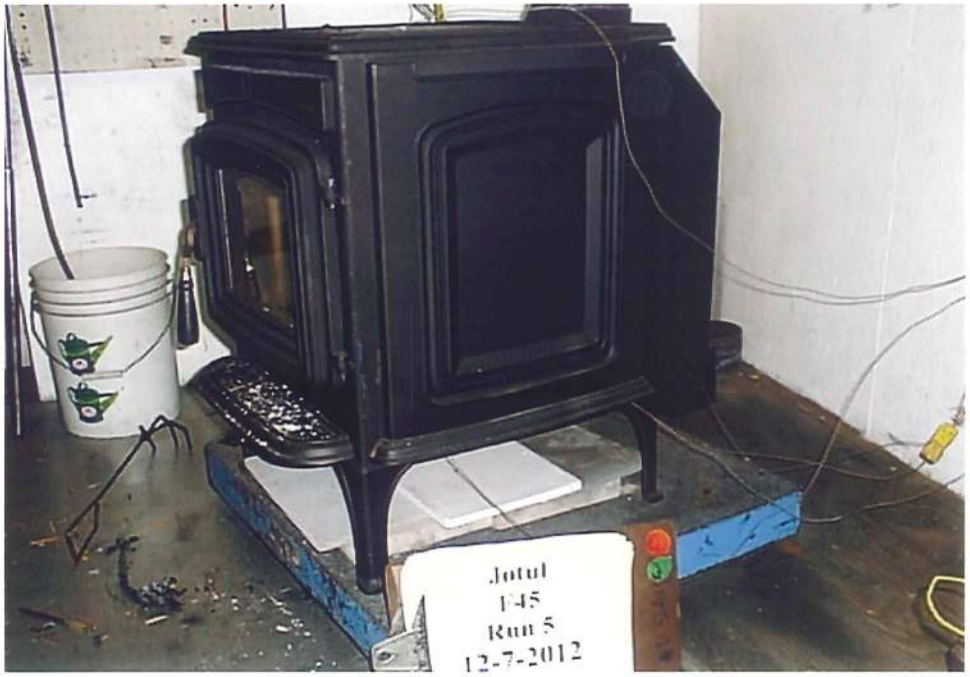
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