LOKEE TESTING Laboratory

United States
Environmental Protection Agency
Wood Heater Certification Test Report

JOTUL U.S.A., INC.
F600

Volume 1 of 1

13235 Prairie Circle East, Sumner, Washington 98390
Telephone: 360-897-9685

United States
Environmental Protection Agency
Wood Heater Certification Test Report

Jotul U.S.A., Inc.
400 Riverside Street
P. O. Box 1157
Portland, ME 04104

F600

Volume 1

Report By:

Chip Wadington
Deborah Wadington

CONFIDENTIAL

RELEASED ONLY BY
AUTHORIZED PERSONNEL

May 15, 2003

TABLE OF CONTENTS

TEST SERIES INFORMATION

Unit name and model number: F600

Type of unit: Wood Heater

Manufacturer: Jotul U.S.A., Inc.
Address: 400 Riverside Steet
Portland, ME 04104

Contact: Roger Purington
Phone Number: 207-797-5912
Fax Number: 207-772-0523

Observers: None

Date Rcv'd: 03/24/2003 Aged: 04/21-22/2003 Tested: 04/29-05/07/2003

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

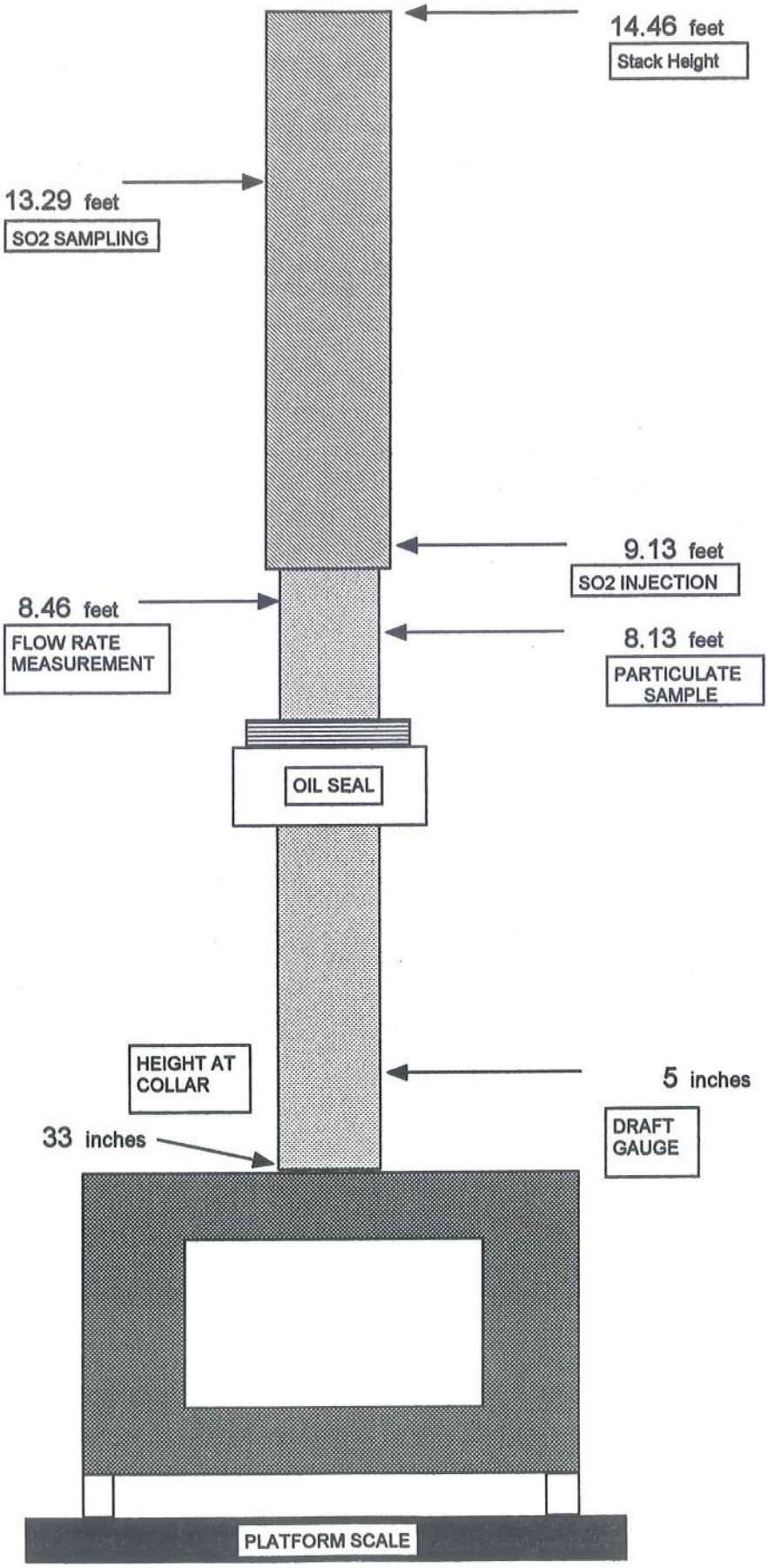
Test Location: 13235 Prairie Circle East
Sumner, WA 98390-7250
Test Site Elevation: 500 feet above sea level

LoKee's Field Team

Team Members: Chip Wadington
Deborah 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.

Model: F600 **Date:** 04/29/03



AGING DATA SHEET

UNIT : F 600 DATE: 4-21-03

Hr #	DATE	TIME	TEMP Fbox 1	TEMP Sec 2
1	4-21	1300	1005	1316
2	"	1400	510	585
3	"	1500	348	965
4	"	1600	552	948
5	"	1700	609	906
6	"	1800	614	964
7	"	1900	510	579
8	"	2000	455	544
9	4-22	1505	888	1058
10	"	1605	541	612
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				

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

COMMENTS:

4-21-03 / Stove lit 0930

4-22-03 / Stove lit 1000

LOKEE TESTING Laboratory

13235 Prairie Circle East, Sumner, Washington 98390
Telephone: 360-897-9685
Website: www.lokeetl.com

April 29, 2003

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 :
Model F 600

If you have any questions please feel free to call.

Sincerely,

Chip Wadington
Owner

LOKEE TESTING Laboratory

13235 Prairie Circle East, Sumner, Washington 98390
Telephone: 360-897-9685

April 29, 2003

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 April 29, 2003 at 10:47 am PST, Irvin Keefer waived the 30 day intent to certify notice at the request of LoKee Testing Laboratory in order to run certification tests on the:

Jotul North America :
Model –F600

If you have any questions please feel free to call.

Sincerely,

Chip Wadington
Owner

LOKEE TESTING Laboratory

13235 Prairie Circle East, Sumner, Washington 98390
Telephone: 360-897-9685

May 8, 2003

Irvin Keefer
Office of Compliance, Manufacturing,
Energy, and Transportation Division (2223-A)
USEPA
401 M Street, S.W.
Washington, D.C. 20460

Mr. Keefer

Here is a document for your records stating that all the test runs were not run on consecutive workdays during the testing of the Jotul F600. This is due to a crack in the back half filter housing that occurred when ice was loaded into the impinger bucket shortly before test run #2 started. This took place after the system leak check earlier in the day. The break was caught during the 5 minute to 10-minute period of the test when the test meter system showed no vacuum during a large sample pull. The test was immediately aborted. There was no sample to collect.

If you have any questions please feel free to call.

Thankyou

Chip Wadington

LOKEE TESTING Laboratory

13235 Prairie Circle East, Sumner, Washington 98390
Telephone: 360-897-9685

May 8, 2003

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If you have any questions please feel free to call.

Thankyou

Chip Wadington

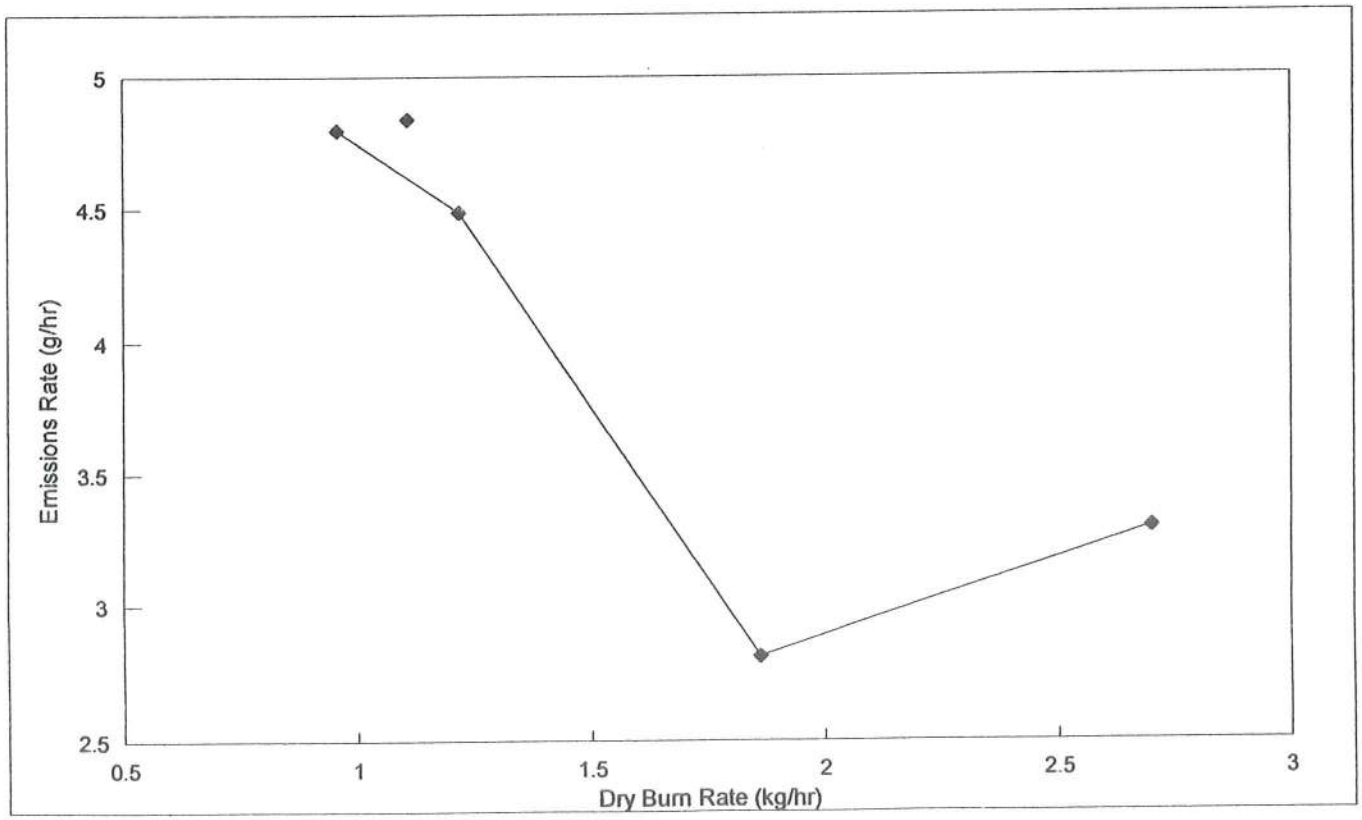
DATA
SUMMARY

Wood Heater Emission Test Summary

Laboratory/Wood Heater Information

Stove Manufacturer:	JOTUL U.S.A., INC
Model Identification:	F600
-Stove Type-	
1=cat, 2=noncat, 3=pellet:	2
Laboratory Name:	LoKee Testing Laboratory
Laboratory Contact:	CHIP WADINGTON
Telephone number:	360-897-9685
Test Dates:	APR 29 THRU MAY 07, 2003
-Test Methods Used-	
Method 28/Other:	28
Sampling Method:	5H

Run no.	Burn Rate (kg/hr)	Emission Rate (g/hr)	Heat Output (Btu/hr)	Wtd Avg (g/hr) 4.08
3	0.96	4.80	11576	
4	1.22	4.49	14711	
1	1.86	2.81	22428	
5	2.70	3.30	32557	
6	1.11	4.84	13385	



DATA SUMMARY

Unit : Jotul U.S.A., Inc. - F600

	RUN #	3	4	1	5		6 FAN		
Particulate Emissions:									
Concentration:	grains/dscf:	.2022	.1511	.0689	.0609		.1636		
Emissions Rate	grams/hr:	4.80	4.49	2.81	3.30		4.84		
Emissions Factor	grams/kg:	4.97	3.68	1.51	1.22		4.35		
Front Half Catch	% of total	44.0	32.8	40.2	52.1		32.3		
Total Mass Captured	total catch:	1.7193	1.1582	.2972	.1357		1.3857		
Heat Output (EPA Default):	BTU/hr	11,623.7	14,698.8	22,462.0	32,510.2		13,436.3		
Fuel Burn Rates:									
Average kg/hr (dry)	Kg/hr	0.96	1.22	1.86	2.70		1.11		
Fuel Moisture Content:									
Kindling (wet basis)	%	13.917	14.286	16.504	15.636		15.110		
Pretest Fuel (wet basis)	%	19.159	18.452	17.369	18.055		17.548		
Test Fuel (wet basis)	%	18.189	17.759	17.789	18.846		18.345		
Air to Fuel Ratio		N/A	N/A	N/A	N/A		N/A		
Average Stack Gas									
Avg CO_2	%	6.63	6.97	8.32	9.61		5.96		
Avg O_2	%	N/A	N/A	N/A	N/A		N/A		
Avg CO	%	1.55	1.30	1.02	0.68		1.50		
Avg Moisture	%	6.40	6.46	7.78	8.62		9.35		
Avg Stack Gas Emissions:									
CO	g/Kg	196.40	163.66	115.58	70.85		205.91		
	g/hr	189.33	199.50	215.33	191.00		229.39		

MINIMUM
DBR

MINIMUM
DBR

MINIMUM
DBR

COMPUTER INPUT DATA SHEET #1

Client: JOTUL USA, INC.

Address: 400 RIVERSIDE ST. / P.O. BOX 1157
PORTLAND, ME 04104

Phone: 800-797-5912 Fax: 207-797-6072

Run No.: 3 Date of Test: 05/01/03 Burn Rate: .964

Model No.: F600 ☒ min ☐ min-1.25 ☐ fan

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

Dry Gas Meter Y Factor: .990 (0.000) (Data Sheet #2)

Post Leak Rate: .006 cfm (.000) (Data Sheet #2)

Time: 425 min. (000) (Data Sheet #2)

Dry Gas Meter Volume: 137.024 cf (00.000) (Data Sheet #2)

Stack Flow: 6.433 dscfm (00.000) (Data Sheet #2)

Δ H: .163 in. H_2O (.000) (Data Sheet #2)

Maximum Vac.: 5.0 (0.0) (Data Sheet #2)

Barometric Pressure: 30.03 in. Hg (00.00) (Data Sheet #2)

H_2O Captured: 190.6 g (00.0) (Data Sheet #3)

Front Half Catch % Of Total: 44.0 % (00.0) (Data Sheet #6)

Total Particulate Catch: 1.7193 g (0.0000) (Data Sheet #6)

Flue Gas Moisture: 6.4012 % (00.000) (Data Sheet #7)

Particulate Emission: .2022 gr/dscf (0.0000) (Data Sheet #7)

Relative Humidity: 34.0 % RH (00.0) (Data Sheet #8)

Ambient Moisture: 1.30 % H_2O (0.00) (Data Sheet #8)

Preburn Fuel Wt.: 46.1 lbs. (00.0) (Data Sheet #8)

Coal Bed Wt.: 4.3 lbs. (00.0) (Data sheet #8)

Test Fuel Wt.: 18.4 lbs. (00.0) (Data sheet #8)

Heat Output (EPA Default): 11,623.7 BTU/hr (00,000.0) (Data Sheet #8)

Kindling Fuel % Moisture (wet): 13.917 % (00.000) (Data Sheet #10)

Pretest Fuel % Moisture (wet): 19.159 % (00.000) (Data Sheet #10)

Test Fuel % Moisture (dry): 22.233 % (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove])

Test Fuel % Moisture (wet): 18.189 %

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

Stack Static Pressure: -.027 in. H_2O (+/- .000) (Data Sheet #12)

Average Ambient Temperature: 81 °F (00) (Data Sheet #14)

Stove Temperature Change: -81.0 °F (+/- 000.0) (Data Sheet #14)

TABLE 1 ----- RAW DATA

CLIENT : Jotul TEST No. : 3

MODEL: F600 DATE: 01-May-03

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	542.800	0.150	87	1.55	6.10	550
5	544.300	0.600	87	0.47	5.90	275
10	547.387	0.150	87	0.70	2.70	550
15	548.934	0.140	87	0.75	3.10	575
20	550.414	0.130	87	0.88	3.60	600
25	551.833	0.110	87	1.02	4.00	650
30	553.142	0.120	87	0.95	5.00	625
35	554.504	0.110	87	1.25	6.10	650
40	555.813	0.100	87	1.46	4.80	675
45	557.074	0.100	87	1.50	5.30	675
50	558.335	0.100	87	1.67	5.50	675
55	559.596	0.140	87	1.15	6.80	575
60	561.075	0.120	87	1.94	4.80	625
65	562.437	0.150	87	1.12	8.10	550
70	563.984	0.200	87	0.86	9.00	475
75	565.775	0.200	87	0.83	8.60	475
80	567.566	0.220	87	0.72	9.80	450
85	569.456	0.220	87	0.74	9.30	450
90	571.347	0.250	87	0.44	10.70	425
95	573.348	0.250	87	0.50	11.60	425
100	575.349	0.280	87	0.44	11.90	400
105	577.475	0.280	87	0.51	11.60	400
110	579.601	0.280	87	0.46	11.30	400
115	581.726	0.250	87	0.31	10.10	425
120	583.728	0.250	87	0.39	9.50	425
125	585.729	0.250	87	0.42	9.30	425
130	587.730	0.250	87	0.37	9.40	425
135	589.731	0.250	87	0.31	10.60	425
140	591.732	0.250	87	0.37	9.80	425
145	593.733	0.250	87	0.26	9.70	425
150	595.734	0.250	87	0.26	10.40	425
155	597.735	0.250	87	0.27	10.60	425
160	599.737	0.250	88	0.21	9.70	425
165	601.745	0.250	88	0.19	9.40	425
170	603.753	0.250	88	0.81	8.50	425
175	605.762	0.180	88	0.93	7.70	500
180	607.470	0.180	88	1.23	6.80	500
185	609.180	0.140	89	1.81	6.10	575
190	610.667	0.150	89	1.76	6.20	550
195	612.222	0.160	89	1.70	6.40	525
200	613.851	0.150	89	1.96	6.20	550
205	615.405	0.160	89	2.06	6.10	525
210	617.034	0.160	89	2.23	6.00	525
215	618.663	0.160	89	2.20	6.00	525

220	620.292	0.150	89	2.15	6.10	550
225	621.847	0.150	89	2.27	5.80	550
230	623.401	0.150	89	2.29	5.80	550
235	624.956	0.150	89	2.44	5.80	550
240	626.511	0.150	89	2.46	5.80	550
245	628.067	0.150	89	2.19	5.90	550
250	629.623	0.140	89	2.36	5.80	575
255	631.111	0.130	90	1.93	6.00	575
260	632.610	0.120	90	2.04	5.80	600
265	634.047	0.120	90	2.14	5.80	600
270	635.484	0.120	90	1.94	5.90	600
275	636.921	0.120	90	1.96	5.90	600
280	638.358	0.120	90	2.03	5.80	600
285	639.794	0.120	90	2.04	5.90	600
290	641.231	0.120	90	1.89	6.00	600
295	642.668	0.120	90	1.92	6.00	600
300	644.105	0.120	90	1.88	5.90	600
305	645.542	0.130	90	1.82	5.90	575
310	647.041	0.130	90	1.43	6.00	575
315	648.540	0.120	90	1.60	5.90	600
320	649.977	0.120	90	1.65	5.80	600
325	651.414	0.120	90	1.77	5.70	600
330	652.851	0.130	90	1.79	5.70	575
335	654.350	0.120	90	1.86	5.70	600
340	655.787	0.120	90	1.81	5.70	600
345	657.224	0.120	90	1.79	5.60	600
350	658.660	0.120	90	1.89	5.50	600
355	660.097	0.120	90	2.04	5.40	600
360	661.534	0.120	90	2.52	5.00	600
365	662.971	0.120	90	2.54	4.90	600
370	664.408	0.120	90	2.51	4.90	600
375	665.845	0.120	88	2.50	4.80	600
380	667.271	0.120	88	2.51	4.80	600
385	668.697	0.120	88	2.50	4.80	600
390	670.124	0.120	88	2.31	5.20	600
395	671.550	0.120	88	2.41	4.90	600
400	672.977	0.110	88	2.38	5.00	625
405	674.346	0.110	88	2.39	4.90	625
410	675.715	0.110	88	2.77	4.60	625
415	677.085	0.110	88	2.75	4.50	625
420	678.454	0.110	88	2.77	4.30	625
425	679.824	0.110	88	2.71	4.30	625
430						

TABLE 2---RAW DATA

CLIENT : Jotul TEST No. 3

MODEL: F600 DATE: 01-May-03

****

METER CAL. FACTOR (Y)	------ 0.99		Wt. WOOD BURNED(LB)	------- 18.4	Lbs
BAROMETRIC PRESS.(Pb)	------ 30.03 in Hg		WET,FUEL MOISTURE %	------- 18.189	%
LEAK RATE POST (Lp)	------ 0.006 cfm		Wt. PART. COLLECTED	------- 1.7193	g
WATER VOL. (V1c)	------ 190.6 Ml		METER VOLUME Vm	------- 137.024	mcf
TEST TIME (MIN)	------ 425 min		HC MOLE FRACTION	------- 0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT :Jotul TEST No. 3

MODEL: F600 DATE: 01-May-03

****

AVG DELTA H	------- 0.16 in H2O		AVG PRCNT CO	-------	1.55 %
AVG METER TEMP. Tm	------- 88 deg F		AVG PRCNT CO2	-------	6.63 %
AVG PPM SO2	------- 546 PPM		AVG BAL CO2/CO	-------	4.29 %

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul TEST No. 3

MODEL: F600 DATE: 01-May-03

****

STD SAMPLE VOL. Vm(std) -----	131.17	dscf	STACK GAS FLOW Qsd -------	365.819	dscf/Hr
				6.10	& dscf/min
VOL. WATER VAPOR Vw(std) ----	8.972	scf	PARTICULATE CONCTRT. Cs ------	0.0131	g/dscf
PRCNT MSTR Bws -------	6.40	%	PARTC.EMISS. RATE E -------	4.80	g/Hr
BURN RATE BR -------	0.96	Kg/Hr	MOLES OF GAS PER Lb WOOD Nt --	0.45	Lb-mole/Lb
CO EMISSION RATE -------	189.33	g/Hr	PART.EMISS. RATE ------	4.97	g/Kgdry fuel
	196.40	& g/Kgdry fuel			

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Jotul TEST No. : 3

MODEL: F600 DATE: 01-May-03

TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR		PROPRTN RATE VAR. AVERAGE	
5	791.7	97		100	
10	815.6	100			
15	816.5	100			
20	816.6	100			
25	817.0	100			
30	816.4	100			
35	816.8	100			
40	816.4	100			
45	816.7	100			
50	816.7	100			
55	816.7	100			
60	816.1	100			
65	816.8	100			
70	816.5	100			
75	816.5	100			
80	816.5	100			
85	816.3	100			
90	816.7	100			
95	816.3	100			
100	816.3	100			
105	816.3	100			
110	816.3	100			
115	816.0	100			
120	816.7	100			
125	816.3	100			
130	816.3	100			
135	816.3	100			
140	816.3	100			
145	816.3	100			
150	816.3	100			
155	816.3	100			
160	816.0	100			
165	817.7	100			
170	817.7	100			
175	818.1	100			
180	818.1	100			
185	818.3	100			
190	817.5	100			
195	817.7	100			
200	817.7	100			
205	817.2	100			
210	817.7	100			
215	817.7	100			
220	817.7	100			

225	817.7	100
230	817.2	100
235	817.7	100
240	817.7	100
245	818.3	100
250	818.3	100
255	817.3	100
260	822.6	100
265	822.8	101
270	822.8	101
275	822.8	101
280	822.8	101
285	822.3	100
290	822.8	101
295	822.8	101
300	822.8	101
305	822.8	101
310	822.6	100
315	822.6	100
320	822.8	101
325	822.8	101
330	822.8	101
335	822.6	100
340	822.8	101
345	822.8	101
350	822.3	100
355	822.8	101
360	822.8	101
365	822.8	101
370	822.8	101
375	824.3	101
380	819.5	100
385	819.5	100
390	820.1	100
395	819.5	100
400	820.1	100
405	819.5	100
410	819.5	100
415	820.1	100
420	819.5	100
425	820.1	100
430		
435		

METER BOX DATA SHEET PAGE # 2

Page: 1 of 4

UNIT: E600 RUN: 3 DATE: 5-1-03

Meter Box: SH Y Factor: .990 ✓

Leak checks: 15 " Hg @ 1007 cfm _____ " Hg @ _____ cfm

15 " Hg @ 1004 cfm _____ " Hg @ _____ cfm

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

ROTO: PRESS: .16 SAMPLING RATIO: 20.5 : 1 BP: 30.06

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1235	542.800	—	6,230	.15	87	550	87	1.0
5	40	544.300	—	12,461	.60	87	275	87	5.0
10	45	547.387	547.387	6,230	.15	87	550	87	1.0
15	50	548.934	548.934	5,959	.14	87	575	87	1.0
20	55	550.414	550.414	5,711	.13	87	600	87	1.0
25	1300	551.833	551.833	5,272	.11	87	650	87	1.0
30	05	553.142	553.142	5,483	.12	87	625	87	1.0
35	10	554.504	554.504	5.272	.11	87	650	87	1.0
40	15	555.813	555.813	5.077	.10	87	675	87	1.0
45	20	557.074	557.074	5.077	.10	87	675	87	1.0
50	25	558.335	558.335	5,077	.10	87	675	87	1.0
55	30	559.596	559.596	5.959	.14	87	575	87	1.0
ROTO PRESS:		.16	TOTALS:	73.808	1.95	1044	BP.: 30.06		
60	1335	561.075	561.075	5,483	.12	87	625	87	1.0
65	40	562.437	562.437	6,230	.15	87	550	87	1.0
70	45	563.984	563.984	7.214	.20	87	475	87	1.0
75	50	565.775	565.775	7.214	.20	87	475	87	1.0
80	55	567.566	567.566	7.615	.22	87	450	87	1.0
85	1400	569.456	569.456	7.615	.22	87	450	87	2.0
90	05	571.347	571.347	8.063	.25	87	425	87	2.0
95	10	573.348	573.348	8.063	.25	87	425	87	2.0
100	15	575.349	575.349	8.567	.28	87	400	87	2.0
105	20	577.475	577.475	8,567	.28	87	400	87	2.0
110	25	579.601	579.601	8.567	.28	87	400	87	2.0
115	30	581.726	581.726	8,063	.25	87	425	87	2.2
			TOTALS:	91,261	2.70	1044	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	165,069	4.65	2088	AVG. BP:		

✓ ✓ ?

METER BOX DATA SHEET PAGE # 2

Page: 2 of 4

UNIT: F600 RUN: 3 DATE: 5-1-03

Meter Box: 5H Y Factor: .990

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

15 " Hg @ .006 cfm _____ " Hg @ _____ cfm

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

ROTO: PRESS: .16			SAMPLING RATIO: 20.5 : 1				BP: 30.06		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1435	583.728	583.728	8.063	.25	87	425	87	2.0
125	40	585.729	585.729	8.063	.25	87	425	87	2.0
130	45	587.730	587.730	8.063	.25	87	425	87	2.0
135	50	589.731	589.731	8.063	.25	87	425	87	2.0
140	55	591.732	591.732	8.063	.25	87	425	87	2.0
145	1500	593.733	593.733	8.063	.25	87	425	87	2.0
150	05	595.734	595.734	8.063	.25	87	425	87	2.0
155	10	597.735	597.735	8.063	.25	87	425	87	2.0
160	15	599.737	599.737	8.048	.25	88	425	88	2.0
165	20	601.745	601.745	8.048	.25	88	425	88	2.0
170	25	603.753	603.753	8.048	.25	88	425	88	2.0
175	30	605.762	605.762	6.841	.18	88	500	88	2.0
ROTO PRESS: .14			TOTALS:	95.489	2.93	1048	BP.: 30.02		
180	1535	607.470	607.470	6.832	.18	88	500	88	2.0
185	40	609.180	609.180	5.941	.14	89	575	89	2.0
190	45	610.667	610.667	6.211	.15	89	550	89	2.0
195	50	612.222	612.222	6.506	.16	89	525	89	2.0
200	55	613.851	613.851	6.211	.15	89	550	89	2.0
205	1600	615.405	615.405	6.506	.16	89	525	89	2.0
210	05	617.034	617.034	6.506	.16	89	525	89	2.0
215	10	618.663	618.663	6.506	.16	89	525	89	2.0
220	15	620.292	620.292	6.211	.15	89	550	89	2.0
225	20	621.847	621.847	6.211	.15	89	550	89	2.0
230	25	623.401	623.401	6.211	.15	89	550	89	2.0
235	30	624.956	624.956	6.211	.15	89	550	89	2.0
			TOTALS:	76.063	1.86	1067	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	171.552	4.79	2115	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 3 of 4

UNIT: F600 RUN: 3 DATE: 5-1-03

Meter Box: 5H Y Factor: .990

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

15 " Hg @ .006 cfm _____ " Hg @ _____ cfm

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

ROTO: PRESS: .14			SAMPLING RATIO: 20.5 : 1				BP: 30.06		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
240	1635	626.511	626.511	6.207	.15	89	550	89	2.0
245	40	628.067	628.067	6.207	.15	89	550	89	2.0
250	45	629.623	629.623	5.937	.14	89	575	89	2.0
255	50	631.111	631.111	5.915	.13	90	575	90	2.0
260	55	632.610	632.610	5.669	.12	90	600	90	2.0
265	1700	634.047	634.047	5.669	.12	90	600	90	2.0
270	05	635.484	635.484	5.669	.12	90	600	90	2.0
275	10	636.921	636.921	5.669	.12	90	600	90	2.0
280	15	638.358	638.358	5.669	.12	90	600	90	2.0
285	20	639.794	639.794	5.669	.12	90	600	90	2.0
290	25	641.231	641.231	5.669	.12	90	600	90	2.0
295	30	642.668	642.668	5.669	.12	90	600	90	2.0
ROTO PRESS: .16			TOTALS:	69.618	1.53	1077	BP.: 30.00		
300	1735	644.105	644.105	5.669	.12	90	600	90	2.0
305	40	645.542	645.542	5.915	.13	90	575	90	2.0
310	45	647.041	647.041	5.915	.13	90	575	90	2.0
315	50	648.540	648.540	5.669	.12	90	600	90	2.0
320	55	649.977	649.977	5.669	.12	90	600	90	2.0
325	1800	651.414	651.414	5.669	.12	90	600	90	2.0
330	05	652.851	652.851	5.915	.13	90	575	90	2.0
335	10	654.350	654.350	5.669	.12	90	600	90	2.0
340	15	655.787	655.787	5.669	.12	90	600	90	2.0
345	20	657.224	657.224	5.669	.12	90	600	90	2.0
350	25	658.660	658.660	5.669	.12	90	600	90	2.0
355	30	660.097	660.097	5.669	.12	90	600	90	2.0
			TOTALS:	68.766	1.47	1080	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	138.384	3.00	2157	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 4 of 4

UNIT: F600 RUN: 3 DATE: 5-1-03

Meter Box: 5H Y Factor: .990

Leak checks: 15 " Hg @ 1007 cfm _____ " Hg @ _____ cfm

15 " Hg @ 1006 cfm _____ " Hg @ _____ cfm

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

ROTO: PRESS: .16			SAMPLING RATIO: 20.5 : 1				BP: 30.00		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
360	1835	661.534	661.534	5.669	.12	90	600	90	2.0
365	40	662.971	662.971	5.669	.12	90	600	90	2.0
370	45	664.408	664.408	5.669	.12	90	600	90	2.0
375	50	665.845	665.845	5.689	.12	88	600	88	2.0
380	55	667.271	667.271	5.689	.12	88	600	88	2.0
385	1900	668.697	668.697	5.689	.12	88	600	88	2.0
390	05	670.124	670.124	5.689	.12	88	600	88	2.0
395	10	671.550	671.550	5.689	.12	88	600	88	2.0
400	15	672.977	672.977	5.462	.11	88	625	88	2.0
405	20	674.346	674.346	5.462	.11	88	625	88	2.0
410	25	675.715	675.715	5.462	.11	88	625	88	2.0
415	30	677.085	677.085	5.462	.11	88	625	88	2.0
ROTO PRESS: .16			TOTALS:	67.300	1.40	1062	BP.: 30.00		
420	1935	678.454	678.454	5.462	.11	88	625	88	2.0
425	40	679.824	679.824	5.462	.11	88	625	88	2.0
430									
435				10.924	.22	176			
440									
445									
450									
455						7598			
460									
465									
470				553.229	11.06	88			
475							586		
			TOTALS:				MAX VACC =		5.0
TOTAL Cu Ft.		137.024	TOTALS:	6.433	.163	548	AVG. BP: 30.03		

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : F600 RUN : 3 DATE : 5-1-03

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	763.9	607.4	486.8	891.8
INITIAL WT	619.0	599.4	483.7	857.2
NET WT GRAMS	144.9	8.0	3.1	34.6

TOTAL CATCH : 190.6 GRAMS H_2O

FRONT HALF

FILTER #	149F	
FINAL WT g	1.2874	✓
INITIAL WT g	.6939	✓
NET WT g	.5935	✓

BEAKER #	6	
DESC.	ACETONE	
FINAL WT g	91.3707	✓
INITIAL WT g	91.2076	✓
NET WT g	.1631	✓
VOL. DESC. ml	110	✓

BACK HALF

FILTER #	149B	
FINAL WT g	.6255	✓
INITIAL WT g	.4288	✓
NET WT g	.1967	✓

BEAKER #	7	8	9	10	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	97.5830	108.7097	108.2322	105.8478	
INITIAL WT g	97.1382	108.6357	108.0960	105.7306	
NET WT g	.4448	.0740	.1362	.1172	.2534
VOL. DESC ml	175	75	200	185	385

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 01/17/03 Time : 2055 By : [illegible]

Manufacturer S & S Grade : # 25 Glass Front Size : 11 cm Lot No. : ZB921

Back Size: 8.2 cm Lot No. : ZB911

	DATE: 01/20/03	BY: [illegible]	DATE: 01/21/03	BY: [illegible]	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
141F	.6987	2108	.6986	0937	HEARTHSTONE MORGAN	R-6
142F	.6899	2109	.6900	0938	" "	R-7
143F	.6957	2110	.6958	0938	NEW BUCK	R-1
144F	.6992	2110	.6995	0940	" "	R-2
145F	.6984	2111	.6985	0941	" "	R-3
146F	.6949	2112	.6950	0942	" "	R-4
147F	.6947	2113	.6946	0943	" "	R-5
148F	.6958	2113	.6960	0943	JOEL F600	R-1
149F	.6938	2114	.6939	0944	" "	R-3
150F	.6941	2115	.6943	0945	" "	R-4
141B	.4321	2116	.4322	0946	HEARTHSTONE MORGAN	R-6
142B	.4291	2117	.4293	0947	" "	R-7
143B	.4287	2118	.4288	0947	NEW BUCK	R-1
144B	.4313	2118	.4312	0948	" "	R-2
145B	.4302	2119	.4303	0949	" "	R-3
146B	.4232	2120	.4234	0950	" "	R-4
147B	.4275	2121	.4275	0950	" "	R-5
148B	.4400	2121	.4400	0951	JOEL F600	R-1
149B	.4287	2122	.4288	0952	" "	R-3
150B	.4297	2123	.4299	0953	" "	R-4

Checked by: C. [illegible] Date: 1-21-03 Time: 1010

SCALE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	DB	% RH
01/20	2105	[illegible]	76	44
01/21	0935	[illegible]	75	44

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 08-19-2002 Time : 1205 By : [illegible]

	DATE: 08-22	BY: [illegible]	DATE:	BY: [illegible]	DATE:	BY:
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
1	104.9172	1043	104.9174	0704		
2	106.2542	1044	106.2538	0705	JOTUL FL600 R-1	
3	107.7782	1046	107.7777	0706		
4	108.7744	1047	108.7740	0708		
5	97.4390	1048	97.4366	0709		
6	91.2080	1050	91.2076	0710		
7	97.1385	1051	97.1382	0711	JOTUL FL600 R-3	
8	108.6356	1052	108.6357	0713		
9	108.0961	1053	108.0960	0714		
10	105.7310	1055	105.7306	0715		
11	104.7892	1056	104.7887	0717		
12	98.2303	1057	98.2304	0718	JOTUL FL600 R-4	
13	104.1788	1059	104.1784	0719		
14	97.9822	1100	97.9819	0721		
15	104.7644	1101	104.7642	0722		
16	95.7427	1102	95.7429	0723		
17	104.5948	1104	104.5944	0724	JOTUL FL600 R-5	
18	108.8626	1105	108.8623	0725		
19	106.5473	1106	106.5468	0726		
20	108.5936	1108	108.5932	0728		

SCALE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	DB	% RH
08-22	1040	[illegible]	78	49
08-23	0700	[illegible]	78	49

Checked by : Chp Weatherly

Date : 8-23-02

Time : 0910

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : F600 RUN : 3 DATE : 5-1-03 Page : 1 of 1

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
6	05/02	1140		91.3705	05/06	2146		91.3707	05/09	0724					
7	05/05	1050		97.5827	05/06	2147		97.5830	05/09	0725					
8	05/05	1030		108.7184	05/06	2148		108.7152	05/09	0726		108.7127	05/16	1443	
				108.7099	05/11	1214		108.7097	05/12	0943					
9	05/02	1140		108.2316	05/06	2149		108.2323	05/09	0728		108.2322	05/16	1444	
10	05/02	1140		105.8477	05/06	2150		105.8478	05/09	0729					

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
149F	5-1	2000		1.2879	05/02	1134		1.2870	05/06	2151		1.2874	05/09	0730	
149B	5-1	2000		.6462	05/02	1135		.6349	05/06	2152		.6300	05/09	0732	
				.6275	05/10	1445		.6253	05/11	1215		.6255	05/12	0944	

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	05/02	1130		77	49
2	05/06	2135		77	46
3	05/09	0715		77	45
4	05/10	1435		78	47
5	05/11	1210		77	46

Weighing Session	Date	Time	By	DB	%RH
6	05/12	0940		76	45
7					
8					
9					
10					

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 05-18-2002 Through 10-27-2002	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9999	10.0000	.9999	.0999		05-18	1905	77	49
99.9997	9.9998	.9999	.0998		05-19	1500	77	48
99.9999	10.0000	.9998	.0999		05-20	0855	77	47
99.9998	9.9998	1.0000	.0999		05-21	0930	78	49
99.9998	9.9999	1.0000	.1000		05-22	1155	78	48
99.9999	9.9999	1.0000	.1001		05-22	1920	78	49
99.9999	10.0001	1.0001	.0998		05-23	2105	77	48
99.9998	9.9998	.9998	.0999		05-28	1225	78	49
99.9998	9.9997	1.0001	.0999		05-28	1625	78	47
99.9997	10.0001	1.0002	.1000		06-27	1950	78	49
99.9998	10.0001	1.0002	.1001		06-29	1830	78	49
99.9997	9.9999	1.0000	.0998		07-01	0845	77	49
100.0000	9.9999	1.0002	.1000		07-01	2220	78	47
99.9998	10.0000	.9999	.0999		08-14	1130	78	49
100.0001	9.9999	1.0000	.1000		08-16	1045	78	49
100.0000	9.9998	1.0000	.0998		08-22	1040	78	49
99.9997	9.9999	.9999	.0997		08-23	0700	78	49
99.9998	10.0000	1.0000	.0998		08-29	0915	78	49
100.0000	10.0000	1.0002	.1001		08-29	2225	78	49
99.9998	9.9999	1.0001	.0998		09-03	1120	78	49
99.9997	9.9998	.9999	.0998		09-03	2230	78	49
100.0000	10.0001	.9999	.0999		09-05	1915	78	49
99.9999	9.9999	1.0000	.0999		09-06	1815	78	48
99.9997	9.9999	1.0000	.0998		09-07	1355	78	47
100.0000	10.0002	.9998	.0997		9-10	1110	77	42
99.9997	10.0002	1.0000	.0100		9-11	1500	74	47
99.9999	9.9999	1.0000	.0997		9-13	2020	76	38
100.0003	10.0002	1.0002	.0998		9-14	1300	76	41
100.0000	10.0001	1.0000	.0999		9-16	1930	74	44
100.0000	9.9999	.9998	.0999		9-17	1710	77	42
100.0000	10.0001	1.0000	.1000		9-19	1000	74	47
100.0001	10.0000	.9998	.0999		9-20	1115	74	44
99.9998	9.9999	1.0001	.0999		10-18	2155	77	44
99.9997	9.9999	1.0000	.1000		10-22	2255	77	46
100.0001	10.0002	1.0000	.0999		10-23	2815	77	42
99.9997	9.9998	.9999	.1000		10-25	1350	77	43
99.9998	9.9999	1.0000	.1000		10-26	1735	77	41
99.9998	9.9998	.9999	.1000		10-27	1130	77	36
99.9998	9.9999	.9999	.0999		10-27	1435	77	38

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 12-05-2002 Through 02-23-2003	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	9.9998	1.0000	.0997		12-05	1825	77	47
99.9998	10.0000	.9999	.1000		12-06	1125	77	45
99.9997	10.0001	1.0000	.1000		12-07	1310	76	41
99.9997	10.0001	1.0000	.0999		12-08	1430	77	44
99.9998	9.9999	1.0001	.0999		12-09	1125	78	44
99.9998	10.0000	.9999	.0998		12-10	1220	78	43
99.9997	10.0000	.9998	.0998		12-11	1650	77	45
99.9997	10.0001	.9999	.0999		12-12	1445	77	47
99.9998	10.0000	.9999	.1000		12-14	1530	78	47
99.9997	10.0000	1.0000	.0999		01-10	2300	78	48
99.9998	9.9999	1.0001	.1000		01-14	1115	77	48
99.9999	10.0000	.9999	.1000		01-15	1705	77	48
99.9999	10.0001	.9999	.0998		01-16	1830	78	46
99.9997	10.0000	1.0000	.0999		01-17	1215	77	41
99.9997	9.9999	1.0000	.0999		01-17	2035	76	42
99.9996	10.0000	.9999	.0999		01-18	1730	77	43
99.9999	9.9999	.9998	.0999		01-19	1210	76	42
99.9998	10.0000	1.0000	.0999		01-20	2105	76	44
99.9999	10.0000	.9999	.0998		01-21	0935	75	44
99.9998	10.0000	.9999	.0999		01-22	1125	77	46
100.0000	9.9998	.9999	.1000		01-23	1430	77	48
99.9999	10.0001	1.0001	.1000		01-24	1200	76	48
99.9998	9.9999	.9999	.0999		01-25	1140	76	47
99.9997	10.0000	1.0000	.0999		01-25	1850	78	48
99.9998	9.9998	1.0000	.1000		01-27	1415	75	47
99.9999	9.9999	1.0000	.1000		01-30	1920	77	48
99.9998	10.0000	.9998	.0999		01-31	2205	78	47
99.9999	9.9998	.9998	.1000		02-01	1855	77	47
99.9997	9.9998	.9999	.1001		02-02	1420	76	46
99.9997	10.0001	.9998	.0999		02-18	1155	77	49
99.9999	9.9999	.9999	.0999		02-19	1925	77	48
99.9997	10.0000	1.0000	.0999		02-22	2010	78	45
99.9997	10.0001	.9999	.1000		02-23	1130	78	44

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 02-24-2003 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
99.9998	10.000	1.0000	.0999		02-24	1055	74	44
99.9997	9.9998	1.0001	.0999		02-25	1700	77	45
100.0000	10.0001	1.0000	.0998		03-01	1010	71	44
99.9997	10.0001	.9998	.0999		03-02	1420	75	45
99.9998	10.0000	.9999	.1000		03-03	1205	76	45
99.9998	10.0000	1.0000	.1000		03-03	2005	77	47
100.0000	10.0001	1.0001	.0999		03-04	1035	75	47
99.9996	10.0001	1.0000	.0999		03-05	0945	71	47
99.9997	10.0001	1.0000	.1000		03-06	1340	74	46
99.9998	9.9999	1.0000	.0998		03-07	2050	76	45
99.9998	9.9999	1.0000	.0999		03-08	1150	77	45
99.9997	9.9998	1.0000	.1000		03-09	1350	76	45
99.9998	10.0000	.9999	.1000		03-10	1220	77	47
99.9997	9.9999	1.0000	.1000		03-18	1740	77	46
99.9997	9.9999	1.0000	.0999		03-20	2145	74	45
99.9998	10.0000	1.0000	.0998		03-22	1725	76	47
99.9997	10.0000	.9999	.1000		03-23	1405	77	47
99.9998	9.9998	.9999	.0999		03-24	1450	74	44
100.0000	9.9998	1.0000	.0998		03-25	1120	75	45
99.9998	10.0000	.9999	.0999		04-30	2300	75	49
99.9997	10.0001	.9999	.1000		05-02	1130	77	49
99.9998	9.9998	1.0000	.0999		05-06	2135	77	46
99.9997	19.9999	1.0001	.0999		05-09	0715	77	45
99.9998	10.0000	.9999	.0999		05-10	1435	78	47
99.9998	9.9999	1.0000	.0998		05-11	1210	77	46
99.9996	10.0001	.9999	.0999		05-12	0940	76	45

BLANK PROCESSING DATA SHEET # 5

UNIT : F600 RUN : 3 DATE : 05/01/03

DATE BLANKS DONE : 02-23-03

BEAKER	A	B	C
	200 ml ACETONE	75 ml DICHLOR	200 ml WATER
	FISHER OPTIMA LOT # 011755	FISHER OPTIMA LOT # 994669	DWNA, INC. SPARKLETTES DISTILLED
FINAL WEIGHT	108.9007	106.3074	106.9660
TARE WEIGHT	108.8995	106.3057	106.9646
NET WEIGHT	.0012 ✓	.0017 ✓	.0014 ✓

TARE BEAKERS INTO DESC : TIME : 1430 DATE : 02-12-03

DATE : 02-18 BY : [illegible] DATE : 02-19 BY : [illegible] DATE : BY :

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.8996	1158	108.8995	1928	✓	
B	106.3060	1159	106.3057	1930	✓	
C	106.9649	1200	106.9646	1931	✓	

FINAL BEAKERS INTO DESC : TIME : 1600 DATE : 02-20-03

DATE : 02-22 BY : [illegible] DATE : 02-23 BY : [illegible] DATE : BY :

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9010	2013	108.9007	1132	✓	
B	106.3078	2015	106.3074	1133	✓	
C	106.9661	2016	106.9660	1134	✓	

TARE QC

DATE	TIME	BY	WB	DB	%
02-18	1155	[illegible]	(	77	49
02-19	1925	[illegible]	)	77	48

FINAL QC

DATE	TIME	BY	WB	DB	%
02-22	2010	[illegible]	(	78	45
02-23	1130	[illegible]	)	78	44

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT: F600 RUN: 3 DATE: 05/01/03

BLANK CALCULATIONS

Acetone: .0012 g ÷ 200 ml = .0000006 g/ml
Dicholoromethane: .0017 g ÷ 75 ml = .000023 g/ml
Distilled Water: .0014 g ÷ 200 ml = .000007 g/ml

FRONT HALF CATCH

FILTERS: .5935 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .5935 g

BEAKERS: .1631 (Total Catch) g - 110 (ml Acetone) (.0007 .000006 g) (Blank Value / ml Acetone) = .1624 g

TOTAL FRONT HALF CATCH: .7559 g

BACK HALF CATCH

FILTERS: .1967 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .1967 g

BEAKERS:

Acetone: .4448 (Total Catch) g - 175 (ml Acetone) (.0011 .000006 g) (Blank Value / ml Acetone) = .4437 g

Extract: .0740 (Total Catch) g - 75 (ml Dichloromethane) (.0017 .000023 g) (Blank Value / Dichloromethane) = .0723 g

Water: .2534 (Total Catch) g - 385 (ml Water) (.0027 .000007 g) (Blank Value / Water) = .2507 g

TOTAL BACK HALF CATCH: .9634 g

TOTAL CATCH: 1.7193 g

% FRONT HALF: 44.0 % (00.0)

CALCULATIONS DATA SHEET # 7

UNIT: JOTUL F6000 RUN: 3 DATE: 05/01/05

1) $Vm(std) = \dfrac{(137.024\ Vm)(17.64)(.990\ mcf)\left(30.03\ "Hg + \frac{.163\ "H_2O}{13.6}\right)}{(548\ TmA)} = \dfrac{131.1833}{000.0000}$ dscf

2) $Vw(std) = (.04707)(190.6\ ml\ H_2O) = \dfrac{8.9715}{00.0000}$ scf

3) $Asw = \dfrac{(8.9715\ scf)}{(8.9715\ scf + 131.1833\ dscf)} = \dfrac{.0640}{.0000}$ Bws × 100 = $\dfrac{6.4012}{00.0000}$ % H_2O

4) $Cs = \dfrac{(1.7193\ g.)}{(131.1833\ dscf)}(15.43) = \dfrac{.2022}{0.0000}$ gr / dscf (140.1548)

5) Estimated g / hr $= \dfrac{(1.7193\ g.)}{(131.1833\ dscf)}(6.433\ dscfm)(60) = \dfrac{5.0582}{00.0000}$ 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 : F600 RUN : 3 DATE : 5-1-03

Test Chamber Air Velocity Start : 0 Stop : 0 Avg.: 0

Wet Bulb / Dry Bulb

Pre : WB : 65 DB : 84 = 34 % RH 1.4 % H_2O

Post : WB : 62 DB : 80 = 34 % RH 1.2 % H_2O

Average : 34.0 % RH 1.30 % H_2O

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

Kindling Weight (lbs) : Paper : .2 Wood : 4.0

Preburn Fuel Weight : 16.5 + 12.7 + 12.9 Total : 42.1

Kindling & Preburn Fuel Weight (wood only) (lbs) : **Total** : 46.1

Coal Bed Wt Range (lbs) : 4.6 - 3.7 **Scale** : 4.6 - 3.7

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

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

Maximum Coal Bed Removal (lbs) : ((4.6 (Upper) + 3.7 (Lower)) ÷ 2) .25 = 1.0 (round down to nearest tenth)

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

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" × 4"	17	4	9.3	50.5
4" × 4"	17	2	9.1	49.5

Test Fuel Weight : 18.4 lbs

Estimated Dry Burn Rate :

$$\frac{18.4 - (18.4 \times .18189)}{2.2046} \times \frac{60}{\frac{425}{\text{TIME}}} = .964 \text{ kg / hr}$$

Estimated BTU's/hr : 19,140 × $\frac{63}{100}$ × $\frac{.964}{\text{DBR}}$ = 11,623.7 BTU's/hr

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

WOOD STOVE OPERATING DATA PAGE #9

Unit : F600 Run : 3 Date : 5-1-03

FIRE STARTED: 0700

WARM UP AND PREBURN:

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

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

CHARCOAL BED PREPARATION :

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

TEST:

DOOR wide open during loading 0 min. 45 sec.

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

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

FAN:

ON / OFF during warm-up

ON / OFF first 30 minutes of test

Fan speed set at 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 16 or — inches.

1st warm up / pre-burn fuel charge (16.5 lbs.) added at 16.5 0720

2nd warm up / pre-burn fuel charge (12.7 lbs.) added at 12.7 0840

3rd warm up / pre-burn fuel charge (12.9 lbs.) added at 12.9 1005

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 : F600 Run : 3 Date : 5-1-03

Room Temperature : 68 °F Correction Factor : 0

Uncorrected Values are corrected for room temperature : Yes _____ No ✓

Time Test Fuel moisture reading taken : 1120

Calibration Checks : X ✓ Y ✓ 12.0 12.1 22.0 22.1

pc #	Dimen.	Use	TOP		BOTTOM		SIDE		Average Corrected
			Uncor.	Cor.	Uncor.	Cor.	Uncor.	Cor.	
1	2"×4"×8'	K	15.5	16.5	15.0	16.0	15.0	16.0	16.167
2									
3									
4	2"×4"×8'	P	20.5	22.0	21.0	22.5	21.0	22.5	22.333
5	2"×4"×8'	P	23.0	24.7	23.0	24.7	21.5	23.1	24.167
6	2"×4"×8'	P	22.0	23.7	22.0	23.7	22.0	23.7	23.700
7	2"×4"×8'	P	21.5	23.1	21.5	23.1	21.5	23.1	23.100
8	2"×4"×8'	P	23.5	25.2	23.5	25.2	23.5	25.2	25.200
9									118.500
10									
11	2×4×17	T	17.5	18.7	18.5	19.8	17.5	18.7	19.067
12	"	T	20.5	22.0	20.5	22.0	20.0	21.4	21.800
13	"	T	21.0	22.5	21.0	22.5	21.0	22.5	22.500
14	"	T	23.0	24.7	23.0	24.7	23.5	25.2	24.867
15	4×4×17	T	22.5	24.1	22.5	24.1	22.5	24.1	24.100
16	"	T	20.0	21.4	19.5	20.9	19.5	20.9	21.067
17									133.401
18									
19									
20	Spacers	T	18.5	19.8	18.0	19.2	18.5	19.8	19.600

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	16.167 %	23.700 %	22.233 %
Wet Moisture % :	13.917 %	19.159 %	18.189 %

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

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

GAS DATA SHEET #12

WEIGHT: 4.3 DATE: 5-1-03

UNIT: F600 RUN: 3 PAGE: 1 OF 3

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
0 1235	22.7	18.4	–	.246	6.1	.525	13.1	.154	1.55	-.024	550
5 40	22.3	18.0	.4	.236	5.9	.578	14.5	.046	.47	-.032	275
10 45	22.1	17.8	.2	.109	2.7	.696	17.4	.069	.70	-.026	550
15 50	21.9	17.6	.2	.125	3.1	.678	16.9	.074	.75	-.025	575
20 55	21.7	17.4	.2	.145	3.6	.653	16.3	.087	.88	-.025	600
25 1300	21.4	17.1	.3	.163	4.0	.629	15.7	.101	1.02	-.025	650
30 05	21.2	16.9	.2	.202	5.0	.593	14.8	.094	.95	-.025	625
35 10	20.8	16.5	.4	.245	6.1	.538	13.5	.124	1.25	-.026	650
40 15	20.3	16.0	.5	.194	4.8	.581	14.5	.145	1.46	-.026	675
45 20	20.1	15.8	.2	.213	5.3	.560	14.0	.149	1.50	-.026	675
50 25	19.7	15.4	.4	.222	5.5	.544	13.6	.166	1.67	-.026	675
55 30	19.2	14.9	.5	.274	6.8	.513	12.8	.114	1.15	-.029	575
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.315	*****
60 1335	18.9	14.6	.3	.194	4.8	.562	14.0	.193	1.94	-.026	625
65 40	18.5	14.2	.4	.324	8.1	.464	11.6	.111	1.12	-.029	550
70 45	17.9	13.6	.6	.360	9.0	.439	11.0	.085	.86	-.035	475
75 50	17.4	13.1	.5	.345	8.6	.455	11.4	.082	.83	-.036	475
80 55	16.8	12.5	.6	.394	9.8	.410	10.3	.071	.72	-.038	450
85 1400	16.2	11.9	.6	.374	9.3	.429	10.7	.073	.74	-.040	450
90 05	15.6	11.3	.6	.431	10.7	.384	9.6	.043	.44	-.041	425
95 10	15.0	10.7	.6	.464	11.6	.349	8.7	.049	.50	-.042	425
100 15	14.4	10.1	.6	.477	11.9	.338	8.5	.043	.44	-.043	400
105 20	13.8	9.5	.6	.466	11.6	.347	8.7	.050	.51	-.043	400
110 25	13.1	8.8	.7	.455	11.3	.360	9.0	.045	.46	-.043	400
115 30	12.6	8.3	.5	.404	10.1	.417	10.4	.030	.31	-.042	425
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.458	*****
120 1435	12.1	7.8	.5	.380	9.5	.437	10.9	.038	.39	-.041	425
125 40	11.7	7.4	.4	.374	9.3	.442	11.1	.041	.42	-.041	425
130 45	11.3	7.0	.4	.378	9.4	.440	11.0	.036	.37	-.040	425
135 50	10.9	6.6	.4	.425	10.6	.396	9.9	.030	.31	-.040	425
140 55	10.5	6.2	.4	.395	9.8	.423	10.6	.036	.37	-.040	425
145 1500	10.1	5.8	.4	.389	9.7	.434	10.8	.025	.26	-.040	425
150 05	9.7	5.4	.4	.416	10.4	.407	10.2	.025	.26	-.040	425
155 10	9.3	5.0	.4	.425	10.6	.397	9.9	.026	.27	-.040	425
160 15	9.0	4.7	.3	.390	9.7	.435	10.9	.020	.21	-.040	425
165 20	8.7	4.4	.3	.377	9.4	.448	11.2	.018	.19	-.039	425
170 25	8.5	4.2	.2	.341	8.5	.460	11.5	.080	.81	-.036	425
175 30	8.3	4.0	.2	.310	7.7	.486	12.1	.092	.93	-.035	500
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.472	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-1.245	*****

GAS DATA SHEET #12

WEIGHT: 4.3 DATE: 05-01-03

UNIT: F600 RUN: 3 PAGE: 2 OF 3

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
180 1535	8.1	3.8	.2	.275	6.8	.509	12.7	.122	1.23	-.033	500
185 40	7.9	3.6	.2	.247	6.1	.514	12.8	.180	1.81	-.031	575
190 45	7.8	3.5	.1	.251	6.2	.512	12.8	.175	1.76	-.030	550
195 50	7.7	3.4	.1	.257	6.4	.508	12.7	.169	1.70	-.029	525
200 55	7.6	3.3	.1	.249	6.2	.506	12.6	.195	1.96	-.028	550
205 1600	7.5	3.2	.1	.245	6.1	.506	12.6	.205	2.06	-.026	525
210 05	7.4	3.1	.1	.243	6.0	.501	12.5	.222	2.23	-.026	525
215 10	7.3	3.0	.1	.242	6.0	.503	12.6	.219	2.20	-.025	525
220 15	7.2	2.9	.1	.246	6.1	.501	12.5	.214	2.15	-.025	550
225 20	7.1	2.8	.1	.235	5.8	.507	12.7	.226	2.27	-.024	550
230 25	7.0	2.7	.1	.235	5.8	.506	12.7	.228	2.29	-.024	550
235 30	6.9	2.6	.1	.235	5.8	.500	12.5	.243	2.44	-.023	550
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.324	*****
240 1635	6.9	2.6	0	.235	5.8	.500	12.5	.245	2.46	-.023	550
245 40	6.8	2.5	.1	.239	5.9	.506	12.7	.218	2.19	-.022	550
250 45	6.7	2.4	.1	.234	5.8	.505	12.6	.235	2.36	-.022	575
255 50	6.6	2.3	.1	.241	6.0	.515	12.9	.192	1.93	-.021	575
260 55	6.5	2.2	.1	.235	5.8	.516	12.9	.203	2.04	-.021	600
265 1700	6.5	2.2	0	.232	5.8	.515	12.9	.213	2.14	-.021	600
270 05	6.4	2.1	.1	.237	5.9	.518	13.0	.193	1.94	-.021	600
275 10	6.3	2.0	.1	.236	5.9	.519	13.0	.195	1.96	-.021	600
280 15	6.3	2.0	0	.235	5.8	.517	12.9	.202	2.03	-.021	600
285 20	6.2	1.9	.1	.236	5.9	.515	12.9	.203	2.04	-.021	600
290 25	6.1	1.8	.1	.242	6.0	.515	12.9	.188	1.89	-.021	600
295 30	6.0	1.7	.1	.241	6.0	.515	12.9	.191	1.92	-.021	600
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.256	*****
300 1735	5.9	1.6	.1	.739	5.9	.519	13.0	.187	1.88	-.021	600
305 40	5.9	1.6	0	.239	5.9	.521	13.0	.181	1.82	-.021	575
310 45	5.8	1.5	.1	.243	6.0	.533	13.3	.142	1.43	-.020	575
315 50	5.7	1.4	.1	.238	5.9	.531	13.3	.159	1.60	-.020	600
320 55	5.6	1.3	.1	.233	5.8	.534	13.4	.164	1.65	-.020	600
325 1800	5.6	1.3	0	.231	5.7	.531	13.3	.176	1.77	-.020	600
330 05	5.5	1.2	.1	.229	5.7	.532	13.3	.178	1.79	-.020	575
335 10	5.4	1.1	.1	.229	5.7	.530	13.2	.185	1.86	-.020	600
340 15	5.4	1.1	0	.228	5.7	.533	13.3	.180	1.81	-.020	600
345 20	5.3	1.0	.1	.225	5.6	.536	13.4	.178	1.79	-.020	600
350 25	5.3	1.0	0	.222	5.5	.535	13.4	.188	1.89	-.020	600
355 30	5.2	.9	.1	.216	5.4	.535	13.4	.203	2.04	-.020	600
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.242	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.822	*****

GAS DATA SHEET #12

WEIGHT: 4.3 DATE: 05-01-03

UNIT: F600 RUN: 3 PAGE: 3 OF 3

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
360 1835	5.2	.9	0	.201	5.0	.531	13.3	.251	2.52	.019	600
365 40	5.1	.8	.1	.199	4.9	.532	13.3	.253	2.54	.019	600
370 45	5.0	.7	.1	.198	4.9	.535	13.4	.250	2.51	.019	600
375 50	5.0	.7	0	.195	4.8	.538	13.5	.249	2.50	.019	600
380 55	4.9	.6	.1	.192	4.8	.541	13.5	.250	2.51	.019	600
385 1900	4.8	.5	.1	.192	4.8	.541	13.5	.249	2.50	.019	600
390 05	4.7	.4	.1	.210	5.2	.531	13.3	.230	2.31	.018	600
395 10	4.7	.4	0	.199	4.9	.538	13.4	.240	2.41	.018	600
400 15	4.6	.3	.1	.200	5.0	.538	13.4	.237	2.38	.018	625
405 20	4.6	.3	0	.198	4.9	.539	13.5	.238	2.39	.019	625
410 25	4.5	.2	.1	.186	4.6	.536	13.4	.276	2.77	.018	625
415 30	4.4	.1	.1	.182	4.5	.541	13.5	.274	2.75	.018	625
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.223	*****
420 1935	4.4	.1	0	.174	4.3	.548	13.7	.276	2.77	.018	625
425 40	4.3	0	.1	.173	4.3	.552	13.8	.270	2.71	.018	625
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.036	*****
											.86
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	2.326	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.027	*****

PREBURN DATA SHEET

UNIT: F-600 RUN: 3 DATE: 5-1-03 PAGE: 1 of 1

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
0 / 1135	5.6	—	382	473	473	241	474	298	880	1173	88	-.046	PREBURN START: # 1.0 UP
5 / 40	5.4	.2	295	441	459	241	458	309	806	1112	89	-.042	COAL BED SCALE RANGE:
10 / 45	5.1	.3	269	416	435	239	432	312	774	1096	88	-.041	4.6 → 3.7
15 / 50	5.0	.1	246	388	416	233	410	312	742	996	88	-.035	PRIMARY AIR: 5/32"
20 / 55	4.9	.1	224	359	395	228	391	310	711	1013	88	-.033	SECONDARY AIR: N/A
25 / 1200	4.8	.1	210	335	376	222	374	309	686	968	87	-.032	FAN: High
30 / 05	4.8	0	200	315	362	217	357	305	660	871	85	-.030	PUMPS ON AT: 1205
35 / 10	4.7	.1	191	294	345	223	341	303	638	837	83	-.028	CHECK WB/DB: N/A
40 / 15	4.6	.1	186	280	333	213	331	305	623	827	84	-.026	
45 / 20	4.5	.1	180	267	320	207	320	302	609	836	85	-.026	
50 / 25	4.5	0	177	256	309	204	312	297	595	808	84	-.025	
55 / 30	4.4	.1	174	248	297	201	304	297	582	803	83	-.025	
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	
60 / 1235	4.3	.1	194	240	287	199	296	288	560	723	84	-.024	

TEMPERATURE DATA SHEET #14

		TEST TIME	425		
STACK AVG	185	TOP AVG	244	LT SIDE AVG	235
BACK AVG	171	RT SIDE AVG	242	BOTTOM AVG	200
FIREBOX AVG	520	SEC/CAT AVG	787	AMBIENT AVG	81

END	181.0
START	262.0
	-81.0 DELTA T

CIRCLE: (LOSS) / GAIN

Jotul U.S.A., Inc. TEMPERATURE DATA SHEET #14A Run 3 05/01/2003

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
0	194	240	287	199	296	288	560	723	84	1313	239	64	248	37	39
5	261	234	285	261	284	279	453	1015	84	1323	240	48	246	37	35
10	186	229	272	259	269	268	431	544	81	1329	240	45	247	37	37
15	172	220	258	251	253	262	408	513	81	1333	239	47	247	38	37
20	166	215	247	243	240	254	390	527	80	1335	238	47	247	38	36
25	163	208	237	236	229	249	376	596	80	1337	237	47	248	37	36
30	163	205	228	229	219	242	363	1009	80	1338	236	47	248	37	35
35	170	210	204	164	209	232	357	814	81	1335	236	48	248	39	36
40	174	221	193	152	202	225	352	772	80	1333	236	48	248	37	36
45	170	210	188	146	197	220	348	767	80	1332	235	48	247	36	35
50	168	205	180	141	193	218	347	931	80	1331	235	48	246	37	35
55	177	211	178	138	189	210	351	910	79	1335	234	49	246	37	35
60	169	210	176	136	186	206	355	737	79	1344	234	49	246	36	35
65	180	212	173	133	184	203	368	1154	78	1350	233	49	246	36	36
70	207	238	175	133	185	199	387	1163	78	1354	233	49	246	37	36
75	220	258	180	132	187	194	413	1072	78	1354	234	48	246	38	35
80	233	274	187	133	191	193	436	1178	78	1352	234	48	247	37	35
85	248	290	196	134	196	190	462	1041	78	1350	234	48	248	37	35
90	263	319	205	136	202	186	493	1085	78	1346	236	48	249	38	36
95	274	345	217	140	210	186	522	1156	79	1342	237	49	248	38	36
100	280	367	228	143	221	184	545	1188	78	1340	238	49	249	36	36
105	282	381	238	149	231	183	563	1167	79	1338	238	50	248	36	36
110	281	389	248	156	242	181	583	1154	80	1338	239	50	248	34	37
115	272	391	259	162	252	178	592	1072	80	1338	239	51	248	34	36
120	264	387	263	165	259	180	594	1029	80	1341	239	52	248	34	36
125	257	378	268	169	266	178	595	1031	80	1343	239	53	247	34	35
130	252	373	270	171	271	179	598	1010	81	1340	238	53	245	35	36
135	254	374	271	174	274	179	602	1049	81	1337	239	54	246	36	37
140	254	379	273	176	276	181	610	1034	81	1334	238	54	248	35	37
145	253	375	276	177	280	181	618	1011	82	1331	238	55	247	35	37
150	253	374	281	179	284	181	634	1053	81	1328	237	55	246	35	37
155	256	377	288	180	290	183	650	1068	82	1329	237	56	245	35	37
160	252	371	294	182	293	181	664	1087	82	1331	237	56	243	35	37
165	247	364	300	184	298	182	671	1073	82	1332	236	57	243	35	37
170	227	345	303	186	300	186	667	921	82	1338	236	57	243	35	37
175	221	335	304	187	301	186	669	1087	82	1339	236	57	242	35	36

Jotul U.S.A., Inc. TEMPERATURE DATA SHEET #14A Run 3 05/01/2003

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
180	211	320	302	189	300	186	665	998	82	1341	236	58	242	35	36
185	201	304	303	187	299	189	658	909	82	1344	235	58	241	35	36
190	195	288	300	184	297	192	655	854	82	1346	235	58	239	34	36
195	190	276	297	183	293	190	651	841	82	1348	235	59	240	34	35
200	182	266	293	183	290	194	641	810	82	1349	235	59	239	34	35
205	177	256	290	182	287	195	631	784	83	1350	234	60	238	34	35
210	174	249	284	182	283	198	621	766	83	1350	234	60	237	35	34
215	171	241	282	180	278	199	613	750	83	1349	234	60	237	34	34
220	168	234	275	179	275	200	605	738	83	1346	233	60	239	35	34
225	166	229	273	179	271	199	597	713	82	1342	233	60	239	35	33
230	164	224	268	179	268	199	588	702	82	1339	232	60	239	36	34
235	162	220	263	178	263	203	584	689	82	1336	232	60	238	35	34
240	161	217	257	177	260	204	579	681	82	1334	232	60	239	35	35
245	159	212	256	178	258	202	568	673	81	1331	232	59	240	36	34
250	158	210	248	176	255	204	562	669	82	1330	231	59	239	37	37
255	157	209	243	175	252	204	560	659	82	1329	231	59	240	36	37
260	156	205	242	174	249	201	555	653	81	1327	232	59	240	36	37
265	156	203	238	172	248	201	550	650	82	1327	232	60	241	37	37
270	155	202	236	171	246	204	547	648	82	1326	232	60	242	37	36
275	154	199	233	170	244	201	544	646	82	1325	232	60	245	36	36
280	153	197	232	169	242	198	542	641	81	1323	233	60	246	35	37
285	153	197	228	168	241	198	540	639	81	1324	233	60	245	35	37
290	153	195	225	167	239	201	533	651	82	1325	233	60	246	36	37
295	153	194	223	166	238	198	531	657	81	1324	233	60	245	36	35
300	153	194	222	166	237	198	529	651	81	1323	233	61	245	36	35
305	152	191	223	166	237	200	528	653	82	1322	234	61	245	35	36
310	151	190	221	165	235	198	525	650	81	1322	234	62	245	35	36
315	150	190	220	165	234	198	519	643	81	1323	235	60	245	36	36
320	149	189	219	165	233	198	513	633	81	1324	235	60	245	36	36
325	149	188	216	164	232	199	509	636	80	1324	235	60	245	37	36
330	149	187	216	162	225	185	507	632	79	1323	235	60	245	38	37
335	149	186	213	164	229	196	504	631	79	1322	235	61	244	38	37
340	148	185	212	164	228	195	499	621	79	1322	235	62	245	38	38
345	148	185	210	163	228	195	493	619	79	1321	235	62	244	38	38
350	147	184	208	162	228	198	490	615	81	1323	235	62	244	38	38
355	146	182	207	162	227	198	487	613	81	1324	235	62	244	37	38

Jotul U.S.A., Inc. TEMPERATURE DATA SHEET #14A Run 3 05/01/2003

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
360	146	182	205	162	226	195	484	602	80	1324	235	62	243	37	38
365	145	181	204	161	225	193	480	593	80	1324	235	62	243	37	38
370	144	180	201	161	224	194	477	586	80	1325	235	62	243	37	37
375	144	179	201	161	223	194	473	580	79	1325	234	63	242	37	37
380	143	177	199	160	221	194	469	573	79	1326	235	63	243	36	37
385	143	176	197	159	220	194	464	568	80	1326	235	63	243	36	37
390	142	175	195	159	218	192	464	571	80	1326	235	64	243	36	37
395	142	174	194	159	217	188	463	570	79	1326	235	64	242	36	36
400	142	173	193	159	215	191	463	568	80	1327	235	64	243	36	36
405	141	172	191	159	213	188	462	564	79	1327	235	62	242	36	36
410	140	172	190	159	212	189	458	558	80	1328	235	62	243	35	36
415	139	170	190	159	211	186	454	550	79	1328	235	62	243	35	36
420	139	169	189	159	209	186	445	541	79	1328	234	62	244	35	36
425	138	168	187	159	208	183	438	534	79	1328	234	62	243	35	35

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 05/01/03 Analyte : CO_2 (15-1)

Unit : FL600 Run # : 3

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 % CO_2 Cyl. Press. : 900 PSI

Certified by : AIR LIQUIDE Date : 02-20-02

Span Cyl. # : CC-3131 Conc. : 12.40 % CO_2 Cyl. Press. : 1625 PSI

Certified by : AIR LIQUIDE Date : 03-13-03

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 : D. Wade Time : 1045 ✓ Temp : 83 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.023	.023	.091 ✓
SPAN	49.6	.496	12.40	49.5	.495	12.342	.058	.233 ✓

POST RUN Audit : by : D. Wade Time : 2000 ✓ 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	.002	+.002	+.009
SPAN	49.6	.496	12.40	49.5	.495	12.342	.058	.233 ✓

± 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 : 05/01/03 Analyte : O_2 (15-2)

Unit : F600 Run # : 3

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 % O_2 Cyl. Press. : 900 PSI

Certified by : AIR LIQUIDE Date : 02-20-02

Span Cyl. # : CC-3131 Conc. : 12.40 % O_2 Cyl. Press. : 1625 PSI

Certified by : AIR LIQUIDE Date : 03-13-03

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 : [signature] Time : 1045 ✓ Temp : 83 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %	
	Meter	DVM	%	Meter	DVM	%			
ZERO	00.0	.000	00.0	00.0	.000	.025	+.025	+.101	✓
SPAN	12.50	.500	12.50	12.55	.501	12.526	+.026	+.105	✓

POST RUN Audit : by : [signature] Time : 2000 ✓ 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	.050	.050	+.201	✓
SPAN	12.50	.500	12.50	12.55	.501	12.526	+.026	+.105	✓

± 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 : 05/01/03 Analyte : CO (15-3)

Unit : F600 Run # : 3

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 % CO Cyl. Press. : 900 PSI

Certified by : AIR LIQUIDE Date : 02-20-02

Span Cyl. # : CC-3131 Conc. : 12.40 % CO Cyl. Press. : 1625 PSI

Certified by : AIR LIQUIDE Date : 03-13-03

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 : D. Wade Time : 1045 Temp : 83 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	,000	.011	+.011	+.110
SPAN	50.2	.502	5.02	50.4	.504	5.050	+.030	+.297

POST RUN Audit : by : D. Wade Time : 2000 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	.011	+.011	+.110
SPAN	50.2	.502	5.02	50.3	.503	5.040	+.020	+.197

± 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 : 05/01/03 Analyte : SO_2 (15-4)

Unit : F600 Run # : 3

Zero Cyl. # : 042JAC 2-A Conc. : 0.00 ppm SO_2 Cyl. Press. : 900 PSI

Certified by : AIR LIQUIDE Date : 02-20-02

Span Cyl. # : CC62184 Conc. : 1290 ppm SO_2 Cyl. Press. : 1025 PSI

Certified by : AIR LIQUIDE Date : 01-29-01

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 : A. Wadington Time : 1045 Temp : 83 °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	14.183	+14.183	+.567
SPAN	51.6	.516	1290	52.0	.520	1300.003	+10.003	+.400

POST RUN Audit : by : A. Wadington Time : 2000 Temp : 77 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.2	.002	11.696	+11.696	+.468
SPAN	51.6	.516	1290	51.8	.518	1295.028	+5.028	+.201

± 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 : F600 RUN : 3 DATE : 5-1-03

Thermocouple Check:

T/C # 1	— °F	T/C # 13	75.3 °F
T/C # 2	— °F	T/C # 14	70.2 °F
T/C # 3	74.3 °F	T/C # 15	76.7 °F
T/C # 4	70.9 °F	T/C # 16	53.4 °F
T/C # 5	69.4 °F	T/C # 17	54.8 °F
T/C # 6	70.5 °F	T/C # 18	77.0 °F
T/C # 7	69.2 °F	T/C # 19	71.0 °F
T/C # 8	69.0 °F	T/C # 20	— °F
T/C # 9	71.2 °F	T/C # 21	— °F
T/C # 10	72.1 °F	T/C # 22	— °F
T/C # 11	65.4 °F	T/C # 23	70.2 °F
T/C # 12	84.1 °F	T/C # 24	— °F

Thermocouple Readout:

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

ZERO 1.3 °F Adj. to 0.0 °F — ZERO .3 °F — Difference .015 % ✓

SPAN 1997.4 °F Adj. to 2000.0 °F — SPAN 2002.6 °F — Difference .130 % ✓

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 201.6 °F	400	= 399.6 °F
600	= 601.3 °F	800	= 801.4 °F	1000	= 1000.6 °F
1200	= 1198.1 °F	1400	= 1399.2 °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 X	Post ✓

Scale Check Pre : 6.0 - 16.0 ✓

Post : 3.7 - 13.7 ✓

Stack Cleaned Prior to Test Run : YES _____ NO X

COMPUTER INPUT DATA SHEET #1

Client: JOTUL USA, INC.

Address: 400 RIVERSIDE ST / P.O. BOX 1157
PORTLAND, ME 04104

Phone: 800-797-5912 Fax: 207-797-6072

Run No.: 4 Date of Test: 05-05-03 Burn Rate: 1.219

Model No.: F600 ☐ min ☒ min-1.25 ~~☐ fan~~

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

Dry Gas Meter Y Factor: .990 (0.000) (Data Sheet #2)

Post Leak Rate: .000 cfm (.000) (Data Sheet #2)

Time: 325 min. (000) (Data Sheet #2)

Dry Gas Meter Volume: 123.211 cf (00.000) (Data Sheet #2)

Stack Flow: 7.929 dscfm (00.000) (Data Sheet #2)

Δ H: .223 in. H_2O (.000) (Data Sheet #2)

Maximum Vac.: 4.0 (0.0) (Data Sheet #2)

Barometric Pressure: 30.11 in. Hg (00.00) (Data Sheet #2)

H_2O Captured: 173.6 g (00.0) (Data Sheet #3)

Front Half Catch % Of Total: 32.8 % (00.0) (Data Sheet #6)

Total Particulate Catch: 1.1582 g (0.0000) (Data Sheet #6)

Flue Gas Moisture: 6.4615 % (00.000) (Data Sheet #7)

Particulate Emission: .1511 gr/dscf (0.0000) (Data Sheet #7)

Relative Humidity: 28.5 % RH (00.0) (Data Sheet #8)

Ambient Moisture: 1.15 % H_2O (0.00) (Data Sheet #8)

Preburn Fuel Wt.: 43.6 lbs. (00.0) (Data Sheet #8)

Coal Bed Wt.: 3.8 lbs. (00.0) (Data sheet #8)

Test Fuel Wt.: 17.7 lbs. (00.0) (Data sheet #8)

Heat Output (EPA Default): 14,698.8 BTU/hr (00,000.0) (Data Sheet #8)

Kindling Fuel % Moisture (wet): 14.286 % (00.000) (Data Sheet #10)

Pretest Fuel % Moisture (wet): 18.452 % (00.000) (Data Sheet #10)

Test Fuel % Moisture (dry): 21.594 % (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove])

Test Fuel % Moisture (wet): 17.759 %

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

Stack Static Pressure: -.035 in. H_2O (+/- .000) (Data Sheet #12)

Average Ambient Temperature: 73 °F (00) (Data Sheet #14)

Stove Temperature Change: -62.6 °F (+/- 000.0) (Data Sheet #14)

TABLE 1 ----- RAW DATA

CLIENT : jotul TEST No. : 4

MODEL: F600 DATE: 05-May-03

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	680.500	0.150	85	1.56	5.80	525
5	682.000	0.460	85	0.63	12.60	300
10	684.689	0.190	85	0.61	3.80	475
15	686.389	0.170	85	0.71	4.90	500
20	688.005	0.150	85	0.85	4.70	525
25	689.544	0.150	85	0.93	4.30	525
30	691.083	0.150	85	0.80	5.20	525
35	692.622	0.150	85	0.87	5.80	525
40	694.161	0.150	85	1.00	5.70	525
45	695.699	0.150	85	0.95	5.90	525
50	697.238	0.190	85	0.85	6.90	475
55	698.939	0.230	85	0.77	8.50	425
60	700.839	0.300	85	0.53	9.80	375
65	702.992	0.260	85	0.62	9.60	400
70	705.011	0.300	86	0.46	10.40	375
75	707.171	0.300	86	0.50	11.40	375
80	709.332	0.300	86	0.40	10.20	375
85	711.493	0.290	87	0.49	11.60	375
90	713.662	0.260	88	0.53	10.90	400
95	715.703	0.260	89	0.60	11.70	400
100	717.751	0.260	89	0.56	11.90	400
105	719.799	0.260	89	0.60	11.90	400
110	721.848	0.260	89	0.43	10.90	400
115	723.896	0.290	89	0.40	11.10	375
120	726.081	0.290	89	0.41	11.60	375
125	728.266	0.260	89	0.44	12.00	400
130	730.314	0.290	89	0.25	10.60	375
135	732.499	0.250	90	0.50	8.70	400
140	734.553	0.250	92	0.62	8.00	400
145	736.626	0.250	92	0.76	7.40	400
150	738.697	0.200	92	1.22	6.40	450
155	740.538	0.200	92	1.33	6.20	450
160	742.379	0.200	92	1.48	6.10	450
165	744.220	0.220	92	1.53	6.20	425
170	746.170	0.230	90	1.89	5.90	425
175	748.105	0.230	90	1.66	6.20	425
180	750.040	0.230	90	1.73	6.10	425
185	751.976	0.230	90	1.84	5.90	425
190	753.911	0.230	90	2.01	5.80	425
195	755.846	0.200	90	1.61	6.30	450
200	757.674	0.200	90	1.46	6.30	450
205	759.502	0.200	90	1.48	6.30	450
210	761.330	0.200	90	1.55	6.30	450
215	763.158	0.200	90	1.58	6.40	450

220	764.986	0.200	90	1.63	6.30	450
225	766.814	0.230	90	1.66	6.20	425
230	768.749	0.230	90	1.85	6.00	425
235	770.685	0.230	90	1.89	5.90	425
240	772.620	0.230	89	1.79	5.70	425
245	774.549	0.230	89	1.94	5.60	425
250	776.477	0.200	89	2.18	5.30	450
255	778.299	0.200	89	2.29	5.00	450
260	780.121	0.200	89	2.12	5.10	450
265	781.943	0.200	89	2.16	5.00	450
270	783.765	0.200	89	2.18	4.90	450
275	785.587	0.200	89	2.05	4.90	450
280	787.409	0.200	89	2.05	4.90	450
285	789.231	0.200	89	1.93	5.30	450
290	791.053	0.200	89	2.05	4.80	450
295	792.875	0.200	89	1.97	4.60	450
300	794.697	0.200	89	2.15	4.30	450
305	796.519	0.200	89	2.11	4.10	450
310	798.341	0.200	89	2.02	4.00	450
315	800.163	0.200	89	1.99	4.00	450
320	801.985	0.180	89	1.96	3.90	475
325	803.711	0.200	89	1.88	3.80	450
330						

TABLE 2---RAW DATA

CLIENT : jotul TEST No. 4

MODEL: F600 DATE: 05-May-03

****

METER CAL. FACTOR (Y) ------	0.99		Wt. WOOD BURNED(LB) -------	17.7	Lbs
BAROMETRIC PRESS.(Pb) ------	30.11	in Hg	WET,FUEL MOISTURE % -------	17.759	%
LEAK RATE POST (Lp) ------	0.000	cfm	Wt. PART. COLLECTED -------	1.1582	g
WATER VOL. (V1c) ------	173.6	Ml	METER VOLUME Vm -------	123.211	mcf
TEST TIME (MIN) ------	325	min	HC MOLE FRACTION -------	0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT :jotul TEST No. 4

MODEL: F600 DATE: 05-May-03

****

AVG DELTA H	-------	0.22 in H2O		AVG PRCNT CO	-------	1.30	%
AVG METER TEMP. Tm	-------	88 deg F		AVG PRCNT CO2	-------	6.97	%
AVG PPM SO2	-------	436	PPM	AVG BAL CO2/CO	-------	5.36	%

TABLE 4 ----- CALCULATIONS

CLIENT : jotul TEST No. 4

MODEL: F600 DATE: 05-May-03

****

STD SAMPLE VOL. Vm(std) -----	118.26	dscf	STACK GAS FLOW Qsd -------	457.992	dscf/Hr
				7.63	& dscf/min
VOL. WATER VAPOR Vw(std) ----	8.171	scf	PARTICULATE CONCTRT. Cs ------	0.0098	g/dscf
PRCNT MSTR Bws -------	6.46	%	PARTC.EMISS. RATE E -------	4.49	g/Hr
BURN RATE BR -------	1.22	Kg/Hr	MOLES OF GAS PER Lb WOOD Nt --	0.44	Lb-mole/Lb
CO EMISSION RATE -------	199.50	g/Hr	PART.EMISS. RATE ------	3.68	g/Kgdry fuel
	163.66	& g/Kgdry fuel			

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : jotul TEST No. : 4

MODEL: F600 DATE: 05-May-03

TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR	PROPRTN RATE VAR. AVERAGE
5	760.5	97	100
10	779.6	99	
15	779.9	99	
20	780.3	99	
25	780.3	99	
30	780.3	99	
35	780.3	99	
40	780.3	99	
45	779.8	99	
50	780.3	99	
55	780.4	99	
60	780.0	99	
65	780.0	99	
70	779.4	99	
75	781.1	100	
80	781.5	100	
85	780.7	99	
90	782.2	100	
95	783.6	100	
100	785.6	100	
105	785.6	100	
110	786.0	100	
115	785.6	100	
120	785.8	100	
125	785.8	100	
130	785.6	100	
135	785.1	100	
140	785.0	100	
145	790.8	101	
150	790.1	101	
155	790.0	101	
160	790.0	101	
165	790.0	101	
170	791.8	101	
175	787.1	100	
180	787.1	100	
185	787.5	100	
190	787.1	100	
195	787.1	100	
200	787.3	100	
205	787.3	100	
210	787.3	100	
215	787.3	100	
220	787.3	100	

225	787.3	100
230	787.1	100
235	787.5	100
240	787.8	100
245	786.1	100
250	785.7	100
255	786.1	100
260	786.1	100
265	786.1	100
270	786.1	100
275	786.1	100
280	786.1	100
285	786.1	100
290	786.1	100
295	786.1	100
300	786.1	100
305	786.1	100
310	786.1	100
315	786.1	100
320	786.1	100
325	786.0	100
330		
335		

METER BOX DATA SHEET PAGE # 2

Page: 1 of 3

UNIT: F600 RUN: 4 DATE: 5-5-03

Meter Box: 5H Y Factor: .990

Leak checks: 16 " Hg @ .003 cfm _____ " Hg @ _____ cfm

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

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

ROTO: PRESS: .16			SAMPLING RATIO: 21.5 : 1				BP: 30.11		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1345	680.500	—	6.562	.15	85	525	85	1.6
5	50	682.000	—	11.483	.46	85	300	85	4.0
10	55	684.689	684.689	7.253	.19	85	475	85	2.0
15	1400	686.389	686.389	6.890	.17	85	500	85	2.0
20	05	688.005	688.005	6.562	.15	85	525	85	2.0
25	10	689.544	689.544	6.562	.15	85	525	85	2.0
30	15	691.083	691.083	6.562	.15	85	525	85	2.0
35	20	692.622	692.622	6.562	.15	85	525	85	2.0
40	25	694.161	694.161	6.562	.15	85	525	85	2.0
45	30	695.699	695.699	6.562	.15	85	525	85	2.0
50	35	697.238	697.238	7.253	.19	85	475	85	2.0
55	40	698.939	698.939	8.106	.23	85	425	85	2.0
ROTO PRESS: .16			TOTALS:	86.919	2.29	1020	BP.: 30.11		
60	1445	700.839	700.839	9.187	.30	85	375	85	2.0
65	50	702.992	702.992	8.612	.26	85	400	85	2.0
70	55	705.011	705.011	9.170	.30	86	375	86	2.0
75	1500	707.171	707.171	9.170	.30	86	375	86	2.0
80	05	709.332	709.332	9.170	.30	86	375	86	2.0
85	10	711.493	711.493	9.153	.29	87	375	87	2.0
90	15	713.662	713.662	8.565	.26	88	400	88	2.0
95	20	715.703	715.703	8.550	.26	89	400	89	2.0
100	25	717.751	717.751	8.550	.26	89	400	89	2.0
105	30	719.799	719.799	8.550	.26	89	400	89	2.0
110	35	721.848	721.848	8.550	.26	89	400	89	2.0
115	40	723.896	723.896	9.120	.29	89	375	89	2.0
			TOTALS:	106.347	3.34	1048	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	193.266	5.63	2068	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 2 of 3

UNIT: F600 RUN: 4 DATE: 5-5-03

Meter Box: 5H Y Factor: .990 ✓

Leak checks: .16 " Hg @ .003 cfm _____ " Hg @ _____ cfm

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

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

ROTO: PRESS: .16			SAMPLING RATIO: 21.5 : 1				BP: 30.11		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1545	726.081	726.081	9.120	.29	89	375	89	2.0
125	50	728.266	728.266	8.550	.26	89	400	89	2.0
130	55	730.314	730.314	9.120	.29	89	375	89	2.0
135	1600	732.499	732.499	8.534	.25	90	400	90	2.0
140	05	734.553	734.553	8.503	.25	92	400	92	2.0
145	10	736.626	736.626	8.503	.25	92	400	92	2.0
150	15	738.697	738.697	7.558	.20	92	450	92	2.0
155	20	740.538	740.538	7.558	.20	92	450	92	2.0
160	25	742.379	742.379	7.558	.20	92	450	92	2.0
165	30	744.220	744.220	8.003	.22	92	425	92	2.0
170	35	746.170	746.170	8.032	.23	90	425	90	2.0
175	40	748.105	748.105	8.032	.23	90	425	90	2.0
ROTO PRESS: .16			TOTALS:	99.071	2.87	1089	BP.: 30.11		
180	1645	750.040	750.040	8.032	.23	90	425	90	2.0
185	50	751.976	751.976	8.032	.23	90	425	90	2.0
190	55	753.911	753.911	8.032	.23	90	425	90	2.0
195	1700	755.846	755.846	7.586	.20	90	450	90	2.0
200	05	757.674	757.674	7.586	.20	90	450	90	2.0
205	10	759.502	759.502	7.586	.20	90	450	90	2.0
210	15	761.330	761.330	7.586	.20	90	450	90	2.0
215	20	763.158	763.158	7.586	.20	90	450	90	2.0
220	25	764.986	764.986	7.586	.20	90	450	90	2.0
225	30	766.814	766.814	8.032	.23	90	425	90	2.0
230	35	768.749	768.749	8.032	.23	90	425	90	2.0
235	40	770.685	770.685	8.032	.23	90	425	90	2.0
			TOTALS:	93,708	2.58	1080	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	192.779	5.45	2169	AVG. BP:		

✓ ✓ ✓

METER BOX DATA SHEET PAGE # 2

Page: 3 of 3

UNIT: F600 RUN: 4 DATE: 5-5-03

Meter Box: 5H Y Factor: .990 ✓

Leak checks: 16 " Hg @ .003 cfm _____ " Hg @ _____ cfm

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

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

ROTO: PRESS: .16			SAMPLING RATIO: 21.5 : 1				BP: 30.10		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
240	1745	772.620	772.620	8.044	.23	89	425	89	2.0
245	50	774.549	774.549	8.044	.23	89	425	89	2.0
250	55	776.477	776.477	7.597	.20	89	450	89	2.0
255	1800	778.299	778.299	7.597	.20	89	450	89	2.0
260	05	780.121	780.121	7.597	.20	89	450	89	2.0
265	10	781.943	781.943	7.597	.20	89	450	89	2.0
270	15	783.765	783.765	7.597	.20	89	450	89	2.0
275	20	785.587	785.587	7.597	.20	89	450	89	2.0
280	25	787.409	787.409	7.597	.20	89	450	89	2.0
285	30	789.231	789.231	7.597	.20	89	450	89	2.0
290	35	791.053	791.053	7.597	.20	89	450	89	2.0
295	40	792.875	792.875	7.597	.20	89	450	89	2.0
ROTO PRESS: .16			TOTALS:	92.058	2.46	1068	BP.: 30.10		
300	1845	794.697	794.697	7.597	.20	89	450	89	2.0
305	50	796.519	796.519	7.597	.20	89	450	89	2.0
310	55	798.341	798.341	7.597	.20	89	450	89	2.0
315	1900	800.163	800.163	7.597	.20	89	450	89	2.0
320	05	801.985	801.985	7.197	.18	89	475	89	2.0
325	10	803.711	803.711	7.597	.20	89	450	89	2.0
330									
335				45.182	1.18	534			
340									
345									
350				523.285	14.72	5839			
355							460		
			TOTALS:			88	MAX VACC =		4.0
TOTAL Cu Ft.		123.211	TOTALS:	7.929	.223	548	AVG. BP: 30.11		

✓ ✓ ✓ ✓

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : FGDD RUN : 4 DATE : 5-5-03

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	759.9	614.2	486.5	894.4
INITIAL WT	612.6	593.8	483.7	891.3
NET WT GRAMS	147.3	20.4	2.8	3.1

TOTAL CATCH : 173.6 GRAMS H_2O

FRONT HALF

FILTER #	150F	
FINAL WT g	.9736	✓
INITIAL WT g	.6943	✓
NET WT g	.2793	✓

BEAKER #	11	
DESC.	ACETONE	
FINAL WT g	104.8900	✓
INITIAL WT g	104.7887	✓
NET WT g	.1013	✓
VOL. DESC. ml	110	✓

BACK HALF

FILTER #	150B	
FINAL WT g	.5766	✓
INITIAL WT g	.4299	✓
NET WT g	.1467	✓

BEAKER #	12	13	14	15	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	98.5737 ✓	104.2654 ✓	98.0891 ✓	104.8639 ✓	
INITIAL WT g	98.2304 ✓	104.1784 ✓	97.9819 ✓	104.7642 ✓	
NET WT g	.3433 ✓	.0870 ✓	.1072 ✓	.0997 ✓	.2069 ✓
VOL. DESC ml	200 ✓	75	200 ✓	180 ✓	(380) ✓

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 01/17/03 Time : 2055 By : [signature]

Manufacturer S & S Grade : # 25 Glass Front Size : 11 cm Lot No. : ZB921

Back Size: 8.2 cm Lot No. : ZB911

	DATE: 01/20/03	BY: [signature]	DATE: 01/21/03	BY: [signature]	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
141F	.6987	2108	.6986	0937	HEARTHSTONE MORGAN R-6	
142F	.6899	2109	.6900	0938	" "	R-7
143F	.6957	2110	.6958	0938	NEW BUCK	R-1
144F	.6992	2110	.6995	0940	" "	R-2
145F	.6984	2111	.6985	0941	" "	R-3
146F	.6949	2112	.6950	0942	" "	R-4
147F	.6947	2113	.6946	0943	" "	R-5
148F	.6958	2113	.6960	0943	JOTUL F600	R-1
149F	.6938	2114	.6939	0944	" "	R-3
150F	.6941	2115	.6943	0945	" "	R-4

141B	.4321	2116	.4322	0946	HEARTHSTONE MORGAN R-6	
142B	.4291	2117	.4293	0947	" "	R-7
143B	.4287	2118	.4288	0947	NEW BUCK	R-1
144B	.4313	2118	.4312	0948	" "	R-2
145B	.4302	2119	.4303	0949	" "	R-3
146B	.4232	2120	.4234	0950	" "	R-4
147B	.4275	2121	.4275	0950	" "	R-5
148B	.4400	2121	.4400	0951	JOTUL F600	R-1
149B	.4287	2122	.4288	0952	" "	R-3
150B	.4297	2123	.4299	0953	" "	R-4

Checked by: C. [signature] Date: 1-21-03 Time: 1010

SCALE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	DB	% RH
01/20	2105	[signature]	76	44
01/21	0935	[signature]	75	44

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 08-19-2002 Time : 1205 By : [signature]

	DATE: 08-22	BY: [signature]	DATE:	BY: [signature]	DATE:	BY:
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
1	104.9172	1043	104.9174	0704		
2	106.2542	1044	106.2538	0705	JOTUL FL600 R-1	
3	107.7782	1046	107.7777	0706		
4	108.7744	1047	108.7740	0708		
5	97.4370	1048	97.4366	0709		
6	91.2080	1050	91.2076	0710		
7	97.1385	1051	97.1382	0711	JOTUL FL600 R-3	
8	108.6356	1052	108.6357	0713		
9	108.0961	1053	108.0960	0714		
10	105.7310	1055	105.7306	0715		
11	104.7892	1056	104.7887	0717		
12	98.2303	1057	98.2304	0718	JOTUL FL600 R-4	
13	104.1788	1059	104.1784	0719		
14	97.9822	1100	97.9819	0721		
15	104.7644	1101	104.7642	0722		
16	95.7427	1102	95.7429	0723		
17	104.5948	1104	104.5944	0724	JOTUL FL600 R-5	
18	108.8626	1105	108.8623	0725		
19	106.5473	1106	106.5468	0726		
20	108.5936	1108	108.5932	0728		

SCALE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	DB	% RH
08-22	1040	[signature]	78	49
08-23	0700	[signature]	78	49

Checked by : Chp Weatherly
Date : 8-23-02
Time : 0910

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : F600 RUN : 4 DATE : 5-5-03 Page : 1 of 1

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
11	05/06	0935		104.8904	05/09	0733		104.8900	05/10	1447					
12	05/06	0935		98.5756	05/09	0734		98.5740	05/10	1448		98.5737	05/11	1217	
13	05/06	2155		104.2753	05/09	0735		104.2708	05/10	1449		104.2658	05/11	1218	
				104.2654	05/12	0946									
14	05/06	0935		98.0891	05/09	0736		98.0891	05/10	1450					
15	05/06	0935		104.8642	05/09	0737		104.8639	05/10	1451					

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
150F	5-5	1950	CJ	.9739	05/06	2153		.9736	05/09	0738					
150B	5-5	1450	CJ	.5857	05/06	2154		.5801	05/09	0739		.5789	05/10	1453	
				.5770	05/11	1219		.5766	05/12	0947					

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	05/06	2135		77	46
2	05/09	0715		77	45
3	05/10	1435		78	47
4	05/11	1210		77	46
5	05/12	0940		76	45

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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 12-05-2002 Through 02-23-2003	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	9.9998	1.0000	.0997		12-05	1825	77	47
99.9998	10.0000	.9999	.1000		12-06	1125	77	45
99.9997	10.0001	1.0000	.1000		12-07	1310	76	41
99.9997	10.0001	1.0000	.0999		12-08	1430	77	44
99.9998	9.9999	1.0001	.0999		12-09	1125	78	44
99.9998	10.0000	.9999	.0998		12-10	1220	78	43
99.9997	10.0000	.9998	.0998		12-11	1650	77	45
99.9997	10.0001	.9999	.0999		12-12	1445	77	47
99.9998	10.0000	.9999	.1000		12-14	1530	78	47
99.9997	10.0000	1.0000	.0999		01-10	2300	78	48
99.9998	9.9999	1.0001	.1000		01-14	1115	77	48
99.9999	10.0000	.9999	.1000		01-15	1705	77	48
99.9999	10.0001	.9999	.0998		01-16	1830	78	46
99.9997	10.0000	1.0000	.0999		01-17	1215	77	41
99.9997	9.9999	1.0000	.0999		01-17	2035	76	42
99.9996	10.0000	.9999	.0999		01-18	1730	77	43
99.9999	9.9999	.9998	.0999		01-19	1210	76	42
99.9998	10.0000	1.0000	.0999		01-20	2105	76	44
99.9999	10.0000	.9999	.0998		01-21	0935	75	44
99.9998	10.0000	.9999	.0999		01-22	1125	77	46
100.0000	9.9998	.9999	.1000		01-23	1430	77	48
99.9999	10.0001	1.0001	.1000		01-24	1200	76	48
99.9998	9.9999	.9999	.0999		01-25	1140	76	47
99.9997	10.0000	1.0000	.0999		01-25	1850	78	48
99.9998	9.9998	1.0000	.1000		01-27	1415	75	47
99.9999	9.9999	1.0000	.1000		01-30	1920	77	48
99.9998	10.0000	.9998	.0999		01-31	2205	78	47
99.9999	9.9998	.9998	.1000		02-01	1855	77	47
99.9997	9.9998	.9999	.1001		02-02	1420	76	46
99.9997	10.0001	.9998	.0999		02-18	1155	77	49
99.9999	9.9999	.9999	.0999		02-19	1925	77	48
99.9997	10.0000	1.0000	.0999		02-22	2010	78	45
99.9997	10.0001	.9999	.1000		02-23	1130	78	44

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 02-24-2003 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
99.9998	10.000	1.0000	.0999		02-24	1055	74	44
99.9997	9.9998	1.0001	.0999		02-25	1700	77	45
100.0000	10.0001	1.0000	.0998		03-01	1010	71	44
99.9997	10.0001	.9998	.0999		03-02	1420	75	45
99.9998	10.0000	.9999	.1000		03-03	1405	76	45
99.9998	10.0000	1.0000	.1000		03-03	2005	77	47
100.0000	10.0001	1.0001	.0999		03-04	1035	75	47
99.9996	10.0001	1.0000	.0999		03-05	0945	71	47
99.9997	10.0001	1.0000	.1000		03-06	1340	74	46
99.9998	9.9999	1.0000	.0998		03-07	2050	76	45
99.9998	9.9999	1.0000	.0999		03-08	1150	77	45
99.9997	9.9998	1.0000	.1000		03-09	1350	76	45
99.9998	10.0000	.9999	.1000		03-10	1220	77	47
99.9997	9.9999	1.0000	.1000		03-18	1740	77	46
99.9997	9.9999	1.0000	.0999		03-20	2145	74	45
99.9998	10.0000	1.0000	.0998		03-22	1725	76	47
99.9997	10.0000	.9999	.1000		03-23	1405	77	47
99.9998	9.9998	.9999	.0999		03-24	1450	74	44
100.0000	9.9998	1.0000	.0998		03-25	1120	75	45
99.9998	10.0000	.9999	.0999		04-30	2300	75	47
99.9997	10.0001	.9999	.1000		05-02	1130	77	49
99.9998	9.9998	1.0000	.0999		05-06	2135	77	46
99.9997	9.9999	1.0001	.0999		05-09	0715	77	45
99.9998	10.0000	.9999	.0999		05-10	1435	78	47
99.9998	9.9999	1.0000	.0998		05-11	1210	77	46
99.9996	10.0001	.9999	.0999		05-12	0940	76	45

BLANK PROCESSING DATA SHEET # 5

UNIT : F600 RUN : 4 DATE : 05/05/03

DATE BLANKS DONE : 02-23-03

BEAKER	A	B	C
	200 ml ACETONE	75 ml DICHLOR	200 ml WATER
	FISHER OPTIMA LOT # 011755	FISHER OPTIMA LOT # 994669	DWNA, INC. SPARKLETTES DISTILLED
FINAL WEIGHT	108.9007	106.3074	106.9660
TARE WEIGHT	108.8995	106.3057	106.9646
NET WEIGHT	.0012 ✓	.0017 ✓	.0014 ✓

TARE BEAKERS INTO DESC : TIME : 1430 DATE : 02-12-03

DATE : 02-18 BY : [illegible] DATE : 02-19 BY : [illegible] DATE : BY :

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.8996	1158	108.8995	1928	✓	
B	106.3060	1159	106.3057	1930	✓	
C	106.9649	1200	106.9646	1931	✓	

FINAL BEAKERS INTO DESC : TIME : 1600 DATE : 02-20-03

DATE : 02-22 BY : [illegible] DATE : 02-23 BY : [illegible] DATE : BY :

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9010	2013	108.9007	1132	✓	
B	106.3078	2015	106.3074	1133	✓	
C	106.9661	2016	106.9660	1134	✓	

TARE QC

DATE	TIME	BY	WB	DB	%
02-18	1155	[illegible]		77	49
02-19	1925	[illegible]		77	48

FINAL QC

DATE	TIME	BY	WB	DB	%
02-22	2010	[illegible]		78	45
02-23	1130	[illegible]		78	44

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT: F600 RUN: 2 DATE: 05/05/03

BLANK CALCULATIONS

Acetone: .0012 g ÷ 200 ml = .000006 g/ml
Dicholoromethane: .0017 g ÷ 75 ml = .000023 g/ml
Distilled Water: .0014 g ÷ 200 ml = .000007 g/ml

FRONT HALF CATCH

FILTERS: .2793 (Total Catch) g - 1 (# of Filters) (.0000 g (Blank Value / Filter)) = .2793 g

BEAKERS: .1013 (Total Catch) g - 110 (ml Acetone) (.000006 g (Blank Value / ml Acetone)) = .1006 g

TOTAL FRONT HALF CATCH: .3799 g

BACK HALF CATCH

FILTERS: .1467 (Total Catch) g - 1 (# of Filters) (.0000 g (Blank Value / Filter)) = .1467 g

BEAKERS:
Acetone: .3433 (Total Catch) g - 200 (ml Acetone) (.000006 g (Blank Value / ml Acetone)) = .3421 g
Extract: .0870 (Total Catch) g - 75 (ml Dichloromethane) (.0017 .000023 g (Blank Value / Dichloromethane)) = .0853 g
Water: .2069 (Total Catch) g - 380 (ml Water) (.000007 g (Blank Value / Water)) = .2042 g

TOTAL BACK HALF CATCH: .7783 g

TOTAL CATCH: 1.1582 g

% FRONT HALF: 32.8 % (00.0)

CALCULATIONS DATA SHEET # 7

UNIT: JOTUL F6000 RUN: 4 DATE: 05/05/05

1) $Vm(std) = \dfrac{(123.211\ Vm)(17.64)(.990\ mcf)\left(30.11\ "Hg + \frac{.223\ "H_2O}{13.6}\right)}{(548\ TmA)} = \dfrac{118.2905}{000.0000}$ dscf

2) $Vw(std) = (.04707)(173.6\ ml\ H_2O) = \dfrac{8.1714}{00.0000}$ scf

3) $Asw = \dfrac{(8.1714\ scf)}{(8.1714\ scf + 118.2905\ dscf)} = \dfrac{.0646}{.0000}$ Bws × 100 = $\dfrac{6.4615}{00.0000}$ % H_2O

4) $Cs = \dfrac{(1.1582\ g.)}{(118.2905\ dscf)}(15.43) = \dfrac{.1511}{0.0000}$ gr / dscf

5) Estimated g / hr = $\dfrac{(1.1582\ g.)}{(118.2905\ dscf)}\left(\dfrac{7.929}{00.0000}\ dscfm\right)(60) = \dfrac{4.6580}{00.0000}$ 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 : F600 RUN : 4 DATE : 5-5-03

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

Wet Bulb / Dry Bulb

Pre : WB : 63 DB : 85 = 27 % RH 1.2 % H_2O

Post : WB : 60 DB : 79 = 30 % RH 1.1 % H_2O

Average : 28.5 % RH 1.15 % H_2O

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

Kindling Weight (lbs) : Paper : 1.2 Wood : 1.7

Preburn Fuel Weight : 15.2 + 12.6 + 14.1 Total : 41.9

Kindling & Preburn Fuel Weight (wood only) (lbs) : **Total** : 43.6

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

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

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

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

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

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" × 4"	17	4	8.9	50.3
4" × 4"	17	2	8.8	49.7

Test Fuel Weight : 17.7 lbs

Estimated Dry Burn Rate :

$$\frac{17.7 - (17.7 \times .17759)}{2.2046} \times \frac{60}{\underset{\text{TIME}}{325}} = 1.219 \text{ kg / hr}$$

Estimated BTU's/hr : $19{,}140 \times \frac{63}{100} \times \frac{1.219}{\text{DBR}} = 14{,}698.8$ BTU's/hr

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

WOOD STOVE OPERATING DATA PAGE #9

Unit : F600 Run : 4 Date : 5-5-03

FIRE STARTED: 0915

WARM UP AND PREBURN:

PRIMARY AIR : Set wide open for all warm-up / preburn fuel charges. Then set to 3/16" 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 ½ min. prior to loading last fuel, raked and leveled. In stove 35 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 3/16".

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 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 : _____ BRAND : _____

All Grades WCLB rules:

WARM UP INFORMATION:

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

1st warm up / pre-burn fuel charge (15.2 lbs.) added at 0935

2nd warm up / pre-burn fuel charge (12.6 lbs.) added at 1100

3rd warm up / pre-burn fuel charge (14.1 lbs.) added at 1205

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

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

TEST DATA SHEET #10

Unit : F600 Run : 4 Date : 5-5-03

Room Temperature : 72 °F Correction Factor : Ø

Uncorrected Values are corrected for room temperature : Yes _____ No ✓

Time Test Fuel moisture reading taken : 1210 ✓

Calibration Checks : X ✓ Y ✓ 12.0 12.1 22.0 22.1

pc #	Dimen.	Use	TOP		BOTTOM		SIDE		Average Corrected
			Uncor.	Cor.	Uncor.	Cor.	Uncor.	Cor.	
1	2"×4"×8'	K	16.0	17.0	15.5	16.5	15.5	16.5	16.667 ✓
2									
3									
4	2"×4"×8'	P	21.5	23.1	21.5	23.1	22.0	23.7	23.300 ✓
5	2"×4"×8'	P	22.0	23.7	22.0	23.7	22.0	23.7	23.700 ✓
6	2"×4"×8'	P	19.5	20.9	21.0	22.5	21.0	22.5	21.967 ✓
7	2"×4"×8'	P	20.0	21.4	19.0	20.3	19.5	20.9	20.867 ✓
8	2"×4"×8'	P	22.0	23.7	22.0	23.7	21.0	22.5	23.300 ✓
9									113.134 ✓
10									
11	2×4×17	T	17.5	18.7	18.5	19.8	18.5	19.8	19.433 ✓
12	"	T	20.5	22.0	21.0	22.5	21.0	22.5	22.333 ✓
13	"	T	20.0	21.4	20.0	21.4	20.0	21.4	21.400 ✓
14	"	T	23.5	25.2	23.0	24.7	23.5	25.2	25.033 ✓
15	4×4×17	T	19.5	20.9	20.0	21.4	19.5	20.9	21.067 ✓
16	"	T	19.0	20.3	19.0	20.3	19.0	20.3	20.300 ✓
17									129.566 ✓
18									
19									
20	Spacers	T	18.5	19.8	18.0	19.2	18.0	19.2	19.400 ✓

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	16.667 % ✓	22.627 % ✓	21.594 % ✓
Wet Moisture % :	14.286 % ✓	18.452 % ✓	17.759 % ✓

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

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

GAS DATA SHEET #12

WEIGHT: 3.8 DATE: 05-05-03

UNIT: F600 RUN: 4 PAGE: 1 OF 2

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
0 1345	21.5	17.7	—	.232	5.8	.539	13.5	.155	1.56	-.028	525
5 50	20.6	16.8	.9	.506	12.6	.302	7.6	.062	.63	-.042	300
10 55	20.3	16.5	.3	.153	3.8	.656	16.4	.060	.61	-.035	475
15 1400	20.1	16.3	.2	.197	4.9	.608	15.2	.070	.71	-.033	500
20 05	19.7	15.9	.4	.190	4.7	.609	15.2	.084	.85	-.033	525
25 10	19.4	15.6	.3	.174	4.3	.622	15.5	.092	.93	-.031	525
30 15	19.1	15.3	.3	.210	5.2	.591	14.8	.079	.80	-.032	525
35 20	18.7	14.9	.4	.233	5.8	.565	14.1	.086	.87	-.034	525
40 25	18.3	14.5	.4	.230	5.7	.563	14.1	.099	1.00	-.034	525
45 30	18.0	14.2	.3	.236	5.9	.559	14.0	.094	.95	-.033	525
50 35	17.5	13.7	.5	.279	6.9	.520	13.0	.084	.85	-.036	475
55 40	17.0	13.2	.5	.342	8.5	.460	11.5	.076	.77	-.040	425
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.411	*****
60 1545	16.4	12.6	.6	.395	9.8	.417	10.4	.052	.53	-.042	375
65 50	15.9	12.1	.5	.384	9.6	.424	10.6	.061	.62	-.043	400
70 55	15.3	11.5	.6	.419	10.4	.396	9.9	.045	.46	-.045	375
75 1600	14.6	10.8	.7	.456	11.4	.357	8.9	.049	.50	-.046	375
80 05	13.9	10.1	.7	.410	10.2	.407	10.2	.039	.40	-.047	375
85 10	13.2	9.4	.7	.464	11.6	.349	8.7	.048	.49	-.047	375
90 15	12.6	8.8	.6	.437	10.9	.375	9.4	.052	.53	-.047	400
95 20	12.0	8.2	.6	.470	11.7	.337	8.5	.059	.60	-.046	400
100 25	11.4	7.6	.6	.479	11.9	.332	8.3	.055	.56	-.046	400
105 30	10.8	7.0	.6	.472	11.9	.330	8.3	.059	.60	-.046	400
110 35	10.2	6.4	.6	.439	10.9	.377	9.4	.042	.43	-.046	400
115 40	9.7	5.9	.5	.447	11.1	.370	9.3	.039	.40	-.046	375
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.547	*****
120 1645	9.2	5.4	.5	.464	11.6	.353	8.8	.040	.41	-.046	375
125 50	8.7	4.9	.5	.480	12.0	.335	8.4	.043	.44	-.046	400
130 55	8.2	4.4	.5	.426	10.6	.397	9.9	.024	.25	-.046	375
135 1700	7.9	4.1	.3	.348	8.7	.465	11.6	.049	.50	-.044	400
140 05	7.6	3.8	.3	.323	8.0	.485	12.1	.061	.62	-.042	400
145 10	7.4	3.6	.2	.299	7.4	.504	12.6	.075	.76	-.041	400
150 15	7.3	3.5	.1	.256	6.4	.528	13.2	.121	1.22	-.038	450
155 20	7.1	3.3	.2	.251	6.2	.529	13.2	.132	1.33	-.037	450
160 25	7.0	3.2	.1	.244	6.1	.530	13.2	.147	1.48	-.036	450
165 30	6.9	3.1	.1	.245	6.2	.523	13.1	.152	1.53	-.035	425
170 35	6.8	3.0	.1	.239	5.9	.518	13.0	.188	1.89	-.035	425
175 40	6.7	2.9	.1	.249	6.2	.518	12.9	.165	1.66	-.034	425
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.480	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-1.438	*****

GAS DATA SHEET #12

WEIGHT: 3.8 DATE: 05-05-03

UNIT: F600 RUN: 4 PAGE: 2 OF 2

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
180 1745	6.5	2.7	.2	.245	6.1	.519	13.0	.172	1.73	.033	425
185 50	6.4	2.6	.1	.237	5.9	.522	13.1	.183	1.84	.032	425
190 55	6.3	2.5	.1	.232	5.8	.521	13.0	.200	2.01	.032	425
195 1800	6.2	2.4	.1	.253	6.3	.516	12.9	.160	1.61	.031	450
200 05	6.1	2.3	.1	.252	6.3	.523	13.1	.145	1.46	.031	450
205 10	6.0	2.2	.1	.252	6.3	.521	13.0	.148	1.48	.031	450
210 15	5.8	2.0	.2	.254	6.3	.517	12.9	.154	1.55	.030	450
215 20	5.7	1.9	.1	.256	6.4	.514	12.8	.157	1.58	.030	450
220 25	5.6	1.8	.1	.252	6.3	.516	12.9	.162	1.63	.030	450
225 30	5.4	1.6	.2	.248	6.2	.519	13.0	.165	1.66	.030	425
230 35	5.3	1.5	.1	.243	6.0	.516	12.9	.184	1.85	.030	425
235 40	5.3	1.5	0	.239	5.9	.518	13.0	.188	1.89	.029	425
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.369	*****
240 1845	5.2	1.4	.1	.231	5.7	.530	13.3	.178	1.79	.029	425
245 50	5.1	1.3	.1	.225	5.6	.530	13.3	.193	1.94	.029	425
250 55	5.0	1.2	.1	.212	5.3	.534	13.3	.217	2.18	.029	450
255 1900	4.9	1.1	.1	.202	5.0	.539	13.4	.228	2.29	.029	450
260 05	4.8	1.0	.1	.205	5.1	.543	13.6	.211	2.12	.028	450
265 10	4.7	.9	.1	.201	5.0	.546	13.6	.215	2.16	.028	450
270 15	4.6	.8	.1	.199	4.9	.547	13.7	.217	2.18	.028	450
275 20	4.5	.7	.1	.199	4.9	.552	13.8	.204	2.05	.027	450
280 25	4.4	.6	.1	.196	4.9	.555	13.9	.204	2.05	.027	450
285 30	4.3	.5	.1	.192	5.3	.544	13.6	.212	1.93	.027	450
290 35	4.2	.4	.1	.192	4.8	.559	14.0	.204	2.05	.027	450
295 40	4.2	.4	0	.187	4.6	.567	14.2	.196	1.97	.027	450
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.335	*****
300 1945	4.1	.3	.1	.174	4.3	.573	14.3	.214	2.15	.026	450
305 50	4.0	.2	.1	.167	4.1	.582	14.5	.210	2.11	.026	450
310 55	4.0	.2	0	.161	4.0	.591	14.8	.201	2.02	.026	450
315 2000	3.9	.1	.1	.160	4.0	.594	14.8	.198	1.99	.026	450
320 05	3.9	.1	0	.158	3.9	.597	14.9	.195	1.96	.025	475
325 10	3.8	0	.1	.153	3.8	.605	15.1	.187	1.88	.025	450
330 15											
335 20										.154	
340 25											
345 30											
350 35											
355 40											.066
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	2.296	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	.035	*****

PREBURN DATA SHEET #1

UNIT: F600 RUN: 4 DATE: 5-5-03 PAGE: 1 of 1

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
0 / 1245	5.6	—	458	531	442	381	462	262	878	1314	67	-.051	PREBURN START: # 1.2 UP
5 / 50	5.3	.3	321	485	450	278	458	271	813	1182	68	-.046	COAL BED SCALE RANGE:
10 / 55	5.0	.3	281	445	434	255	435	277	783	1100	67	-.042	4.4 → 3.6
15 / 1300	4.9	.1	263	414	418	242	412	278	758	1045	69	-.041	PRIMARY AIR: 3/16"
20 / 05	4.6	.3	242	382	399	233	391	284	728	942	74	-.038	SECONDARY AIR: N/A
25 / 10	4.5	.1	220	354	384	227	376	283	703	882	75	-.036	FAN: High
30 / 15	4.3	.2	207	324	365	218	356	279	679	839	75	-.034	PUMPS ON AT: 1325
35 / 20	4.2	.1	200	302	346	211	338	276	651	889	75	-.032	CHECK WB/DB: N/A
40 / 25	4.1	.1	196	294	335	208	333	277	641	862	75	-.032	
45 / 30	4.0	.1	188	280	327	205	322	273	625	775	75	-.031	
50 / 35	4.0	0	183	268	309	202	312	274	613	759	75	-.030	
55 / 40	3.9	.1	179	259	298	200	304	272	601	746	76	-.028	
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	
60 / 1345	3.8	.1	199	245	294	195	291	273	562	690	76	-.028	

TEMPERATURE DATA SHEET #14

		TEST TIME	325		
STACK AVG	214	TOP AVG	272	LT SIDE AVG	264
BACK AVG	184	RT SIDE AVG	270	BOTTOM AVG	214
FIREBOX AVG	563	SEC/CAT AVG	844	AMBIENT AVG	73

END	197.0
START	259.6
	-62.6 DELTA T

CIRCLE: (LOSS) / GAIN

Jotul U.S.A., Inc. TEMPERATURE DATA SHEET #14A Run 1 05/05/2003

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
0	199	245	294	195	291	273	562	690	76	1332	242	62	248	39	39
5	368	280	287	258	278	271	473	947	76	1336	246	45	249	39	36
10	220	273	277	258	266	263	438	729	76	1343	248	44	246	39	35
15	198	260	266	251	253	256	414	837	76	1349	247	43	248	38	36
20	191	255	254	242	241	254	395	708	75	1342	247	43	243	37	35
25	182	246	243	234	232	246	384	653	74	1336	248	43	240	36	37
30	181	241	236	226	226	235	378	691	71	1332	245	43	241	36	37
35	187	239	214	159	218	229	376	718	71	1330	246	43	241	38	36
40	189	239	202	146	213	224	374	725	70	1331	245	44	241	37	36
45	192	240	194	139	210	218	371	804	69	1334	247	44	240	36	36
50	197	239	187	134	206	214	371	976	73	1337	247	44	241	37	36
55	229	265	184	131	205	211	383	1003	70	1338	244	43	243	37	36
60	249	292	185	130	206	206	387	1065	70	1332	242	43	244	35	36
65	266	317	190	131	210	203	398	1077	70	1328	241	44	245	34	35
70	282	336	195	133	217	199	415	1072	71	1326	240	44	247	36	37
75	300	355	201	135	226	196	448	1081	71	1324	239	43	247	36	37
80	301	368	211	139	237	194	475	1047	72	1325	240	43	248	35	38
85	309	381	222	144	248	195	508	1096	73	1325	240	43	247	37	36
90	308	384	235	149	259	194	536	1088	73	1328	239	44	248	36	38
95	307	387	249	155	269	195	565	1122	74	1328	239	44	247	38	38
100	302	399	263	163	277	193	577	1166	75	1326	238	44	246	37	38
105	299	402	273	171	289	191	589	1176	74	1325	238	45	245	38	37
110	292	405	283	177	297	191	608	1175	74	1326	238	46	244	38	38
115	289	402	292	185	306	189	626	1186	74	1326	237	46	243	38	39
120	291	405	299	191	312	191	639	1177	73	1326	237	48	242	38	39
125	298	413	305	197	321	192	652	1193	73	1327	237	49	242	38	39
130	289	410	315	204	328	193	664	1161	74	1330	237	49	242	38	39
135	274	386	322	214	332	192	677	1119	74	1333	237	50	243	37	39
140	262	368	325	223	334	196	684	1097	75	1335	236	50	242	38	39
145	253	353	331	228	333	197	688	1059	74	1338	236	50	242	38	39
150	235	335	329	230	331	200	682	953	74	1340	235	50	243	39	38
155	224	317	327	232	326	201	677	908	73	1342	235	50	242	39	39
160	215	301	323	233	322	203	671	869	73	1343	234	50	241	38	39
165	208	289	318	231	317	204	672	846	73	1344	234	51	240	38	37
170	202	278	314	223	312	209	670	824	73	1343	233	51	240	39	38
175	198	266	310	218	307	209	670	814	71	1342	232	51	242	39	36

Jotul U.S.A., Inc. TEMPERATURE DATA SHEET #14A Run 4 05/05/2003

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
180	195	259	309	214	304	210	668	803	72	1342	231	50	242	37	36
185	191	251	306	210	300	212	665	786	72	1341	231	50	243	37	37
190	189	244	302	208	297	212	660	775	72	1340	231	50	243	37	37
195	186	240	300	205	295	212	671	767	72	1338	232	50	242	38	35
200	184	235	296	199	292	213	674	769	71	1332	232	50	237	38	35
205	183	232	296	195	290	213	673	767	72	1329	232	50	237	38	35
210	182	228	292	190	289	216	673	763	73	1326	233	51	239	36	35
215	181	225	291	187	288	216	671	763	73	1322	233	51	239	36	35
220	180	223	291	184	286	220	666	764	74	1321	234	51	240	37	34
225	179	221	292	183	284	220	661	763	73	1320	235	52	240	37	34
230	178	219	287	181	282	225	655	758	74	1318	235	52	241	37	35
235	177	216	284	180	280	225	649	746	74	1318	235	52	241	36	35
240	176	215	282	179	277	224	632	737	73	1318	236	52	242	35	34
245	174	213	274	178	276	226	622	726	74	1318	236	52	242	35	34
250	172	212	273	177	272	226	611	709	73	1318	236	51	242	35	35
255	170	208	269	176	269	222	601	694	72	1318	236	51	242	34	36
260	168	207	262	175	266	225	590	682	73	1317	236	51	242	34	35
265	167	205	256	173	263	222	580	671	72	1315	236	51	242	34	37
270	166	203	252	171	261	223	573	662	73	1315	236	51	242	34	36
275	166	201	250	169	259	224	567	655	73	1315	236	51	242	35	36
280	165	199	245	167	257	221	560	649	73	1316	236	52	242	35	37
285	164	198	243	165	256	219	558	641	72	1316	236	52	242	35	37
290	163	196	239	163	253	216	555	636	72	1316	236	52	242	35	38
295	163	195	235	162	251	216	549	630	72	1315	236	52	241	36	36
300	161	194	232	160	249	214	539	619	72	1315	235	52	242	36	36
305	158	191	228	159	246	213	531	609	72	1315	235	52	242	37	36
310	157	188	227	157	242	212	521	599	72	1315	235	52	242	36	37
315	155	185	222	156	238	208	512	588	72	1315	235	52	240	36	37
320	153	183	218	155	236	208	506	579	71	1314	235	52	241	36	36
325	151	181	215	154	232	203	499	571	70	1313	234	52	241	37	35

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 05/01/03 Analyte : CO_2 (15-1)

Unit : FL600 Run # : 4

Zero Cyl. # : 042JAC 2-A Conc. : 0.00 % CO_2 Cyl. Press. : 900 PSI

Certified by : AIR LIQUIDE Date : 02-20-02

Span Cyl. # : CC-3131 Conc. : 12.40 % CO_2 Cyl. Press. : 1625 PSI

Certified by : AIR LIQUIDE Date : 03-13-03

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 : A. Washington Time : 1255 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	,023	,023	,091	✓
SPAN	49.6	.496	12.40	49.6	.496	12.367	.033	,133	✓

POST RUN Audit : by : A. Washington Time : 2030 Temp : 72 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %	
	Meter	DVM	%	Meter	DVM	%			
ZERO	00.0	.000	00.0	00.1	.001	,002	+.002	+009	✓
SPAN	49.6	.496	12.40	49.7	.497	12.392	,008	,033	✓

± 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 : 05/01/03 Analyte : O_2 (15-2)

Unit : F600 Run # : 4

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 % O_2 Cyl. Press. : 900 PSI

Certified by : AIR LIQUIDE Date : 02-20-02

Span Cyl. # : CC-3131 Conc. : 12.40 % O_2 Cyl. Press. : 1625 PSI

Certified by : AIR LIQUIDE Date : 03-13-03

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 : [signature] Time : 1255 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	.025	+.025	+.101
SPAN	12.50	.500	12.50	12.55	.501	12.526	+.026	+.105

POST RUN Audit : by : [signature] Time : 2030 Temp : 72 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.001	.050	+.050	+.201
SPAN	12.50	.500	12.50	12.50	.500	12.051	+.001	+.006

± 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 : 05/01/03 Analyte : CO (15-3)

Unit : F600 Run # : 4

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 % CO Cyl. Press. : 900 PSI

Certified by : AIR LIQUIDE Date : 02-20-03

Span Cyl. # : CC-3131 Conc. : 12.40 % CO Cyl. Press. : 1625 PSI

Certified by : AIR LIQUIDE Date : 03-13-03

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 : A. Washington Time : 1255 ✓ 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	.011	+.011	+.110 ✓
SPAN	50.2	.502	5.02	50.3	.503	5.040	+.020	+.197 ✓

POST RUN Audit : by : A. Washington Time : 2030 ✓ Temp : 72 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.001	.001	+.001	+.010 ✓
SPAN	50.2	.502	5.02	50.2	.502	5.030	+.010	+.097 ✓

± 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 : 05/01/03 Analyte : SO_2 (15-4)

Unit : F600 Run # : 4

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 ppm SO_2 Cyl. Press. : 900 PSI

Certified by : AIR LIQUIDE Date : 02-20-02

Span Cyl. # : CC62184 Conc. : 1290 ppm SO_2 Cyl. Press. : 1025 PSI

Certified by : AIR LIQUIDE Date : 01-29-01

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 : ~~A. Wadsworth~~ Time : 1250 Temp : 68 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.2	.002	11.696	+11.696	.468
SPAN	51.6	.516	1290	51.8	.518	1295.028	+5.028	.201

POST RUN Audit : by : ~~A. Wadsworth~~ Time : 2030 Temp : 72 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.001	9.209	+9.209	.368
SPAN	51.6	.516	1290	51.7	.517	1292.541	+2.541	.102

± 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 : F600 RUN : 4 DATE : 5-5-03

Thermocouple Check:

T/C # 1	— °F	T/C # 13	53.8 °F
T/C # 2	— °F	T/C # 14	53.5 °F
T/C # 3	54.0 °F	T/C # 15	54.0 °F
T/C # 4	50.8 °F	T/C # 16	52.2 °F
T/C # 5	49.8 °F	T/C # 17	52.8 °F
T/C # 6	49.6 °F	T/C # 18	55.3 °F
T/C # 7	49.6 °F	T/C # 19	52.5 °F
T/C # 8	49.4 °F	T/C # 20	— °F
T/C # 9	50.0 °F	T/C # 21	— °F
T/C # 10	50.4 °F	T/C # 22	— °F
T/C # 11	49.6 °F	T/C # 23	52.0 °F
T/C # 12	56.3 °F	T/C # 24	— °F

Thermocouple Readout:

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

ZERO -2.6 °F Adj. to 0.0 °F ZERO 1.6 °F Difference .080 % ✓

SPAN 2001.6 °F Adj. to 2000.0 °F SPAN 2002.3 °F Difference .115 % ✓

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 201.7 °F	400	= 399.6 °F
600	= 601.3 °F	800	= 801.5 °F	1000	= 1000.6 °F
1200	= 1198.2 °F	1400	= 1399.1 °F	1600	= 1599.7 °F
1800	= 1800.0 °F	2000	= 2000.0 °F		

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

Scale Check Pre : 5.8 - 15.8 ✓

Post : 3.5 - 13.5 ✓

Stack Cleaned Prior to Test Run : YES ____ NO X

COMPUTER INPUT DATA SHEET #1

Client: JOTUL USA, INC.

Address: 400 RIVERSIDE ST. / P.O. BOX 1157
PORTLAND, ME 04104

Phone: 800-797-5912 Fax: 207-797-6072

Run No.: 1 Date of Test: 04-29-03 Burn Rate: 1.863

Model No.: F600 ☐ min ☐ min-1.25 ☐ fan

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

Dry Gas Meter Y Factor: .990 (0.000) (Data Sheet #2) Post Leak Rate: .004 cfm (.000) (Data Sheet #2) Time: 215 min. (000) (Data Sheet #2)

Dry Gas Meter Volume: 70.692 cf (00.000) (Data Sheet #2)

Stack Flow: 9.279 dscfm (00.000) (Data Sheet #2) Δ H: .153 in. H_2O (.000) (Data Sheet #2)

Maximum Vac.: 3.0 (0.0) (Data Sheet #2) Barometric Pressure: 29.85 in. Hg (00.00) (Data Sheet #2)

H_2O Captured: 119.5 g (00.0) (Data Sheet #3)

Front Half Catch % Of Total: 40.2 % (00.0) (Data Sheet #6) Total Particulate Catch: .2972 g (0.0000) (Data Sheet #6)

Flue Gas Moisture: 7.7941 % (00.000) (Data Sheet #7)

Particulate Emission: .0689 gr/dscf (0.0000) (Data Sheet #7)

Relative Humidity: 46.5 % RH (00.0) (Data Sheet #8) Ambient Moisture: 1.6 % H_2O (0.00) (Data Sheet #8)

Preburn Fuel Wt.: 56.0 lbs. (00.0) (Data Sheet #8) Coal Bed Wt.: 4.2 lbs. (00.0) (Data sheet #8) Test Fuel Wt.: 17.9 lbs. (00.0) (Data sheet #8)

Heat Output (EPA Default): 22,462.0 BTU/hr (00,000.0) (Data Sheet #8)

Kindling Fuel % Moisture (wet): 16.504 % (00.000) (Data Sheet #10) Pretest Fuel % Moisture (wet): 17.369 % (00.000) (Data Sheet #10)

Test Fuel % Moisture (dry): 21.639 % (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove]) Test Fuel % Moisture (wet): 17.789 %

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

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

Average Ambient Temperature: 77 °F (00) (Data Sheet #14) Stove Temperature Change: -47.3 °F (+/- 000.0) (Data Sheet #14)

TABLE 1 ----- RAW DATA

CLIENT : Jotul TEST No. : 1

MODEL: F600 DATE: 29-Apr-03

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	324.000	0.150	88	0.60	2.10	375
5	325.500	0.340	85	0.61	11.30	250
10	327.810	0.170	85	0.60	8.00	350
15	329.461	0.150	83	0.76	8.20	375
20	330.991	0.170	83	0.66	11.50	350
25	332.630	0.170	83	0.69	12.80	350
30	334.269	0.150	83	0.91	13.30	375
35	335.799	0.120	87	1.17	13.70	425
40	337.169	0.110	90	1.08	12.80	425
45	338.554	0.110	90	0.98	12.60	425
50	339.939	0.110	92	0.95	12.80	425
55	341.324	0.110	92	0.90	12.90	425
60	342.709	0.110	92	0.94	12.90	425
65	344.095	0.130	91	0.70	12.10	400
70	345.573	0.130	91	0.54	11.60	400
75	347.050	0.140	93	0.48	11.60	375
80	348.637	0.140	94	0.43	11.60	375
85	350.231	0.140	95	0.45	12.10	375
90	351.829	0.160	95	0.42	10.10	350
95	353.542	0.160	96	0.36	8.50	350
100	355.261	0.140	96	0.79	6.70	375
105	356.866	0.140	97	1.02	6.50	375
110	358.477	0.140	97	1.03	6.50	375
115	360.087	0.160	97	0.99	6.60	350
120	361.812	0.160	97	1.05	6.60	350
125	363.543	0.160	97	1.21	6.00	350
130	365.273	0.160	97	1.24	5.90	350
135	367.004	0.160	97	1.29	5.90	350
140	368.734	0.160	97	1.28	6.10	350
145	370.465	0.160	97	1.35	6.20	350
150	372.195	0.160	97	1.33	6.20	350
155	373.926	0.160	97	1.41	5.90	350
160	375.656	0.160	97	1.48	5.80	350
165	377.387	0.160	97	1.39	5.80	350
170	379.117	0.160	97	1.30	5.80	350
175	380.848	0.160	97	1.29	5.90	350
180	382.578	0.160	97	1.27	6.00	350
185	384.309	0.160	97	1.33	5.80	350
190	386.039	0.160	97	1.34	5.70	350
195	387.770	0.160	97	1.40	5.70	350
200	389.500	0.160	97	1.42	5.60	350
205	391.231	0.160	97	1.39	5.60	350
210	392.961	0.160	97	1.50	5.50	350
215	394.692	0.160	97	1.61	5.20	350

TABLE 2---RAW DATA

CLIENT : Jotul TEST No. 1

MODEL: F600 DATE: 29-Apr-03

****

METER CAL. FACTOR (Y)	0.99		Wt. WOOD BURNED(LB)	17.9	Lbs
BAROMETRIC PRESS.(Pb)	29.85 in Hg		WET,FUEL MOISTURE %	17.789	%
LEAK RATE POST (Lp)	0.004 cfm		Wt. PART. COLLECTED	0.2972	g
WATER VOL. (V1c)	119.5 Ml		METER VOLUME Vm	70.692	mcf
TEST TIME (MIN)	215 min		HC MOLE FRACTION	0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT :Jotul TEST No. 1

MODEL: F600 DATE: 29-Apr-03

****

AVG DELTA H	------- 0.15 in H2O		AVG PRCNT CO	-------	1.02 %
AVG METER TEMP. Tm	------- 94 deg F		AVG PRCNT CO2	-------	8.32 %
AVG PPM SO2	------- 365 PPM		AVG BAL CO2/CO	-------	8.14 %

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul TEST No. 1

MODEL: F600 DATE: 29-Apr-03

****

STD SAMPLE VOL. Vm(std) -----	66.64	dscf	STACK GAS FLOW Qsd -------	629.550	dscf/Hr & 10.49 dscf/min
VOL. WATER VAPOR Vw(std) ----	5.625	scf	PARTICULATE CONCTRT. Cs ------	0.0045	g/dscf
PRCNT MSTR Bws -------	7.78	%	PARTC.EMISS. RATE E -------	2.81	g/Hr
BURN RATE BR -------	1.86	Kg/Hr	MOLES OF GAS PER Lb WOOD Nt --	0.40	Lb-mole/Lb
CO EMISSION RATE -------	215.33 g/Hr & 115.58	g/Kgdry fuel	PART.EMISS. RATE ------	1.51	g/Kgdry fuel

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Jotul

TEST No. : 1

MODEL: F600

DATE: 29-Apr-03

TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR		PROPRTN RATE VAR. AVERAGE	
5	537.1	96		100	
10	553.2	98			
15	554.3	99			
20	551.3	98			
25	551.3	98			
30	551.3	98			
35	549.3	98			
40	553.8	99			
45	558.4	99			
50	557.4	99			
55	556.3	99			
60	556.3	99			
65	557.2	99			
70	559.8	100			
75	558.4	99			
80	561.0	100			
85	562.5	100			
90	563.4	100			
95	563.2	100			
100	564.6	100			
105	564.3	100			
110	565.9	101			
115	565.6	101			
120	565.6	101			
125	567.6	101			
130	567.2	101			
135	567.6	101			
140	567.2	101			
145	567.6	101			
150	567.2	101			
155	567.6	101			
160	567.2	101			
165	567.6	101			
170	567.2	101			
175	567.6	101			
180	567.2	101			
185	567.6	101			
190	567.2	101			
195	567.6	101			
200	567.2	101			
205	567.6	101			
210	567.2	101			
215	567.6	101			
220					

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METER BOX DATA SHEET PAGE # 2

Page: 1 of 2

UNIT: F600 RUN: 1 DATE: 4-29-03

Meter Box: 5H Y Factor: 1.996

Leak checks: 16, " Hg @ .008 cfm _____ " Hg @ _____ cfm

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

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

ROTO: PRESS: .16			SAMPLING RATIO: 30 : 1				BP: 29.90		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1230	324.000	—	9.073	.15	88	375	88	1.0
5	35	325.500	—	13.684	.34	85	250	85	3.0
10	40	327.810	327.810	9.774	.17	85	350	85	1.0
15	45	329.461	329.461	9.156	.15	83	375	83	1.0
20	50	330.991	330.991	9.810	.17	83	350	83	1.0
25	55	332.630	332.630	9.810	.17	83	350	83	1.0
30	1300	334.269	334.269	9.156	.15	83	375	83	1.0
35	05	335.799	335.799	8.020	.12	87	425	87	1.0
40	10	337.169	337.169	7.976	.11	90	425	90	1.0
45	15	338.554	338.554	7.976	.11	90	425	90	1.0
50	20	339.939	339.939	7.947	.11	92	425	92	1.0
55	25	341.324	341.324	7.947	.11	92	425	92	1.0
ROTO PRESS: .16			TOTALS:	110.329	1.86	1041	BP.: 29.89		
60	1330	342.709	342.709	7.945	.11	92	425	92	1.0
65	35	344.095	344.095	8.456	.13	91	400	91	1.0
70	40	345.573	345.573	8.456	.13	91	400	91	1.0
75	45	347.050	347.050	8.988	.14	93	375	93	1.0
80	50	348.637	348.637	8.971	.14	94	375	94	1.0
85	55	350.231	350.231	8.955	.14	95	375	95	1.0
90	1400	351.829	351.829	9.595	.16	95	350	95	1.0
95	05	353.542	353.542	9.578	.16	96	350	96	1.0
100	10	355.261	355.261	8.939	.14	96	375	96	1.0
105	15	356.866	356.866	8.923	.14	97	375	97	1.0
110	20	358.477	358.477	8.923	.14	97	375	97	1.0
115	25	360.087	360.087	9.560	.16	97	350	97	1.0
			TOTALS:	107.289	1.69	1134	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	217.618	3.55	2175	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 2 of 2

UNIT: F600 RUN: 1 DATE: 4-29-03

Meter Box: SH Y Factor: .990

Leak checks: 16 " Hg @ .008 cfm _____ " Hg @ _____ cfm

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

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

ROTO: PRESS: .16			SAMPLING RATIO: 30 : 1				BP: 29.86		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1430	361.812	361.812	9.532	.16	97	350	97	1.0
125	35	363.543	363.543	9.532	.16	97	350	97	1.0
130	40	365.273	365.273	9.532	.16	97	350	97	1.0
135	45	367.004	367.004	9.532	.16	97	350	97	1.0
140	50	368.734	368.734	9.532	.16	97	350	97	1.0
145	55	370.465	370.465	9.532	.16	97	350	97	1.0
150	1500	372.195	372.195	9.532	.16	97	350	97	1.0
155	05	373.926	373.926	9.532	.16	97	350	97	1.0
160	10	375.656	375.656	9.532	.16	97	350	97	1.0
165	15	377.387	377.387	9.532	.16	97	350	97	1.0
170	20	379.117	379.117	9.532	.16	97	350	97	1.0
175	25	380.848	380.848	9.532	.16	97	350	97	1.0
ROTO PRESS: .16			TOTALS:	114.384	1.92	1164	BP.: 29.80		
180	1530	382.578	382.578	9.532	.16	97	350	97	1.0
185	35	384.309	384.309	9.532	.16	97	350	97	1.0
190	40	386.039	386.039	9.532	.16	97	350	97	1.0
195	45	387.770	387.770	9.532	.16	97	350	97	1.0
200	50	389.500	389.500	9.532	.16	97	350	97	1.0
205	55	391.231	391.231	9.532	.16	97	350	97	1.0
210	1600	392.961	392.961	9.532	.16	97	350	97	1.0
215	05	394.692	394.692	9.532	.16	97	350	97	1.0
220	10			76.256	1.28	776			
225	15								
230						4115			
235				408.758	6.75		.44		
			TOTALS:			94	MAX VACC =		3.0
TOTAL Cu Ft.		70.692	TOTALS:	9.279	.153	554	AVG. BP: 29.85		

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : F600 RUN : 1 DATE : 4-29-03

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

SCALE	WEIGHT
295.0 g	295.0
590.0 g	590.0
885.0 g	885.0

IMPINGER	#1	#2	#3	#4
FINAL WT	715.9	579.0	485.8	857.8
INITIAL WT	615.3	573.1	483.6	847.0
NET WT GRAMS	100.6 ✓	5.9 ✓	2.2 ✓	10.8 ✓

TOTAL CATCH : 119.5 ✓ GRAMS H_2O

FRONT HALF

FILTER #	148F	
FINAL WT g	.7781	✓
INITIAL WT g	.6960	✓
NET WT g	.0821	✓

BEAKER #	1
DESC.	ACETONE
FINAL WT g	104.9557 ✓
INITIAL WT g	104.9174 ✓
NET WT g	.0383 ✓
VOL. DESC. ml	130 ✓

BACK HALF

FILTER #	148B	
FINAL WT g	.4603	✓
INITIAL WT g	.4400	✓
NET WT g	.0203	✓

BEAKER #	2	3	4	5	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	106.3414 ✓	107.8011 ✓	108.7999 ✓	97.4616 ✓	
INITIAL WT g	106.2538 ✓	107.7777 ✓	108.7740 ✓	97.4366 ✓	
NET WT g	.0876 ✓	.0234 ✓	.0259 ✓	.0250 ✓	.0509 ✓
VOL. DESC ml	140 ✓	75	150 ✓	150 ✓	(300) ✓

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 01/17/03 Time : 2055 By : [signature]

Manufacturer S & S Grade : # 25 Glass Front Size : 11 cm Lot No. : ZB921

Back Size: 8.2 cm Lot No. : ZB911

	DATE: 01/20/03	BY: [signature]	DATE: 01/21/03	BY: [signature]	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
141F	.6987	2108	.6986	0937	HEARTHSTONE MORGAN	R-6
142F	.6899	2109	.6900	0938	" "	R-7
143F	.6957	2110	.6958	0938	NEW BUCK	R-1
144F	.6992	2110	.6995	0940	" "	R-2
145F	.6984	2111	.6985	0941	" "	R-3
146F	.6949	2112	.6950	0942	" "	R-4
147F	.6947	2113	.6946	0943	" "	R-5
148F	.6958	2113	.6960	0943	JOTUL F600	R-1
149F	.6938	2114	.6939	0944	" "	R-3
150F	.6941	2115	.6943	0945	" "	R-4
141B	.4321	2116	.4322	0946	HEARTHSTONE MORGAN	R-6
142B	.4291	2117	.4293	0947	" "	R-7
143B	.4287	2118	.4288	0947	NEW BUCK	R-1
144B	.4313	2118	.4312	0948	" "	R-2
145B	.4302	2119	.4303	0949	" "	R-3
146B	.4232	2120	.4234	0950	" "	R-4
147B	.4275	2121	.4275	0950	" "	R-5
148B	.4400	2121	.4400	0951	JOTUL F600	R-1
149B	.4287	2122	.4288	0952	" "	R-3
150B	.4297	2123	.4299	0953	" "	R-4

Checked by: [signature] Date: 1-21-03 Time: 1010

SCALE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	DB	% RH
01/20	2105	[signature]	76	44
01/21	0935	[signature]	75	44

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 08-19-2002 Time : 1205 By : [signature]

	DATE: 08-22	BY: [signature]	DATE:	BY: [signature]	DATE:	BY:
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
1	104.9172	1043	104.9174	0704		
2	106.2542	1044	106.2538	0705	JOTUL FL600 R-1	
3	107.7782	1046	107.7777	0706		
4	108.7744	1047	108.7740	0708		
5	97.4370	1048	97.4366	0709		
6	91.2080	1050	91.2076	0710		
7	97.1385	1051	97.1382	0711	JOTUL FL600 R-3	
8	108.6356	1052	108.6357	0713		
9	108.0961	1053	108.0960	0714		
10	105.7310	1055	105.7306	0715		
11	104.7892	1056	104.7887	0717		
12	98.2303	1057	98.2304	0718	JOTUL FL600 R-4	
13	104.1788	1059	104.1784	0719		
14	97.9822	1100	97.9819	0721		
15	104.7644	1101	104.7642	0722		
16	95.7427	1102	95.7429	0723		
17	104.5948	1104	104.5944	0724	JOTUL FL600 R-5	
18	108.8626	1105	108.8623	0725		
19	106.5473	1106	106.5468	0726		
20	108.5936	1108	108.5932	0728		

SCALE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	DB	% RH
08-22	1040	[signature]	78	49
08-23	0700	[signature]	78	49

Checked by : Chp Weatherly

Date : 8-23-02

Time : 0910

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : F600 RUN : 1 DATE : 4-29-03 Page : 1 of 1

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
1	04/30	2145		104.9553	05/06	2138		104.9557	05/09	0717					
2	04/30	2145		106.3400	05/06	2139		106.3412	05/09	0718		106.3414	05/10	1438	
3	04/30	2145		107.8004	05/06	2141		107.8012	05/09	0719		107.8011	05/10	1439	
4	04/30	2145		108.8005	05/06	2142		108.7997	05/09	0720		108.7999	05/10	1440	
5	04/30	2145		97.4632	05/06	2143		97.4621	05/09	0722		97.4612	05/10	1441	
				97.4616	05/11	1213									

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
148F	4-29	1635		.7799	04/30	2303		.7785	05/02	1132		.7781	05/06	2144	
148B	4-29	1635		.4628	04/30	2304		.4608	05/02	1133		.4602	05/06	2145	
				.4603	05/09	0723									

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	04/30	2300		75	47
2	05/02	1130		77	49
3	05/06	2135		77	46
4	05/09	0715		77	45
5	05/10	1435		78	47

Weighing Session	Date	Time	By	DB	%RH
6	05/11	1210		77	46
7					
8					
9					
10					

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 05-18-2002 Through 10-27-2002	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9999	10.0000	.9999	.0999	AF	05-18	1905	77	49
99.9997	9.9998	.9999	.0998	AF	05-19	1500	77	48
99.9999	10.0000	.9998	.0999	AKW	05-20	0855	77	47
99.9998	9.9998	1.0000	.0999	AKW	05-21	0930	78	49
99.9998	9.9999	1.0000	.1000	AKW	05-22	1155	78	48
99.9999	9.9999	1.0000	.1001	AKW	05-22	1920	78	49
99.9999	10.0001	1.0001	.0998	AKW	05-23	2105	77	48
99.9998	9.9998	.9998	.0999	AKW	05-28	1225	78	49
99.9998	9.9997	1.0001	.0999	AKW	05-28	1625	78	47
99.9997	10.0001	1.0002	.1000	AKW	06-27	1950	78	49
99.9998	10.0001	1.0002	.1001	AKW	06-29	1830	78	49
99.9997	9.9999	1.0000	.0998	AKW	07-01	0845	77	49
100.0000	9.9999	1.0002	.1000	AKW	07-01	2220	78	47
99.9998	10.0000	.9999	.0999	AKW	08-14	1130	78	49
100.0001	9.9999	1.0000	.1000	AKW	08-16	1045	78	49
100.0000	9.9998	1.0000	.0998	AKW	08-22	1040	78	49
99.9997	9.9999	.9999	.0997	AKW	08-23	0700	78	49
99.9998	10.0000	1.0000	.0998	AKW	08-29	0915	78	49
100.0000	10.0000	1.0002	.1001	AKW	08-29	2225	78	49
99.9998	9.9999	1.0001	.0998	AKW	09-03	1120	78	49
99.9997	9.9998	.9999	.0998	AKW	09-03	2230	78	49
100.0000	10.0001	.9999	.0999	AKW	09-05	1915	78	49
99.9999	9.9999	1.0000	.0999	AKW	09-06	1815	78	48
99.9997	9.9999	1.0000	.0998	AKW	09-07	1355	78	47
100.0000	10.0002	.9998	.0997	CP	9-10	1110	77	42
99.9997	10.0002	1.0000	.0100	CP	9-11	1500	74	47
99.9999	9.9999	1.0000	.0997	CP	9-13	2020	76	38
100.0003	10.0002	1.0002	.0998	CP	9-14	1300	76	41
100.0000	10.0001	1.0000	.0999	CP	9-16	1930	74	44
100.0000	9.9999	.9998	.0999	CP	9-17	1710	77	42
100.0000	10.0001	1.0000	.1000	CP	9-19	1000	74	47
100.0001	10.0000	.9998	.0999	CP	9-20	1115	74	44
99.9998	9.9999	1.0001	.0999	AKW	10-18	2155	77	44
99.9997	9.9999	1.0000	.1000	AKW	10-22	2255	77	46
100.0001	10.0002	1.0000	.0999	AKW	10-23	2315	77	42
99.9997	9.9998	.9999	.1000	AKW	10-25	1350	77	43
99.9998	9.9999	1.0000	.1000	AKW	10-26	1735	77	41
99.9998	9.9998	.9999	.1000	AKW	10-27	1130	77	36
99.9998	9.9999	.9999	.0999	AKW	10-27	1435	77	38

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 12-05-2002 Through 02-23-2003	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	9.9998	1.0000	.0997		12-05	1825	77	47
99.9998	10.0000	.9999	.1000		12-06	1125	77	45
99.9997	10.0001	1.0000	.1000		12-07	1310	76	41
99.9997	10.0001	1.0000	.0999		12-08	1430	77	44
99.9998	9.9999	1.0001	.0999		12-09	1125	78	44
99.9998	10.0000	.9999	.0998		12-10	1220	78	43
99.9997	10.0000	.9998	.0998		12-11	1650	77	45
99.9997	10.0001	.9999	.0999		12-12	1445	77	47
99.9998	10.0000	.9999	.1000		12-14	1530	78	47
99.9997	10.0000	1.0000	.0999		01-10	2300	78	48
99.9998	9.9999	1.0001	.1000		01-14	1115	77	48
99.9999	10.0000	.9999	.1000		01-15	1705	77	48
99.9999	10.0001	.9999	.0998		01-16	1830	78	46
99.9997	10.0000	1.0000	.0999		01-17	1215	77	41
99.9997	9.9999	1.0000	.0999		01-17	2035	76	42
99.9996	10.0000	.9999	.0999		01-18	1730	77	43
99.9999	9.9999	.9998	.0999		01-19	1210	76	42
99.9998	10.0000	1.0000	.0999		01-20	2105	76	44
99.9999	10.0000	.9999	.0998		01-21	0935	75	44
99.9998	10.0000	.9999	.0999		01-22	1125	77	46
100.0000	9.9998	.9999	.1000		01-23	1430	77	48
99.9999	10.0001	1.0001	.1000		01-24	1200	76	48
99.9998	9.9999	.9999	.0999		01-25	1140	76	47
99.9997	10.0000	1.0000	.0999		01-25	1850	78	48
99.9998	9.9998	1.0000	.1000		01-27	1415	75	47
99.9999	9.9999	1.0000	.1000		01-30	1920	77	48
99.9998	10.0000	.9998	.0999		01-31	2205	78	47
99.9999	9.9998	.9998	.1000		02-01	1855	77	47
99.9997	9.9998	.9999	.1001		02-02	1420	76	46
99.9997	10.0001	.9998	.0999		02-18	1155	77	49
99.9999	9.9999	.9999	.0999		02-19	1925	77	48
99.9997	10.0000	1.0000	.0999		02-22	2010	78	45
99.9997	10.0000	.9999	.1000		02-23	1130	78	44

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 02-24-2003 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
99.9998	10.000	1.0000	.0999	[illegible]	02-24	1055	74	44
99.9997	9.9998	1.0001	.0999	[illegible]	02-25	1700	77	45
100.0000	10.0001	1.0000	.0998	[illegible]	03-01	1010	71	44
99.9997	10.0001	.9998	.0999	[illegible]	03-02	1420	75	45
99.9998	10.0000	.9999	.1000	[illegible]	03-03	1205	76	45
99.9998	10.0000	1.0000	.1000	[illegible]	03-03	2005	77	47
100.0000	10.0001	1.0001	.0999	[illegible]	03-04	1035	75	47
99.9996	10.0001	1.0000	.0999	[illegible]	03-05	0945	71	47
99.9997	10.0001	1.0000	.1000	[illegible]	03-06	1340	74	46
99.9998	9.9999	1.0000	.0998	[illegible]	03-07	2050	76	45
99.9998	9.9999	1.0000	.0999	[illegible]	03-08	1150	77	45
99.9997	9.9998	1.0000	.1000	[illegible]	03-09	1350	76	45
99.9998	10.0000	.9999	.1000	[illegible]	03-10	1220	77	47
99.9997	9.9999	1.0000	.1000	[illegible]	03-18	1740	77	46
99.9997	9.9999	1.0000	.0999	[illegible]	03-20	2145	74	45
99.9998	10.0000	1.0000	.0998	[illegible]	03-22	1725	76	47
99.9997	10.0000	.9999	.1000	[illegible]	03-23	1405	77	47
99.9998	9.9998	.9999	.0999	[illegible]	03-24	1450	74	44
100.0000	9.9998	1.0000	.0998	[illegible]	03-25	1120	75	45
99.9998	10.0000	.9999	.0999	[illegible]	04-30	2300	75	47
99.9997	10.0001	.9999	.1000	[illegible]	05-02	1130	77	49
99.9998	9.9998	1.0000	.0999	[illegible]	05-06	2135	77	46
99.9997	9.9999	1.0001	.0999	[illegible]	05-09	0715	77	45
99.9998	10.0000	.9999	.0999	[illegible]	05-10	1435	78	47
99.9998	9.9999	1.0000	.0998	[illegible]	05-11	1210	77	46
99.9996	10.0001	.9999	.0999	[illegible]	05-12	0940	76	45

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 05-18-2002 Through 10-27-2002	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9999	10.0000	.9999	.0999	AK	05-18	1905	77	49
99.9997	9.9998	.9999	.0998	AK	05-19	1500	77	48
99.9999	10.0000	.9998	.0999	AKW	05-20	0855	77	47
99.9998	9.9998	1.0000	.0999	AKW	05-21	0930	78	49
99.9998	9.9999	1.0000	.1000	AK	05-22	1155	78	48
99.9999	9.9999	1.0000	.1001	AKW	05-22	1920	78	49
99.9999	10.0001	1.0001	.0998	AKW	05-23	2105	77	48
99.9998	9.9998	.9998	.0999	AK	05-28	1225	78	49
99.9998	9.9997	1.0001	.0999	AKW	05-28	1625	78	47
99.9997	10.0001	1.0002	.1000	AKW	06-27	1950	78	49
99.9998	10.0001	1.0002	.1001	AKW	06-29	1830	78	49
99.9997	9.9999	1.0000	.0998	AK	07-01	0845	77	49
100.0000	9.9999	1.0002	.1000	AK	07-01	2220	78	47
99.9998	10.0000	.9999	.0999	AK	08-14	1130	78	49
100.0001	9.9999	1.0000	.1000	AK	08-16	1045	78	49
100.0000	9.9998	1.0000	.0998	AKW	08-22	1040	78	49
99.9997	9.9999	.9999	.0997	AKW	08-23	0700	78	49
99.9998	10.0000	1.0000	.0998	AKW	08-29	0915	78	49
100.0000	10.0000	1.0002	.1001	AK	08-29	2225	78	49
99.9998	9.9999	1.0001	.0998	AK	09-03	1120	78	49
99.9997	9.9998	.9999	.0998	AK	09-03	2230	78	49
100.0000	10.0001	.9999	.0999	AK	09-05	1915	78	49
99.9999	9.9999	1.0000	.0999	AK	09-06	1815	78	48
99.9997	9.9999	1.0000	.0998	AK	09-07	1355	78	47
100.0000	10.0002	.9998	.0997	CLP	9-10	1110	77	42
99.9997	10.0002	1.0000	.0100	CLP	9-11	1500	74	47
99.9999	9.9999	1.0000	.0997	CLP	9-13	2020	76	38
100.0003	10.0002	1.0002	.0998	CLP	9-14	1300	76	41
100.0000	10.0001	1.0000	.0999	CLP	9-16	1930	74	44
100.0000	9.9999	.9998	.0999	CLP	9-17	1710	77	42
100.0000	10.0001	1.0000	.1000	CLP	9-19	1000	74	47
100.0001	10.0000	.9998	.0999	CLP	9-20	1115	74	44
99.9998	9.9999	1.0001	.0999	AK	10-18	2155	77	44
99.9997	9.9999	1.0000	.1000	AK	10-22	2255	77	46
100.0001	10.0002	1.0000	.0999	AKW	10-23	2315	77	42
99.9997	9.9998	.9999	.1000	AKW	10-25	1350	77	43
99.9998	9.9999	1.0000	.1000	AK	10-26	1735	77	41
99.9998	9.9998	.9999	.1000	AK	10-27	1130	77	36
99.9998	9.9999	.9999	.0999	AK	10-27	1435	77	38

BLANK PROCESSING DATA SHEET # 5

UNIT : F600 RUN : 1 DATE : 04/29/03

DATE BLANKS DONE : 02-23-03

BEAKER	A	B	C
	200 ml ACETONE	75 ml DICHLOR	200 ml WATER
	FISHER OPTIMA LOT # 011755	FISHER OPTIMA LOT # 994669	DWNA, INC. SPARKLETTES DISTILLED
FINAL WEIGHT	108.9007	106.3074	106.9660
TARE WEIGHT	108.8995	106.3057	106.9646
NET WEIGHT	.0012 ✓	.0017 ✓	.0014 ✓

TARE BEAKERS INTO DESC : TIME : 1430 DATE : 02-12-03

DATE : 02-18 BY : [illegible] DATE : 02-19 BY : [illegible] DATE : BY :

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.8996	1158	108.8995	1928	✓	
B	106.3060	1159	106.3057	1930	✓	
C	106.9649	1200	106.9646	1931	✓	

FINAL BEAKERS INTO DESC : TIME : 1600 DATE : 02-20-03

DATE : 02-22 BY : [illegible] DATE : 02-23 BY : [illegible] DATE : BY :

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9010	2013	108.9007	1132	✓	
B	106.3078	2015	106.3074	1133	✓	
C	106.9661	2016	106.9660	1134	✓	

TARE QC

DATE	TIME	BY	WB	DB	%
02-18	1155	[illegible]		77	49
02-19	1925	[illegible]		77	48

FINAL QC

DATE	TIME	BY	WB	DB	%
02-22	2010	[illegible]		78	45
02-23	1130	[illegible]		78	44

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT : F600 RUN : 1 DATE : 04/29/03

BLANK CALCULATIONS

Acetone : .0012 g ÷ 200 ml = .0000006 g/ml
Dicholoromethane : .0017 g ÷ 75 ml = .000023 g/ml
Distilled Water : .0014 g ÷ 200 ml = .000007 g/ml

FRONT HALF CATCH

FILTERS : .0821 g (Total Catch) - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0821 g

BEAKERS : .0383 g (Total Catch) - 130 (ml Acetone) (.000006 g) (Blank Value / ml Acetone) = .0375 g

TOTAL FRONT HALF CATCH : .1196 g

BACK HALF CATCH

FILTERS : .0203 g (Total Catch) - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0203 g

BEAKERS :

Acetone : .0876 g (Total Catch) - 140 (ml Acetone) (.000006 g) (Blank Value / ml Acetone) = .0868 g

Extract : .0234 g (Total Catch) - 75 (ml Dichloromethane) (.0017 .000023 g) (Blank Value / Dichloromethane) = .0217 g

Water : .0509 g (Total Catch) - 300 (ml Water) (.000007 g) (Blank Value / Water) = .0488 g

TOTAL BACK HALF CATCH : .1776 g

TOTAL CATCH : .2972 g

% FRONT HALF : 40.2 % (00.0)

CALCULATIONS DATA SHEET # 7

UNIT : JOTUL F600 RUN : 1 DATE : 04/28/05

1) $Vm(std) = \dfrac{(70.692\ Vm)(17.64)(.990\ mcf)\left(29.85"\ Hg + \frac{.153"\ H_2O}{13.6}\right)}{(554\ TmA)} = \dfrac{66.5430}{000.0000}$ dscf

2) $Vw(std) = (.04707)(119.5\ ml\ H_2O) = \dfrac{5.6249}{00.0000}$ scf

3) $Asw = \dfrac{(5.6249\ scf)}{(5.6249\ scf + 66.5430\ dscf)} = \dfrac{.0779}{.0000}$ Bws × 100 = $\dfrac{7.7941}{00.0000}$ % H_2O

4) $Cs = \dfrac{(.2972\ g.)}{(66.5430\ dscf)}(15.43) = \dfrac{.0689}{0.0000}$ gr / dscf

5) Estimated g / hr = $\dfrac{(.2972\ g.)}{(66.5430\ dscf)}\left(\dfrac{9.279}{00.0000}\ dscfm\right)(60) = \dfrac{2.4866}{00.0000}$ 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 : F600 RUN : 1 DATE : 4-29-03

Test Chamber Air Velocity Start : 0 Stop : 0 Avg.: 0

Wet Bulb / Dry Bulb

Pre : WB : 62 DB : 78 = 39 % RH 1.3 % H_2O

Post : WB : 69 DB : 81 = 54 % RH 1.9 % H_2O

Average : 46.5 % RH 1.6 % H_2O

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

Kindling Weight (lbs) : Paper : .2 Wood : 4.7

Preburn Fuel Weight : 20.0 + 14.8 + 16.5 Total : 51.3

Kindling & Preburn Fuel Weight (wood only) (lbs) : **Total** : 56.0

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

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

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

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

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

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" × 4"	17	4	8.4	46.9
4" × 4"	17	2	9.5	53.1

Test Fuel Weight : 17.9 lbs

Estimated Dry Burn Rate :

$$\frac{17.9 - (17.9 \times .17789)}{2.2046} \times \frac{60}{\underset{\text{TIME}}{215}} = 1.863 \text{ kg / hr}$$

Estimated BTU's/hr : $19{,}140 \times \frac{63}{100} \times \frac{1.863}{\text{DBR}} = 22{,}462.0$ BTU's/hr

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

1 - 17

WOOD STOVE OPERATING DATA PAGE #9

Unit : F600 Run : 1 Date : 4-29-03

FIRE STARTED: 0815

WARM UP AND PREBURN:

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

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

CHARCOAL BED PREPARATION :

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

TEST:

DOOR wide open during loading 0 min. 30 sec.

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

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

FAN:

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

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

Fan speed set at High

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

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

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

All Grades WCLB rules:

WARM UP INFORMATION:

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

1st warm up / pre-burn fuel charge (20.0 lbs.) added at 0835

2nd warm up / pre-burn fuel charge (14.8 lbs.) added at 0945

3rd warm up / pre-burn fuel charge (16.5 lbs.) added at 1050

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 : F600 Run : 1 Date : 4-29-03

Room Temperature : 72 °F Correction Factor : Ø

Uncorrected Values are corrected for room temperature : Yes _____ No ✓

Time Test Fuel moisture reading taken : 1050

Calibration Checks : X ✓ Y ✓ 12.0 12.1 22.0 22.1

pc #	Dimen.	Use	TOP		BOTTOM		SIDE		Average Corrected
			Uncor.	Cor.	Uncor.	Cor.	Uncor.	Cor.	
1	2"×4"×8'	K	19.5	20.9	18.0	19.2	18.0	19.2	19.767
2									
3									
4	2"×4"×8'	P	20.0	21.4	20.5	22.0	20.0	21.4	21.600
5	2"×4"×8'	P	21.5	23.1	21.5	23.1	21.5	23.1	23.100
6	2"×4"×8'	P	18.0	19.2	18.5	19.8	18.0	19.2	19.400
7	2"×4"×8'	P	20.0	21.4	19.5	20.9	18.0	19.2	20.500
8	2"×4"×8'	P	19.5	20.9	19.0	20.3	19.0	20.3	20.500
9									105.100
10									
11	2×4×17"	T	19.5	20.9	19.5	20.9	19.5	20.9	20.900
12	"	T	19.5	20.9	20.0	21.4	20.0	21.4	21.233
13	"	T	20.0	21.4	20.0	21.4	20.0	21.4	21.400
14	"	T	21.5	23.1	23.0	24.7	23.0	24.7	24.167
15	4×4×17"	T	19.5	20.9	19.5	20.9	20.0	21.4	21.067
16	"	T	20.0	21.4	19.5	20.9	19.5	20.9	21.067
17									129.834
18									
19									
20	Spacers	T	18.0	19.2	18.0	19.2	18.0	19.2	19.200

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	19.767 %	21.020 %	21.639 %
Wet Moisture % :	16.504 %	17.369 %	17.789 %

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

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

GAS DATA SHEET #12

WEIGHT: 4.2 DATE: 04/29/03

UNIT: F600 RUN: 1 PAGE: 1 OF 2

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
0 1230	22.1	17.9	–	.085	2.1	.724	18.1	.059	.60	-.034	375
5 35	21.2	17.0	.9	.453	11.3	.356	8.9	.060	.61	-.043	250
10 40	20.6	16.4	.6	.322	8.0	.487	12.2	.059	.60	-.044	350
15 45	19.8	15.6	.8	.328	8.2	.475	11.9	.075	.76	-.045	375
20 50	18.8	14.6	1.0	.462	11.5	.345	8.6	.065	.66	-.048	350
25 55	17.9	13.7	.9	.512	12.8	.293	7.3	.068	.69	-.050	350
30 1300	16.7	12.5	1.2	.533	13.3	.263	6.6	.090	.91	-.051	375
35 05	15.6	11.4	1.1	.548	13.7	.238	6.0	.116	1.17	-.050	425
40 10	14.6	10.4	1.0	.512	12.8	.278	7.0	.107	1.08	-.050	425
45 15	13.7	9.5	.9	.507	12.6	.287	7.2	.097	.98	-.051	425
50 20	12.7	8.5	1.0	.514	12.8	.281	7.0	.094	.95	-.050	425
55 25	11.9	7.7	.8	.516	12.9	.281	7.0	.089	.90	-.051	425
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.567	*****
60 1330	11.1	6.9	.8	.519	12.9	.276	6.9	.093	.94	-.051	425
65 35	10.3	6.1	.8	.484	12.1	.321	8.0	.089	.90	-.050	400
70 40	9.7	5.5	.6	.466	11.6	.345	8.6	.053	.54	-.049	400
75 45	9.1	4.9	.6	.466	11.6	.348	8.7	.047	.48	-.048	375
80 50	8.5	4.3	.6	.465	11.6	.351	8.8	.042	.43	-.047	375
85 55	7.9	3.7	.6	.487	12.1	.328	8.2	.044	.45	-.047	375
90 1400	7.4	3.2	.5	.406	10.1	.410	10.3	.041	.42	-.046	350
95 05	7.1	2.9	.3	.340	8.5	.479	12.0	.035	.36	-.045	350
100 10	6.9	2.7	.2	.269	6.7	.532	13.3	.078	.79	-.044	375
105 15	6.8	2.6	.1	.261	6.5	.531	13.3	.101	1.02	-.041	375
110 20	6.6	2.4	.2	.263	6.5	.529	13.2	.102	1.03	-.040	375
115 25	6.5	2.3	.1	.266	6.6	.527	13.2	.098	.99	-.038	350
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.546	*****
120 1430	6.4	2.2	.1	.267	6.6	.524	13.1	.104	1.05	-.037	350
125 35	6.2	2.0	.2	.242	6.0	.543	13.6	.120	1.21	-.037	350
130 40	6.1	1.9	.1	.239	5.9	.545	13.6	.123	1.24	-.036	350
135 45	6.0	1.8	.1	.239	5.9	.543	13.6	.128	1.29	-.035	350
140 50	5.8	1.6	.2	.247	6.1	.535	13.4	.127	1.28	-.035	350
145 55	5.7	1.5	.1	.250	6.2	.529	13.2	.134	1.35	-.035	350
150 1500	5.6	1.4	.1	.249	6.2	.531	13.3	.132	1.33	-.034	350
155 05	5.5	1.3	.1	.236	5.9	.541	13.5	.140	1.41	-.034	350
160 10	5.4	1.2	.1	.234	5.8	.540	13.5	.147	1.48	-.034	350
165 15	5.2	1.0	.2	.234	5.8	.544	13.6	.138	1.39	-.034	350
170 20	5.1	.9	.1	.235	5.8	.546	13.7	.129	1.30	-.033	350
175 25	5.0	.8	.1	.238	5.9	.544	13.6	.128	1.29	-.032	350
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.416	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-1.529	*****

GAS DATA SHEET #12

WEIGHT: 4.2 DATE: 04/29/03

UNIT: F600 RUN: 1 PAGE: 2 OF 2

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
180 1530	4.9	.7	.1	.240	6.0	.542	13.6	.126	1.27	-.031	350
185 35	4.8	.6	.1	.234	5.8	.546	13.6	.132	1.33	-.031	350
190 40	4.7	.5	.1	.231	5.7	.549	13.7	.133	1.34	-.031	350
195 45	4.6	.4	.1	.230	5.7	.547	13.7	.139	1.40	-.031	350
200 50	4.4	.2	.2	.227	5.6	.549	13.7	.141	1.42	-.031	350
205 55	4.4	.2	0	.225	5.6	.552	13.8	.138	1.39	-.031	350
210 1600	4.3	.1	.1	.221	55	.552	13.8	.149	1.50	-.031	350
215 05	4.2	0	.1	.209	5.2	.560	14.0	.160	1.61	-.031	350
220 10											
225 15											
230 20											
235 25											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.248	*****
240 1630										÷	
245 35											
250 40											
255 45											
260 50											
265 55											
270 1700											
275 05											
280 10											
285 15											
290 20											
295 25											
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****		*****
300 1730											
305 35											
310 40											
315 45											
320 50											
325 55											
330 1800											
335 05											
340 10											
345 15											
350 20											
355 25											÷44
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-1.777	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.040	*****

✓

PREBURN DATA SHEET #1

UNIT: F600 RUN: 1 DATE: 04/29/03 PAGE: 1 of 1

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
0 / 1130	7.7	–	482	563	450	223	485	285	876	1390	77	.052	PREBURN START: # 3.3 UP
5 / 35	7.4	.3	391	536	454	229	489	288	861	1243	74	.049	COAL BED SCALE RANGE:
10 / 40	6.9	.5	335	489	454	236	481	289	843	1191	78	.046	4.4 – 3.6
15 / 45	6.6	.3	315	460	447	237	466	290	832	1204	76	.046	PRIMARY AIR: 1/8"
20 / 50	6.3	.3	298	428	440	238	450	290	822	1182	77	.045	SECONDARY AIR: N/A
25 / 55	6.1	.2	284	404	431	236	436	288	811	1112	77	.043	FAN: HIGH
30 / 1200	5.9	.3	265	384	427	236	425	287	795	1004	77	.041	PUMPS ON AT: 1205
35 / 05	5.8	.1	254	365	417	233	414	286	780	966	77	.040	CHECK WB/DB: N/A
40 / 10	5.6	.2	243	342	407	231	398	284	762	937	77	.038	
45 / 15	5.5	.1	235	327	396	228	385	282	747	913	76	.038	
50 / 20	4.5	.2	247	314	384	226	371	284	715	849	72	.035	took .8 out @ 1215
55 / 25	4.4	.1	228	300	371	222	359	280	702	820	73	.035	
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	
60 / 1230	4.2	.2	232	284	361	220	346	277	678	778	74	.034	

TEMPERATURE DATA SHEET #14

		TEST TIME	215		
STACK AVG	277	TOP AVG	340	LT SIDE AVG	347
BACK AVG	224	RT SIDE AVG	336	BOTTOM AVG	232
FIREBOX AVG	696	SEC/CAT AVG	997	AMBIENT AVG	77

END	250.2	
START	297.5	
	-47.3	DELTA T

CIRCLE: (LOSS) / GAIN

Jotul U.S.A., Inc. TEMERATURE DATA SHEET #14A Run 1 04/29/2003

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
0	232	284	361	220	346	277	678	778	74	1360	245	61	242	37	37
5	376	322	342	293	330	273	555	1268	71	1333	242	54	249	37	37
10	286	334	323	286	312	260	519	1257	70	1314	239	53	248	37	38
15	296	355	308	274	297	253	510	1243	70	1311	237	53	247	36	37
20	327	382	299	265	289	245	518	1238	70	1316	237	53	247	36	37
25	353	417	296	260	285	237	539	1248	70	1321	238	53	248	36	37
30	369	436	301	261	290	231	567	1240	73	1328	241	53	249	36	37
35	380	452	299	189	297	224	597	1253	74	1348	242	54	249	36	37
40	379	456	308	184	306	220	623	1225	75	1378	238	54	249	36	36
45	377	457	317	186	315	213	645	1244	77	1386	238	55	247	36	37
50	376	461	327	189	325	209	672	1265	78	1393	238	56	246	36	37
55	376	467	338	194	335	206	702	1287	76	1388	238	56	247	36	37
60	372	476	350	200	343	202	729	1269	73	1403	235	56	247	38	36
65	366	474	363	208	355	202	754	1273	72	1397	237	57	248	37	38
70	348	455	374	221	367	203	777	1228	78	1382	240	57	247	37	36
75	341	449	388	235	378	202	798	1213	79	1370	242	57	246	38	36
80	335	443	396	247	386	206	813	1202	79	1377	240	57	245	37	36
85	331	439	407	261	394	207	829	1225	80	1375	241	58	244	37	37
90	326	429	415	268	402	210	846	1188	81	1372	243	58	244	37	37
95	308	411	422	266	407	214	846	1123	81	1368	244	58	243	36	37
100	289	389	426	264	409	215	842	1062	81	1365	243	58	242	36	35
105	272	370	425	257	405	221	839	997	82	1357	240	58	242	36	35
110	260	353	417	249	393	225	828	955	81	1346	238	59	241	36	36
115	252	336	411	240	384	228	812	942	81	1338	236	59	240	37	35
120	245	322	404	235	373	228	797	908	81	1332	235	59	240	38	35
125	239	310	393	230	366	234	770	886	81	1328	233	59	239	38	36
130	233	299	382	224	358	236	749	858	80	1323	233	59	238	37	36
135	229	288	373	219	350	236	732	837	80	1319	232	59	237	37	35
140	225	280	360	215	343	237	722	835	81	1318	233	59	238	37	37
145	222	274	350	210	336	239	718	827	80	1317	233	59	238	37	38
150	220	266	345	208	331	239	711	815	80	1320	233	59	239	36	37
155	216	261	338	205	326	239	697	792	80	1326	233	51	241	36	38
160	214	256	332	202	321	240	687	778	79	1329	233	50	241	37	37
165	211	249	325	200	316	240	677	766	79	1329	233	50	242	37	36
170	209	246	321	199	311	240	668	753	78	1329	233	50	242	35	36
175	207	242	316	199	307	241	663	748	79	1327	233	50	242	36	37

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
180	205	237	312	198	304	243	664	743	79	1326	234	50	243	36	37
185	203	235	306	199	302	243	659	739	79	1325	234	50	243	36	35
190	202	231	303	199	299	244	649	737	78	1324	234	51	243	34	35
195	201	228	301	198	298	246	645	739	78	1322	233	51	243	35	36
200	200	226	301	198	296	247	646	725	78	1322	233	51	244	35	36
205	199	224	298	197	295	248	643	722	78	1322	233	51	244	34	34
210	198	222	292	196	293	250	641	715	78	1323	233	52	243	34	34
215	196	220	291	196	292	251	636	701	78	1323	233	52	243	35	35

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 04-29-03 Analyte : CO_2 (15-1)

Unit : F600 Run # : |

Zero Cyl. # : 042JAC 2-A Conc. : 0.00 % CO_2 Cyl. Press. : 900 PSI

Certified by : AIR LIQUIDE Date : 02-20-02

Span Cyl. # : CC-3131 Conc. : 12.40 % CO_2 Cyl. Press. : 1625 PSI

Certified by : AIR LIQUIDE Date : 03-13-03

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 : A. Washington Time : 1125 ✓ Temp : 75 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-.023	-.023	-.091 ✓
SPAN	49.6	.496	12.40	49.6	.496	12.367	-.033	-.133 ✓

POST RUN Audit : by : A. Washington Time : 1625 ✓ Temp : 76 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	-.001	-.048	-.048	-.191 ✓
SPAN	49.6	.496	12.40	49.8	.498	12.417	+.017	+.067 ✓

± 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 : 04-29-03 Analyte : O_2 (15-2)

Unit : F600 Run # : 1

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 % O_2 Cyl. Press. : 900 PSI

Certified by : AIR LIQUIDE Date : 02-20-02

Span Cyl. # : CC-3131 Conc. : 12.40 % O_2 Cyl. Press. : 1625 PSI

Certified by : AIR LIQUIDE Date : 03-13-03

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 : A. Wadlington Time : 1125 Temp : 75 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.000	+.025	+.101
SPAN	12.50	.500	12.50	12.50	.500	12.501	+.001	+.006

POST RUN Audit : by : A. Wadlington Time : 1625 Temp : 76 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.001	.050	+.050	+.201
SPAN	12.50	.500	12.50	12.50	.500	12.501	+.001	+.006

± 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 : 04-29-03 Analyte : CO (15-3)

Unit : F600 Run # : 1

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 % CO Cyl. Press. : 900 PSI

Certified by : AIR LIQUIDE Date : 02-20-OR

Span Cyl. # : CC-3131 Conc. : 12.40 % CO Cyl. Press. : 1625 PSI

Certified by : AIR LIQUIDE Date : 03-13-03

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 : D. Washington Time : 1125 Temp : 75 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %	
	Meter	DVM	%	Meter	DVM	%			
ZERO	00.0	.000	00.0	00.0	.000	.011	+.011	+.110	✓
SPAN	50.2	.502	5.02	50.2	.502	5.030	+.010	+.097	✓

POST RUN Audit : by : D. Washington Time : 1625 Temp : 76 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %	
	Meter	DVM	%	Meter	DVM	%			
ZERO	00.0	.000	00.0	00.0	.000	.011	+.011	+.110	✓
SPAN	50.2	.502	5.02	50.0	.500	5.010	+.010	+.103	✓

± 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 : 04-29-03 Analyte : SO_2 (15-4)

Unit : F600 Run # : 1

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 ppm SO_2 Cyl. Press. : 900 PSI

Certified by : AIR LIQUIDE Date : 02-20-02

Span Cyl. # : CC62184 Conc. : 1290 ppm SO_2 Cyl. Press. : 1025 PSI

Certified by : AIR LIQUIDE Date : 01-29-01

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 : D. Wadington Time : 1115 Temp : 75 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %	
	Meter	DVM	PPM	Meter	DVM	%			
ZERO	00.0	.000	00.0	00.0	.000	6.722	+6.722	+.269	✓
SPAN	51.6	.516	1290	51.6	.516	1290.054	+.054	+002	✓

POST RUN Audit : by : D. Wadington Time : 1625 Temp : 76 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %	
	Meter	DVM	PPM	Meter	DVM	%			
ZERO	00.0	.000	00.0	00.1	.001	9.209	+9.209	+.368	✓
SPAN	51.6	.516	1290	51.5	.515	1287.567	-2.433	-.097	✓

± 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 : F600 RUN : 1 DATE : 4-29-03

Thermocouple Check:

T/C # 1	— °F	T/C # 13	62.0 °F
T/C # 2	— °F	T/C # 14	61.3 °F
T/C # 3	61.5 °F	T/C # 15	62.0 °F
T/C # 4	59.5 °F	T/C # 16	57.6 °F
T/C # 5	58.3 °F	T/C # 17	57.7 °F
T/C # 6	58.4 °F	T/C # 18	62.3 °F
T/C # 7	58.2 °F	T/C # 19	59.9 °F
T/C # 8	58.1 °F	T/C # 20	— °F
T/C # 9	58.4 °F	T/C # 21	— °F
T/C # 10	58.4 °F	T/C # 22	— °F
T/C # 11	57.5 °F	T/C # 23	60.1 °F
T/C # 12	64.4 °F	T/C # 24	— °F

Thermocouple Readout:

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

ZERO 1.2 °F Adj. to 0.0 °F ZERO 1.8 °F Difference .090 % ✓

SPAN 1996.0 °F Adj. to 2000.0 °F SPAN 2003.4 °F Difference .170 % ✓

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 202.0 °F	400	= 399.2 °F
600	= 600.5 °F	800	= 801.6 °F	1000	= 1000.7 °F
1200	= 1198.2 °F	1400	= 1399.2 °F	1600	= 1599.8 °F
1800	= 1800.2 °F	2000	= 2000.0 °F		

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

Scale Check Pre : 8.3 – 18.3 ✓

Post : 4.0 – 14.0 ✓

Stack Cleaned Prior to Test Run : YES X NO _____

COMPUTER INPUT DATA SHEET #1

Client: Jotul USA, Inc.

Address: 400 Riverside St. / P.O. Box 1157
Portland, ME 04104

Phone: 800-797-5912 Fax: 207-797-6072

Run No.: 5 Date of Test: 05-06-03 Burn Rate: 2.696

Model No.: F600 ☐ min ☐ min-1.25 ☐ fan

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

Dry Gas Meter Y Factor: .990 (0.000) (Data Sheet #2) Post Leak Rate: .012 cfm (.000) (Data Sheet #2) Time: 145 min. (000) (Data Sheet #2)

Dry Gas Meter Volume: 36.308 cf (00.000) (Data Sheet #2)

Stack Flow: 10.707 dscfm (00.000) (Data Sheet #2) Δ H: .093 in. H_2O (.000) (Data Sheet #2)

Maximum Vac.: 2.0 (0.0) (Data Sheet #2) Barometric Pressure: 29.97 in. Hg (00.00) (Data Sheet #2)

H_2O Captured: 68.9 g (00.0) (Data Sheet #3)

Front Half Catch % Of Total: 52.1 % (00.0) (Data Sheet #6) Total Particulate Catch: .1357 g (0.0000) (Data Sheet #6)

Flue Gas Moisture: 8.6220 % (00.000) (Data Sheet #7)

Particulate Emission: .0609 gr/dscf (0.0000) (Data Sheet #7)

Relative Humidity: 25.5 % RH (00.0) (Data Sheet #8) Ambient Moisture: 1.05 % H_2O (0.00) (Data Sheet #8)

Preburn Fuel Wt.: 51.1 lbs. (00.0) (Data Sheet #8) Coal Bed Wt.: 4.2 lbs. (00.0) (Data sheet #8) Test Fuel Wt.: 17.7 lbs. (00.0) (Data sheet #8)

Heat Output (EPA Default): 32,510.2 BTU/hr (00,000.0) (Data Sheet #8)

Kindling Fuel % Moisture (wet): 15.636 % (00.000) (Data Sheet #10) Pretest Fuel % Moisture (wet): 18.055 % (00.000) (Data Sheet #10)

Test Fuel % Moisture (dry): 23.222 % (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove]) Test Fuel % Moisture (wet): 18.846 %

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

Stack Static Pressure: -.042 in. H_2O (+/- .000) (Data Sheet #12)

Average Ambient Temperature: 78 °F (00) (Data Sheet #14) Stove Temperature Change: -97.7 °F (+/- 000.0) (Data Sheet #14)

TABLE 1 ----- RAW DATA

CLIENT : Jotul TEST No. : 5

MODEL: F600 DATE: 06-May-03

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	804.500	0.150	87	0.45	8.00	250
5	806.000	0.100	89	0.38	11.00	300
10	807.300	0.090	89	0.53	9.30	325
15	808.500	0.090	90	0.46	10.80	325
20	809.704	0.080	91	0.54	12.30	350
25	810.827	0.070	92	0.89	13.10	375
30	811.878	0.060	93	0.81	12.90	375
35	812.933	0.060	94	1.28	13.90	400
40	813.926	0.050	94	1.34	13.80	425
45	814.861	0.070	94	0.78	12.90	350
50	815.995	0.090	94	0.61	12.20	325
55	817.217	0.090	94	0.55	12.50	325
60	818.439	0.090	94	0.37	12.00	325
65	819.664	0.090	94	0.30	11.70	325
70	820.890	0.100	94	0.13	11.30	300
75	822.217	0.100	94	0.12	11.10	300
80	823.544	0.100	94	0.13	10.40	300
85	824.871	0.100	94	0.34	7.80	300
90	826.198	0.100	94	0.44	7.50	300
95	827.525	0.100	94	0.58	7.20	300
100	828.853	0.100	94	0.60	7.30	300
105	830.180	0.100	94	0.73	7.10	300
110	831.507	0.100	94	0.86	6.60	300
115	832.834	0.100	94	0.95	6.60	300
120	834.161	0.100	94	1.01	6.60	300
125	835.491	0.100	94	1.08	6.30	300
130	836.820	0.100	94	1.18	6.40	300
135	838.150	0.100	94	1.03	6.70	300
140	839.479	0.100	94	1.03	6.40	300
145	840.808	0.100	94	0.96	6.60	300
150						

TABLE 3 -----FIELD DATA AVERAGES

CLIENT :Jotul TEST No. 5

MODEL: F600 DATE: 06-May-03

****

AVG DELTA H	-------	0.09 in H2O		AVG PRCNT CO	-------	0.68	%
AVG METER TEMP. Tm	-------	93 deg F		AVG PRCNT CO2	-------	9.61	%
AVG PPM SO2	-------	319	PPM	AVG BAL CO2/CO	-------	14.09	%

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul TEST No. 5

MODEL: F600 DATE: 06-May-03

****

STD SAMPLE VOL. Vm(std) -----	34.39	dscf	STACK GAS FLOW Qsd -------	836.313	dscf/Hr
				13.94	& dscf/min
VOL. WATER VAPOR Vw(std) ----	3.243	scf	PARTICULATE CONCTRT. Cs ------	0.0039	g/dscf
PRCNT MSTR Bws -------	8.62	%	PARTC.EMISS. RATE E -------	3.30	g/Hr
BURN RATE BR -------	2.70	Kg/Hr	MOLES OF GAS PER Lb WOOD Nt --	0.37	Lb-mole/Lb
CO EMISSION RATE -------	191.00	g/Hr	PART.EMISS. RATE ------	1.22	g/Kgdry fuel
	70.85	& g/Kgdry fuel			

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Jotul TEST No. : 5

MODEL: F600 DATE: 06-May-03

TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR		PROPRTN RATE VAR. AVERAGE	
5	358.5	96		100	
10	372.1	99			
15	371.8	99			
20	372.3	99			
25	373.3	100			
30	373.6	100			
35	374.4	100			
40	375.5	100			
45	375.7	100			
50	375.2	100			
55	375.5	100			
60	375.5	100			
65	376.4	100			
70	376.7	100			
75	376.4	100			
80	376.4	100			
85	376.4	100			
90	376.4	100			
95	376.4	100			
100	376.7	100			
105	376.4	100			
110	376.4	100			
115	376.4	100			
120	376.4	100			
125	377.3	101			
130	377.0	101			
135	377.3	101			
140	377.0	101			
145	377.0	101			
150					
155					

METER BOX DATA SHEET PAGE # 2

Page: 1 of 2

UNIT: F600 RUN: 5 DATE: 5-6-03

Meter Box: 5H Y Factor: .990

Leak checks: 16 " Hg @ .011 cfm _____ " Hg @ _____ cfm

03 15 " Hg @ .012 cfm _____ " Hg @ _____ cfm

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

ROTO: PRESS: .16			SAMPLING RATIO: 45 : 1				BP: 30.04		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1245	804.500	—	13.618	.15	87	250	87	2.0
5	50	806.000	—	11.373	.10	89	300	89	2.0
10	55	807.300	807.300	10.498	.09	89	325	89	2.0
15	1300	808.500	808.500	10.479	.09	90	325	90	2.0
20	05	809.704	809.704	9.713	.08	91	350	91	2.0
25	10	810.827	810.827	9.065	.07	92	375	92	2.0
30	15	811.878	811.878	9.033	.06	93	375	93	2.0
35	20	812.933	812.933	8.453	.06	94	400	94	2.0
40	25	813.926	813.926	7.956	.05	94	425	94	2.0
45	30	814.861	814.861	9.660	.07	94	350	94	2.0
50	35	815.995	815.995	10.403	.09	94	325	94	2.0
55	40	817.217	817.217	10.403	.09	94	325	94	2.0
ROTO PRESS: .16			TOTALS:	120.734	1.00	1101	BP.: 29.96		
60	1345	818.439	818.439	10.376	.09	94	325	94	2.0
65	50	819.664	819.664	10.376	.09	94	325	94	2.0
70	55	820.890	820.890	11.240	.10	94	300	94	2.0
75	1400	822.217	822.217	11.240	.10	94	300	94	2.0
80	05	823.544	823.544	11.240	.10	94	300	94	2.0
85	10	824.871	824.871	11.240	.10	94	300	94	2.0
90	15	826.198	826.198	11.240	.10	94	300	94	2.0
95	20	827.525	827.525	11.240	.10	94	300	94	2.0
100	25	828.853	828.853	11.240	.10	94	300	94	2.0
105	30	830.180	830.180	11.240	.10	94	300	94	2.0
110	35	831.507	831.507	11.240	.10	94	300	94	2.0
115	40	832.834	832.834	11.240	.10	94	300	94	2.0
			TOTALS:	133.152	1.18	1128	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	253.886	2.18	2229	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 2 of 2

UNIT : F600 RUN : 5 DATE : 5-6-03

Meter Box: 5H Y Factor: .990

Leak checks: 16 " Hg @ .011 cfm _____ " Hg @ _____ cfm

15 " Hg @ .012 cfm _____ " Hg @ _____ cfm

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

ROTO: PRESS: .16			SAMPLING RATIO: 45 : 1				BP: 29.91		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1445	834.161	834.161	11.222	.10	94	300	94	2.0
125	50	835.491	835.491	11.222	.10	94	300	94	2.0
130	55	836.820	836.820	11.222	.10	94	300	94	2.0
135	1500	838.150	838.150	11.222	.10	94	300	94	2.0
140	05	839.479	839.479	11.222	.10	94	300	94	2.0
145	10	840.808	840.808	11.222	.10	94	300	94	2.0
150									
155				67.332	.60	564			
160									
165									
170									
175									
ROTO PRESS:			TOTALS:				BP.:		
180									
185									
190									
195									
200									
205									
210									
215									
220									
225									
230									
235						2793	.30		
			TOTALS:	321.218	2.78	93	MAX VACC =		2.0
TOTAL Cu Ft.		36.308	TOTALS:	10.707	.093	(553)	AVG. BP:		29.97

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : F600 RUN : 5 DATE : 5-6-03

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	668.9	591.7	484.6	827.9
INITIAL WT	613.0	590.8	484.2	816.2
NET WT GRAMS	55.9	.9	.4	11.7

TOTAL CATCH : 68.9 GRAMS H_2O

FRONT HALF

FILTER #	151F	
FINAL WT g	.7429	✓
INITIAL WT g	.6941	✓
NET WT g	.0488	✓

BEAKER #	16
DESC.	ACETONE
FINAL WT g	95.7655
INITIAL WT g	95.7429
NET WT g	.0226
VOL. DESC. ml	110

BACK HALF

FILTER #	151B	
FINAL WT g	.4432	✓
INITIAL WT g	.4359	✓
NET WT g	.0073	✓

BEAKER #	17	18	19	20	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	104.6339	108.8705	106.5538	108.6007	
INITIAL WT g	104.5944	108.8623	106.5468	108.5932	
NET WT g	.0395	.0082	.0070	.0075	.0145
VOL. DESC ml	150	75	150	125	275

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 01/17/03 Time : 2055 By : [signature]

Manufacturer S & S Grade : # 25 Glass Front Size : 11 cm Lot No. : ZB921

Back Size: 8.2 cm Lot No. : ZB911

	DATE: 01/21/03	BY: [signature]	DATE: 01/22/03	BY: [signature]	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
151F	.6940	0954	(.6941)	1128	JOEL FL600	R-5
152F	.6984	0955	(.6982)	1129	" "	R-6
153F	.6999	0955	(.6998)	1130		
154F	.6969	0956	(.6968)	1131		
155F	.6984	0957	(.6985)	1131		
156F	.6915	0958	(.6914)	1132		
157F	.6974	0959	(.6976)	1133		
158F	.6990	0959	(.6990)	1134		
159F	.6931	1000	(.6932)	1135		
160F	.6989	1001	(.6992)	1135		
151B	.4360	1002	(.4359)	1136	JOEL FL600	R-5
152B	.4316	1002	(.4316)	1137	" "	R-6
153B	.4307	1003	(.4311)	1138		
154B	.4295	1004	(.4293)	1138		
155B	.4321	1005	(.4323)	1139		
156B	.4243	1006	(.4245)	1140		
157B	.4294	1006	(.4294)	1141		
158B	.4350	1007	(.4354)	1142		
159B	.4290	1008	(.4290)	1142		
160B	.4274	1009	(.4274)	1143		

Checked by: [signature] Date: 1-22-03 Time: 1149

SCALE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	DB	% RH
01/21	0935	[signature]	75	44
01/22	1125	[signature]	77	46

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 08-19-2002 Time : 1205 By : [illegible]

	DATE: 08-22	BY: [illegible]	DATE:	BY: [illegible]	DATE:	BY:
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
1	104.9172	1043	104.9174	0704		
2	106.2542	1044	106.2538	0705	JOTUL FL600 R-1	
3	107.7782	1046	107.7777	0706		
4	108.7744	1047	108.7740	0708		
5	97.4370	1048	97.4366	0709		
6	91.2080	1050	91.2076	0710		
7	97.1385	1051	97.1382	0711	JOTUL FL600 R-3	
8	108.6356	1052	108.6357	0713		
9	108.0961	1053	108.0960	0714		
10	105.7310	1055	105.7306	0715		
11	104.7892	1056	104.7887	0717		
12	98.2303	1057	98.2304	0718	JOTUL FL600 R-4	
13	104.1788	1059	104.1784	0719		
14	97.9822	1100	97.9819	0721		
15	104.7644	1101	104.7642	0722		
16	95.7427	1102	95.7429	0723		
17	104.5948	1104	104.5944	0724	JOTUL FL600 R-5	
18	108.8626	1105	108.8623	0725		
19	106.5473	1106	106.5468	0726		
20	108.5936	1108	108.5932	0728		

SCALE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	DB	% RH
08-22	1040	[illegible]	78	49
08-23	0700	[illegible]	78	49

Checked by: Chp Weatherly

Date : 8-23-02

Time : 0910

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : F600 RUN : 5 DATE : 5-6-03 Page : 1 of 1

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
16	05/07	2300		95.7662	05/09	0740		95.7654	05/10	1454		95.7655	05/11	1220	
17	05/07	2300		104.6345	05/09	0741		104.6339	05/10	1455		104.6339	05/11	1221	
18	05/07	2030		108.8712	05/09	0743		108.8702	05/10	1456		108.8705	05/11	1223	
19	05/07	2030		106.5553	05/09	0744		106.5540	05/10	1457		106.5538	05/11	1224	
20	05/07	2030		108.6004	05/09	0745		108.6010	05/10	1458		108.6007	05/11	1225	

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
151F	5-6	1600		.7445	05/06	2156		.7432	05/09	0746		.7429	05/10	1459	
151B	5-6	1600		.4439	05/06	2157		.4431	05/09	0748		.4432	05/10	1500	

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	05/06	2135		77	46
2	05/09	0715		77	45
3	05/10	1435		78	47
4	05/11	1210		77	46
5					

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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 05-18-2002 Through 10-27-2002	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9999	10.0000	.9999	.0999		05-18	1905	77	49
99.9997	9.9998	.9999	.0998		05-19	1500	77	48
99.9999	10.0000	.9998	.0999		05-20	0855	77	47
99.9998	9.9998	1.0000	.0999		05-21	0930	78	49
99.9998	9.9999	1.0000	.1000		05-22	1155	78	48
99.9999	9.9999	1.0000	.1001		05-22	1920	78	49
99.9999	10.0001	1.0001	.0998		05-23	2105	77	48
99.9998	9.9998	.9998	.0999		05-28	1225	78	49
99.9998	9.9997	1.0001	.0999		05-28	1625	78	47
99.9997	10.0001	1.0002	.1000		06-27	1950	78	49
99.9998	10.0001	1.0002	.1001		06-29	1830	78	49
99.9997	9.9999	1.0000	.0998		07-01	0845	77	49
100.0000	9.9999	1.0002	.1000		07-01	2220	78	47
99.9998	10.0000	.9999	.0999		08-14	1130	78	49
100.0001	9.9999	1.0000	.1000		08-16	1045	78	49
100.0000	9.9998	1.0000	.0998		08-22	1040	78	49
99.9997	9.9999	.9999	.0997		08-23	0700	78	49
99.9998	10.0000	1.0000	.0998		08-29	0915	78	49
100.0000	10.0000	1.0002	.1001		08-29	2225	78	49
99.9998	9.9999	1.0001	.0998		09-03	1120	78	49
99.9997	9.9998	.9999	.0998		09-03	2230	78	49
100.0000	10.0001	.9999	.0999		09-05	1915	78	49
99.9999	9.9999	1.0000	.0999		09-06	1815	78	48
99.9997	9.9999	1.0000	.0998		09-07	1355	78	47
100.0000	10.0002	.9998	.0997		9-10	1110	77	42
99.9997	10.0002	1.0000	.0100		9-11	1500	74	47
99.9999	9.9999	1.0000	.0997		9-13	2020	76	38
100.0003	10.0002	1.0002	.0998		9-14	1300	76	41
100.0000	10.0001	1.0000	.0999		9-16	1930	74	44
100.0000	9.9999	.9998	.0999		9-17	1710	77	42
100.0000	10.0001	1.0000	.1000		9-19	1000	74	47
100.0001	10.0000	.9998	.0999		9-20	1115	74	44
99.9998	9.9999	1.0001	.0999		10-18	2155	77	44
99.9997	9.9999	1.0000	.1000		10-22	2255	77	46
100.0001	10.0002	1.0000	.0999		10-23	2815	77	42
99.9997	9.9998	.9999	.1000		10-25	1350	77	43
99.9998	9.9999	1.0000	.1000		10-26	1735	77	41
99.9998	9.9998	.9999	.1000		10-27	1130	77	36
99.9998	9.9999	.9999	.0999		10-27	1435	77	38

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 12-05-2002 Through 02-23-2003	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	9.9998	1.0000	.0997		12-05	1825	77	47
99.9998	10.0000	.9999	.1000		12-06	1125	77	45
99.9997	10.0001	1.0000	.1000		12-07	1310	76	41
99.9997	10.0001	1.0000	.0999		12-08	1430	77	44
99.9998	9.9999	1.0001	.0999		12-09	1125	78	44
99.9998	10.0000	.9999	.0998		12-10	1220	78	43
99.9997	10.0000	.9998	.0998		12-11	1650	77	45
99.9997	10.0001	.9999	.0999		12-12	1445	77	47
99.9998	10.0000	.9999	.1000		12-14	1530	78	47
99.9997	10.0000	1.0000	.0999		01-10	2300	78	48
99.9998	9.9999	1.0001	.1000		01-14	1115	77	48
99.9999	10.0000	.9999	.1000		01-15	1705	77	48
99.9999	10.0001	.9999	.0998		01-16	1830	78	46
99.9997	10.0000	1.0000	.0999		01-17	1215	77	41
99.9997	9.9999	1.0000	.0999		01-17	2035	76	42
99.9996	10.0000	.9999	.0999		01-18	1730	77	43
99.9999	9.9999	.9998	.0999		01-19	1210	76	42
99.9998	10.0000	1.0000	.0999		01-20	2105	76	44
99.9999	10.0000	.9999	.0998		01-21	0935	75	44
99.9998	10.0000	.9999	.0999		01-22	1125	77	46
100.0000	9.9998	.9999	.1000		01-23	1430	77	48
99.9999	10.0001	1.0001	.1000		01-24	1200	76	48
99.9998	9.9999	.9999	.0999		01-25	1140	76	47
99.9997	10.0000	1.0000	.0999		01-25	1850	78	48
99.9998	9.9998	1.0000	.1000		01-27	1415	75	47
99.9999	9.9999	1.0000	.1000		01-30	1920	77	48
99.9998	10.0000	.9998	.0999		01-31	2205	78	47
99.9999	9.9998	.9998	.1000		02-01	1855	77	47
99.9997	9.9998	.9999	.1001		02-02	1420	76	46
99.9997	10.0001	.9998	.0999		02-18	1155	77	49
99.9999	9.9999	.9999	.0999		02-19	1925	77	48
99.9997	10.0000	1.0000	.0999		02-22	2010	78	45
99.9997	10.0000	.9999	.1000		02-23	1130	78	44

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 02-24-2003 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
99.9998	10.000	1.0000	.0999		02-24	1055	74	44
99.9997	9.9998	1.0001	.0999		02-25	1700	77	45
100.0000	10.0001	1.0000	.0998		03-01	1010	71	44
99.9997	10.0001	.9998	.0999		03-02	1420	75	45
99.9998	10.0000	.9999	.1000		03-03	1205	76	45
99.9998	10.0000	1.0000	.1000		03-03	2005	77	47
100.0000	10.0001	1.0001	.0999		03-04	1035	75	47
99.9996	10.0001	1.0000	.0999		03-05	0945	71	47
99.9997	10.0001	1.0000	.1000		03-06	1340	74	46
99.9998	9.9999	1.0000	.0998		03-07	2050	76	45
99.9998	9.9999	1.0000	.0999		03-08	1150	77	45
99.9997	9.9998	1.0000	.1000		03-09	1350	76	45
99.9998	10.0000	.9999	.1000		03-10	1220	77	47
99.9997	9.9999	1.0000	.1000		03-18	1740	77	46
99.9997	9.9999	1.0000	.0999		03-20	2145	74	45
99.9998	10.0000	1.0000	.0998		03-22	1725	76	47
99.9997	10.0000	.9999	.1000		03-23	1405	77	47
99.9998	9.9998	.9999	.0999		03-24	1450	74	44
100.0000	9.9998	1.0000	.0998		03-25	1120	75	45
99.9998	10.0000	.9999	.0999		04-30	2300	75	47
99.9997	10.0001	.9999	.1000		05-02	1130	77	49
99.9998	9.9998	1.0000	.0999		05-06	2135	77	46
99.9997	9.9999	1.0001	.0999		05-09	0715	77	45
99.9998	10.0000	.9999	.0999		05-10	1435	78	47
99.9998	9.9999	1.0000	.0998		05-11	1210	77	46
99.9996	10.0001	.9999	.0999		05-12	0940	76	45

BLANK PROCESSING DATA SHEET # 5

UNIT : F600 RUN : 5 DATE : 05/06/03

DATE BLANKS DONE : 02-23-03

BEAKER	A	B	C
	200 ml ACETONE	75 ml DICHLOR	200 ml WATER
	FISHER OPTIMA LOT # 011755	FISHER OPTIMA LOT # 994669	DWNA, INC. SPARKLETTES DISTILLED
FINAL WEIGHT	108.9007	106.3074	106.9660
TARE WEIGHT	108.8995	106.3057	106.9646
NET WEIGHT	.0012 ✓	.0017 ✓	.0014 ✓

TARE BEAKERS INTO DESC : TIME : 1430 DATE : 02-12-03

DATE : 02-18 BY : [illegible] DATE : 02-19 BY : [illegible] DATE : BY :

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.8996	1158	108.8995	1928	✓	
B	106.3060	1159	106.3057	1930	✓	
C	106.9649	1200	106.9646	1931	✓	

FINAL BEAKERS INTO DESC : TIME : 1600 DATE : 02-20-03

DATE : 02-22 BY : [illegible] DATE : 02-23 BY : [illegible] DATE : BY :

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9010	2013	108.9007	1132	✓	
B	106.3078	2015	106.3074	1133	✓	
C	106.9661	2016	106.9660	1134	✓	

TARE QC

DATE	TIME	BY	WB	DB	%
02-18	1155	[illegible]		77	49
02-19	1925	[illegible]		77	48

FINAL QC

DATE	TIME	BY	WB	DB	%
02-22	2010	[illegible]		78	45
02-23	1130	[illegible]		78	44

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT : F600 RUN : 5 DATE : 05/06/03

BLANK CALCULATIONS

Acetone : .0012 g ÷ 200 ml = .000006 g/ml
Dicholoromethane : .0017 g ÷ 75 ml = .000023 g/ml
Distilled Water : .0014 g ÷ 200 ml = .000007 g/ml

FRONT HALF CATCH

FILTERS : .0488 g (Total Catch) - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0488 g

BEAKERS : .0226 g (Total Catch) - 110 (ml Acetone) (.000006 g) (Blank Value / ml Acetone) = .0219 g

TOTAL FRONT HALF CATCH : .0707 g

BACK HALF CATCH

FILTERS : .0073 g (Total Catch) - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0073 g

BEAKERS :

Acetone : .0395 g (Total Catch) - 150 (ml Acetone) (.000006 g) (Blank Value / ml Acetone) = .0386 g

Extract : .0082 g (Total Catch) - 75 (ml Dichloromethane) .0017 (.000023 g) (Blank Value / Dichloromethane) = .0065 g

Water : .0145 g (Total Catch) - 275 (ml Water) (.000007 g) (Blank Value / Water) = .0126 g

TOTAL BACK HALF CATCH : .0650 g

TOTAL CATCH : .1357 g

% FRONT HALF : 52.1 % (00.0)

CALCULATIONS DATA SHEET # 7

UNIT : JOTUL F600 RUN : 5 DATE : 05/06/03

1) $Vm\,(std) = \dfrac{(36.308\ Vm)(17.64)(.990\ mcf)\left(29.97\text{" Hg} + \frac{.093\text{" } H_2O}{13.6}\right)}{(553\ TmA)} = \dfrac{34.3714}{000.0000}$ dscf

2) $Vw\,(std) = (.04707)(68.9\ ml\ H_2O) = \dfrac{3.2431}{00.0000}$ scf

3) $Asw = \dfrac{(3.2431\ scf)}{(3.2431\ scf + 34.3714\ dscf)} = \dfrac{.0862}{.0000}$ Bws × 100 = $\dfrac{8.6220}{00.0000}$ % H_2O

4) $Cs = \dfrac{(.1357\ g.)}{(34.3714\ dscf)}(15.43) = \dfrac{.0609}{0.0000}$ gr / dscf

5) Estimated g / hr $= \dfrac{(.1357\ g.)}{(34.3714\ dscf)}\left(\dfrac{10.707}{00.0000}\ dscfm\right)(60) = \dfrac{2.5363}{00.0000}$ 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 : F600 RUN : 5 DATE : 5-6-03

Test Chamber Air Velocity Start : 0 Stop : 0 Avg.: 0

Wet Bulb / Dry Bulb

Pre : WB : 60 DB : 84 = 23 % RH 0.9 % H_2O

Post : WB : 64 DB : 86 = 28 % RH 1.2 % H_2O

Average : 25.5 % RH 1.05 % H_2O

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

Kindling Weight (lbs) : Paper : .2 Wood : 2.2

Preburn Fuel Weight : 15.5 + 19.6 + 13.8 Total : 48.9

Kindling & Preburn Fuel Weight (wood only) (lbs) : **Total :** 51.1

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

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

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

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

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

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" x 4"	17	4	8.5	48.0
4" x 4"	17	2	9.2	52.0

Test Fuel Weight : 17.7 lbs

Estimated Dry Burn Rate :

$$\frac{17.7 - (17.7 \times .18846)}{2.2046} \times \frac{60}{\frac{145}{\text{TIME}}} = 2.696 \text{ kg / hr}$$

Estimated BTU's/hr : 19,140 x $\frac{63}{100}$ x $\frac{2.696}{\text{DBR}}$ = 32,510.2 BTU's/hr

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

WOOD STOVE OPERATING DATA PAGE #9

Unit : F600 Run : 5 Date : 5-6-03

FIRE STARTED: 0850

WARM UP AND PREBURN:

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

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

CHARCOAL BED PREPARATION :

Raked and leveled prior to each warm-up / preburn charge. At 1 ½ min. prior to loading last fuel, raked and leveled. In stove 30 sec.

TEST:

DOOR wide open during loading 0 min. 50 sec.

PRIMARY AIR : Opened full for first 5 min., then set to run setting of 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 16 or — inches.

1st warm up / pre-burn fuel charge (15.5 lbs.) added at 0905

2nd warm up / pre-burn fuel charge (19.6 lbs.) added at 1010

3rd warm up / pre-burn fuel charge (13.8 lbs.) added at 1115

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 : F600 Run : 5 Date : 05-06-03

Room Temperature : 71 °F Correction Factor : ϕ

Uncorrected Values are corrected for room temperature : Yes _____ No ✓

Time Test Fuel moisture reading taken : 1035 ✓

Calibration Checks : X ✓ Y ✓ 12.0 12.2 22.0 22.0

pc #	Dimen.	Use	TOP		BOTTOM		SIDE		Average Corrected
			Uncor.	Cor.	Uncor.	Cor.	Uncor.	Cor.	
1	2"×4"×8'	K	18.0	19.2	17.0	18.2	17.0	18.2	18.533
2									
3									
4	2"×4"×8'	P	21.5	23.1	21.0	22.5	22.0	23.7	23.100
5	2"×4"×8'	P	21.0	22.5	21.0	22.5	21.0	22.5	22.500
6	2"×4"×8'	P	18.5	19.8	19.5	20.9	19.5	20.9	20.533
7	2"×4"×8'	P	20.5	22.0	20.5	22.0	20.5	22.0	22.000
8	2"×4"×8'	P							88.133
9									
10	2×4×17	T	19.5	20.9	20.0	21.4	20.0	21.4	21.233
11	11	T	21.5	23.1	21.5	23.1	22.0	23.7	23.300
12	11	T	21.5	23.1	21.5	23.1	21.5	23.1	23.100
13	11	T	23.0	24.7	23.0	24.7	23.0	24.7	24.700
14	4×4×17	T	21.5	23.1	22.0	23.7	21.5	23.1	23.300
15	11	T	22.0	23.7	22.0	23.7	22.0	23.7	23.700
16									139.333
17									
18									
19									
20	Spacers	T	18.5	19.8	19.5	20.9	19.0	20.3	20.333

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	18.533 %	22.033 %	23.222 %
Wet Moisture % :	15.636 %	18.055 %	18.846 %

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

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

GAS DATA SHEET #12

WEIGHT: 4.2 DATE: 05-06-03

UNIT: F600 RUN: 5 PAGE: 1 OF 1

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
0 1245	21.9	17.7	—	.323	8.0	.492	12.3	.044	.45	-.040	250
5 50	20.6	16.4	1.3	.441	11.0	.377	9.4	.037	.38	-.027	300
10 55	19.6	15.4	1.0	.375	9.3	.437	10.9	.052	.53	-.045	325
15 1300	18.5	14.3	1.1	.435	10.8	.380	9.5	.045	.46	-.046	325
20 05	17.3	13.1	1.2	.492	12.3	.319	8.0	.053	.54	-.047	350
25 10	16.1	11.9	1.2	.525	13.1	.272	6.8	.088	.89	-.047	375
30 15	15.0	10.8	1.1	.519	12.9	.281	7.0	.060	.81	-.048	375
35 20	13.8	9.6	1.2	.556	13.9	.226	5.7	.127	1.28	-.049	400
40 25	12.6	8.4	1.2	.555	13.8	.224	5.6	.133	1.34	-.049	425
45 30	11.6	7.4	1.0	.519	12.9	.283	7.1	.077	.78	-.049	350
50 35	10.6	6.4	1.0	.491	12.2	.317	7.9	.060	.61	-.048	325
55 40	9.8	5.6	.8	.503	12.5	.308	7.7	.054	.55	-.048	325
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.543	*****
60 1345	9.0	4.8	.8	.480	12.0	.338	8.5	.036	.37	-.047	325
65 50	8.3	4.1	.7	.471	11.7	.350	8.8	.029	.30	-.047	325
70 55	7.7	3.5	.6	.453	11.3	.375	9.4	.012	.13	-.046	300
75 1400	7.2	3.0	.5	.447	11.1	.381	9.5	.011	.12	-.046	300
80 65	6.8	2.6	.4	.418	10.4	.410	10.3	.012	.13	-.045	300
85 10	6.5	2.3	.3	.314	7.8	.505	12.6	.033	.34	-.043	300
90 15	6.3	2.1	.2	.302	7.5	.513	12.8	.043	.44	-.042	300
95 20	6.1	1.9	.2	.291	7.2	.519	13.0	.057	.58	-.041	300
100 25	5.9	1.7	.2	.293	7.3	.516	12.9	.059	.60	-.040	300
105 30	5.7	1.5	.2	.285	7.1	.519	13.0	.072	.73	-.039	300
110 35	5.5	1.3	.2	.267	6.6	.532	13.3	.085	.86	-.038	300
115 40	5.4	1.2	.1	.265	6.6	.530	13.3	.094	.95	-.038	300
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.512	*****
120 1445	5.1	.9	.3	.264	6.6	.529	13.2	.100	1.01	-.037	300
125 50	4.9	.7	.2	.254	6.3	.536	13.4	.107	1.08	-.036	300
130 55	4.7	.5	.2	.259	6.4	.527	13.2	.117	1.18	-.036	300
135 1500	4.6	.4	.1	.271	6.7	.521	13.0	.102	1.03	-.035	300
140 05	4.4	.2	.2	.258	6.4	.534	13.3	.102	1.03	-.035	300
145 10	4.2	-0	.2	.265	6.6	.530	13.2	.095	.96	-.035	300
150 15											
155 20										-.214	
160 25											
165 30											
170 35											
175 40											-.30
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-1.269	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.042	*****

PREBURN DATA SHEET #1

UNIT: FL600 RUN: 5 DATE: 05-06-03 PAGE: 1 of 1

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
0 1115	19.2	—	478	479	480	310	465	305	842	1114	76	-.026	PREBURN START: # 14.8 UP
5 20	17.4	1.8	529	538	447	284	426	311	743	1159	74	-.045	COAL BED SCALE RANGE:
10 25	15.8	1.6	552	565	420	262	403	308	722	1199	74	-.046	4.4 – 3.6
15 30	14.1	1.7	561	589	401	247	390	298	728	1225	75	-.046	PRIMARY AIR: WIDE OPEN
20 35	12.5	1.6	567	600	394	241	385	291	760	1267	75	-.047	SECONDARY AIR: N/A
25 40	10.9	1.6	555	603	402	244	389	286	805	1358	75	-.046	FAN: HIGH
30 45	9.6	1.3	546	603	410	248	399	279	837	1363	75	-.046	PUMPS ON AT: 1155
35 50	8.4	1.2	545	611	422	251	412	272	868	1353	76	-.047	CHECK WB/DB: N/A
40 55	7.6	.8	531	611	440	259	430	271	903	1348	77	-.047	
45 1200	7.0	.6	478	573	456	269	447	267	924	1315	77	-.046	
50 05	6.7	.3	422	523	470	270	459	271	920	1237	78	-.045	
55 10	6.4	.3	389	485	470	266	459	272	894	1175	77	-.043	
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	
60 1215	6.2	.2	374	457	465	266	455	271	876	1138	79	-.041	
65 20	5.9	.3	455	446	458	264	447	284	887	1220	77	-.040	
70 25	5.5	.4	469	441	460	271	450	312	922	1211	78	-.040	
75 30	5.1	.4	467	436	471	286	458	355	952	1201	78	-.040	
80 35	4.8	.3	456	421	478	294	465	384	958	1137	78	-.040	
85 40	4.5	.3	443	413	479	301	468	399	948	1109	77	-.040	
90 45	4.2	.3	413	406	475	306	464	425	913	1091	74	-.040	
95 50													

TEMPERATURE DATA SHEET #14

		TEST TIME	145		
STACK AVG	400	TOP AVG	428	LT SIDE AVG	417
BACK AVG	256	RT SIDE AVG	416	BOTTOM AVG	288
FIREBOX AVG	811	SEC/CAT AVG	1119	AMBIENT AVG	78

END	317.5	
START	415.2	
	-97.7	DELTA T

CIRCLE: (LOSS) / GAIN

Jotul U.S.A., Inc. TEMPERATURE DATA SHEET #14A Run 5 05/06/2003

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
0	413	406	475	306	464	425	913	1091	74	1359	236	52	246	33	36
5	660	420	449	283	438	415	711	1265	73	1353	239	44	245	33	34
10	455	435	416	246	407	387	669	1080	73	1347	235	45	246	34	37
15	450	445	398	225	388	359	659	1145	77	1341	236	45	247	34	37
20	465	467	385	213	376	339	664	1267	77	1338	237	45	249	35	36
25	482	488	378	206	372	322	687	1333	78	1337	235	46	248	37	36
30	487	504	380	204	374	305	713	1335	79	1336	234	46	247	37	35
35	506	520	385	206	380	291	738	1270	81	1337	235	47	248	37	37
40	514	534	393	211	389	279	769	1266	80	1346	237	49	247	36	37
45	493	526	399	224	396	269	799	1256	79	1349	235	49	248	37	37
50	474	516	409	242	403	261	821	1242	78	1346	236	50	249	38	35
55	462	509	418	258	410	254	842	1244	79	1345	236	51	248	37	35
60	450	501	425	269	416	252	862	1247	78	1348	236	50	246	37	36
65	444	496	434	278	424	248	884	1223	78	1357	238	50	246	36	36
70	430	493	442	290	436	245	891	1195	78	1370	237	50	245	36	36
75	420	485	446	300	453	244	899	1196	79	1379	236	50	244	36	38
80	404	470	447	312	466	243	907	1204	80	1383	238	50	243	36	37
85	375	448	452	312	470	246	919	1150	79	1376	237	51	242	37	37
90	352	422	451	300	466	248	922	1112	79	1367	238	51	241	36	36
95	336	401	448	286	457	254	894	1075	79	1353	238	52	241	38	37
100	324	384	441	276	450	259	880	1050	78	1339	238	52	241	38	36
105	315	370	433	269	443	263	876	1009	78	1328	236	52	242	38	36
110	305	356	425	263	433	269	852	970	78	1325	236	53	243	37	37
115	297	345	417	255	422	271	842	947	79	1310	234	53	240	37	35
120	290	333	411	248	412	276	823	928	78	1306	232	53	240	37	35
125	284	325	405	244	401	279	801	914	79	1302	232	54	241	37	35
130	280	315	397	239	392	281	784	907	79	1308	231	54	241	36	34
135	278	310	391	237	385	284	777	897	78	1304	230	54	242	36	35
140	275	305	384	236	379	290	761	884	78	1302	232	54	244	36	35
145	274	300	378	236	378	296	761	877	78	1301	233	54	243	36	34

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 05/06/03 Analyte : CO_2 (15-1)

Unit : F600 Run # : 5

Zero Cyl. # : 042JAC 2-A Conc. : 0.00 % CO_2 Cyl. Press. : 900 PSI

Certified by : AIR LIQUIDE Date : 02-20-02

Span Cyl. # : CC-3131 Conc. : 12.40 % CO_2 Cyl. Press. : 1625 PSI

Certified by : AIR LIQUIDE Date : 03-13-03

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 : D. Wadington Time : 1125 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	.048	.048	.191
SPAN	49.6	.496	12.40	49.5	.495	12.342	.058	.233

POST RUN Audit : by : D. Wadington Time : 1535 Temp : 78 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.023	.023	.091
SPAN	49.6	.496	12.40	49.6	.496	12.367	.033	.133

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

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

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

ZERO / SPAN CHECK DATA SHEET #15-2

Date : 05/06/03 Analyte : O_2 (15-2)

Unit : F600 Run # : 5

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 % O_2 Cyl. Press. : 900 PSI

Certified by : AIR LIQUIDE Date : 02-20-02

Span Cyl. # : CC-3131 Conc. : 12.40 % O_2 Cyl. Press. : 1625 PSI

Certified by : AIR LIQUIDE Date : 03-13-03

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 : D. Washington Time : 1125 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	.050	+.050	+.201
SPAN	12.50	.500	12.50	12.50	.500	12.501	+.001	+.006

POST RUN Audit : by : D. Washington Time : 1535 Temp : 78 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.025	+.025	+.101
SPAN	12.50	.500	12.50	12.55	.501	12.526	+.026	+.105

± 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 : 05/06/03 Analyte : CO (15-3)

Unit : F600 Run # : 5

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 % CO Cyl. Press. : 900 PSI

Certified by : AIR LIQUIDE Date : 02-20-03

Span Cyl. # : CC-3131 Conc. : 12.40 % CO Cyl. Press. : 1625 PSI

Certified by : AIR LIQUIDE Date : 03-13-03

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 : D. Wadington Time : 1125 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	.011	+.011	+.110
SPAN	50.2	.502	5.02	50.1	.501	5.020	+.000	-.003

POST RUN Audit : by : D. Wadington Time : 1535 Temp : 78 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.001	.021	+.021	+.210
SPAN	50.2	.502	5.02	50.2	.502	5.030	+.010	+.097

± 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 : 05/06/03 Analyte : SO_2 (15-4)

Unit : F600 Run # : 5

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 ppm SO_2 Cyl. Press. : 900 PSI

Certified by : AIR LIQUIDE Date : 02-20-02

Span Cyl. # : CC62184 Conc. : 1290 ppm SO_2 Cyl. Press. : 1025 PSI

Certified by : AIR LIQUIDE Date : 01-29-01

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 : D. Wadington Time : 1120 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	9.209	+9.209	+.368
SPAN	51.6	.516	1290	51.7	.517	1292.541	+2.541	+.102

POST RUN Audit : by : D. Wadington Time : 1535 Temp : 78 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.001	9.209	+9.209	+.368
SPAN	51.6	.516	1290	51.8	.518	1295.028	+5.028	+.201

± 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 : F600 RUN : 5 DATE : 5-6-03

Thermocouple Check:

T/C # 1	— °F	T/C # 13	62.5 °F
T/C # 2	— °F	T/C # 14	61.0 °F
T/C # 3	62.4 °F	T/C # 15	63.2 °F
T/C # 4	58.6 °F	T/C # 16	50.2 °F
T/C # 5	57.6 °F	T/C # 17	515 °F
T/C # 6	57.8 °F	T/C # 18	63.7 °F
T/C # 7	57.2 °F	T/C # 19	59.6 °F
T/C # 8	56.4 °F	T/C # 20	— °F
T/C # 9	58.0 °F	T/C # 21	— °F
T/C # 10	58.7 °F	T/C # 22	— °F
T/C # 11	55.4 °F	T/C # 23	58.7 °F
T/C # 12	67.9 °F	T/C # 24	— °F

Thermocouple Readout:

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

ZERO .3 °F Adj. to 0.0 °F ZERO 1.3 °F Difference .065 %

SPAN 1999.1 °F Adj. to 2000.0 °F SPAN 2002.3 °F Difference .115 %

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 202.0 °F	400	= 399.4 °F
600	= 601.6 °F	800	= 801.7 °F	1000	= 1000.7 °F
1200	= 1198.3 °F	1400	= 1399.2 °F	1600	= 1599.8 °F
1800	= 1800.1 °F	2000	= 2000.0 °F		

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

Scale Check Pre : 20.1 - 30.1

Post : 3.9 - 13.9

Stack Cleaned Prior to Test Run : YES ____ NO X

COMPUTER INPUT DATA SHEET #1

Client: JOTUL USA, INC

Address: 400 RIVERSIDE ST. / P.O. BOX 1157
PORTLAND, ME 04104

Phone: 800-797-5912 Fax: 207-797-6072

Run No.: 6 Date of Test: 05/07/03 Burn Rate: 1.114

Model No.: F600 ☐ min ☒ min-1.25 ☒ fan

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

Dry Gas Meter Y Factor: .990 (0.000) (Data Sheet #2) Post Leak Rate: .017 cfm (.000) (Data Sheet #2) Time: 355 min. (000) (Data Sheet #2)

Dry Gas Meter Volume: 135.109 cf (00.000) (Data Sheet #2)

Stack Flow: 1,098 dscfm (00.000) (Data Sheet #2) Δ H: .237 in. H_2O (.000) (Data Sheet #2)

Maximum Vac.: 5.0 (0.0) (Data Sheet #2) Barometric Pressure: 29.94 in. Hg (00.00) (Data Sheet #2)

H_2O Captured: 286.5 g (00.0) (Data Sheet #3)

Front Half Catch % Of Total: 32.3 % (00.0) (Data Sheet #6) Total Particulate Catch: 1.3857 g (0.0000) (Data Sheet #6)

Flue Gas Moisture: 9.3558 % (00.000) (Data Sheet #7)

Particulate Emission: .1636 gr/dscf (0.0000) (Data Sheet #7)

Relative Humidity: 30.5 % RH (00.0) (Data Sheet #8) Ambient Moisture: 1.0 % H_2O (0.00) (Data Sheet #8)

Preburn Fuel Wt.: 56.1 lbs. (00.0) (Data Sheet #8) Coal Bed Wt.: 4.4 lbs. (00.0) (Data sheet #8) Test Fuel Wt.: 17.8 lbs. (00.0) (Data sheet #8)

Heat Output (EPA Default): 13,436.3 BTU/hr (00,000.0) (Data Sheet #8)

Kindling Fuel % Moisture (wet): 15.110 % (00.000) (Data Sheet #10) Pretest Fuel % Moisture (wet): 17.548 % (00.000) (Data Sheet #10)

Test Fuel % Moisture (dry): 22.467 % Test Fuel % Moisture (wet): 18.345 % (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove])

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

Stack Static Pressure: -.031 in. H_2O (+/- .000) (Data Sheet #12)

Average Ambient Temperature: 72 °F (00) (Data Sheet #14) Stove Temperature Change: -60.3 °F (+/- 000.0) (Data Sheet #14)

TABLE 1 ----- RAW DATA

CLIENT : Jotul TEST No. : 6

MODEL: F600 DATE: 07-May-03

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	841.500	0.150	79	0.67	1.50	600
5	843.000	0.720	79	0.45	4.80	275
10	846.329	0.160	81	0.67	3.00	575
15	847.937	0.150	81	0.73	3.30	600
20	849.479	0.140	81	0.82	3.60	625
25	850.959	0.130	82	0.91	4.00	650
30	852.387	0.130	82	0.89	4.40	650
35	853.815	0.130	82	1.34	5.60	650
40	855.243	0.180	81	1.20	6.40	550
45	856.925	0.200	81	1.04	5.70	525
50	858.686	0.240	81	0.95	8.20	475
55	860.632	0.300	81	0.68	9.10	425
60	862.807	0.380	81	0.45	9.90	375
65	865.270	0.380	81	0.29	9.70	375
70	867.734	0.380	81	0.67	8.00	375
75	870.197	0.440	81	0.48	8.80	350
80	872.836	0.440	81	0.37	9.60	350
85	875.475	0.380	81	0.36	9.80	375
90	877.938	0.380	81	0.40	9.80	375
95	880.402	0.380	81	0.42	10.00	375
100	882.865	0.300	81	0.39	8.80	425
105	885.040	0.270	81	0.93	7.30	450
110	887.094	0.270	81	1.10	7.20	450
115	889.148	0.330	82	0.65	8.90	400
120	891.466	0.330	82	0.45	10.30	400
125	893.785	0.380	82	0.37	11.70	375
130	896.258	0.380	82	0.43	11.70	375
135	898.730	0.300	82	0.37	10.80	425
140	900.913	0.330	82	0.18	8.70	400
145	903.231	0.330	82	0.29	8.70	400
150	905.550	0.300	82	0.46	8.10	425
155	907.733	0.240	82	1.22	6.60	475
160	909.686	0.240	82	1.17	6.60	475
165	911.639	0.190	82	1.89	5.50	525
170	913.407	0.180	82	2.17	4.90	550
175	915.095	0.180	83	2.29	4.70	550
180	916.782	0.190	82	2.33	4.40	525
185	918.551	0.190	82	2.41	4.40	525
190	920.320	0.190	82	2.50	4.50	525
195	922.089	0.190	82	2.48	4.50	525
200	923.858	0.190	82	2.50	4.60	525
205	925.627	0.190	82	2.60	4.70	525
210	927.396	0.200	81	2.38	4.60	525
215	929.159	0.200	81	2.35	4.60	525

220	930.921	0.200	81	2.46	4.50	525
225	932.683	0.200	81	2.47	4.50	525
230	934.445	0.180	81	2.41	4.50	550
235	936.128	0.180	81	2.32	4.50	550
240	937.810	0.180	80	2.27	4.50	550
245	939.486	0.180	80	2.26	4.50	550
250	941.163	0.180	80	2.27	4.40	550
255	942.839	0.180	80	2.23	4.30	550
260	944.515	0.180	80	2.28	4.30	550
265	946.191	0.180	80	2.19	4.20	550
270	947.868	0.180	80	2.20	4.30	550
275	949.544	0.180	80	2.22	4.30	550
280	951.220	0.180	80	2.24	4.30	550
285	952.896	0.180	80	2.19	4.30	550
290	954.572	0.160	80	2.16	4.20	575
295	956.176	0.180	80	2.14	4.20	550
300	957.852	0.180	80	2.12	4.20	550
305	959.528	0.180	80	2.15	4.20	550
310	961.205	0.180	80	2.23	4.30	550
315	962.881	0.180	80	2.20	4.30	550
320	964.557	0.180	80	2.15	4.20	550
325	966.233	0.180	80	2.09	4.20	550
330	967.909	0.180	80	1.74	6.20	550
335	969.586	0.200	80	1.64	6.00	525
340	971.342	0.200	80	1.72	5.50	525
345	973.097	0.200	80	1.86	5.00	525
350	974.853	0.200	80	2.01	4.80	525
355	976.609	0.200	80	2.01	4.60	525
360						

TABLE 2---RAW DATA

CLIENT : Jotul TEST No. 6

MODEL: F600 DATE: 07-May-03

****

METER CAL. FACTOR (Y)	------ 0.99		Wt. WOOD BURNED(LB)	------- 17.8	Lbs
BAROMETRIC PRESS.(Pb)	------ 29.94 in Hg		WET,FUEL MOISTURE %	------- 18.345	%
LEAK RATE POST (Lp)	------ 0.017 cfm		Wt. PART. COLLECTED	------- 1.3857	g
WATER VOL. (V1c)	------ 286.5 Ml		METER VOLUME Vm	------- 135.109	mcf
TEST TIME (MIN)	------ 355 min		HC MOLE FRACTION	------- 0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT :Jotul TEST No. 6

MODEL: F600 DATE: 07-May-03

****

AVG DELTA H	-------	0.24 in H2O	AVG PRCNT CO	-------	1.50	%
AVG METER TEMP. Tm	-------	81 deg F	AVG PRCNT CO2	-------	5.96	%
AVG PPM SO2	-------	501 PPM	AVG BAL CO2/CO	-------	3.98	%

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul TEST No. 6

MODEL: F600 DATE: 07-May-03

****

STD SAMPLE VOL. Vm(std) -----	130.75	dscf	STACK GAS FLOW Qsd -------	456.953	dscf/Hr
				7.62	& dscf/min
VOL. WATER VAPOR Vw(std) ----	13.486	scf	PARTICULATE CONCTRT. Cs ------	0.0106	g/dscf
PRCNT MSTR Bws -------	9.35	%	PARTC.EMISS. RATE E -------	4.84	g/Hr
BURN RATE BR -------	1.11	Kg/Hr	MOLES OF GAS PER Lb WOOD Nt --	0.48	Lb-mole/Lb
CO EMISSION RATE -------	229.39	g/Hr	PART.EMISS. RATE ------	4.35	g/Kgdry fuel
	205.91	& g/Kgdry fuel			

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Jotul TEST No. : 6

MODEL: F600 DATE: 07-May-03

TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR	PROPRTN RATE VAR. AVERAGE
5	873.9	98	100
10	888.5	99	
15	894.5	100	
20	895.0	100	
25	894.0	100	
30	896.2	100	
35	896.2	100	
40	897.0	100	
45	895.0	100	
50	894.5	100	
55	894.4	100	
60	894.5	100	
65	894.0	100	
70	894.4	100	
75	894.0	100	
80	894.2	100	
85	894.2	100	
90	894.0	100	
95	894.4	100	
100	894.0	100	
105	894.5	100	
110	894.4	100	
115	893.6	100	
120	895.7	100	
125	896.1	100	
130	896.0	100	
135	895.6	100	
140	896.2	100	
145	895.7	100	
150	896.1	100	
155	896.2	100	
160	896.0	100	
165	896.0	100	
170	896.3	100	
175	895.7	100	
180	895.2	100	
185	896.9	100	
190	896.9	100	
195	896.9	100	
200	896.9	100	
205	896.9	100	
210	897.7	100	
215	895.5	100	
220	895.0	100	

225	895.0	100
230	895.0	100
235	895.5	100
240	895.8	100
245	893.4	100
250	894.0	100
255	893.4	100
260	893.4	100
265	893.4	100
270	894.0	100
275	893.4	100
280	893.4	100
285	893.4	100
290	893.4	100
295	893.9	100
300	893.4	100
305	893.4	100
310	894.0	100
315	893.4	100
320	893.4	100
325	893.4	100
330	893.4	100
335	894.0	100
340	893.6	100
345	893.1	100
350	893.6	100
355	893.6	100
360		
365		

METER BOX DATA SHEET PAGE # 2

Page: 1 of 3

UNIT: F-600 RUN: 6 DATE: 5-7-03

Meter Box: 5H Y Factor: .990

Leak checks: 15 " Hg @ .010 cfm _____ " Hg @ _____ cfm

15 " Hg @ .017 cfm _____ " Hg @ _____ cfm

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

ROTO: PRESS: .16			SAMPLING RATIO: 19 : 1				BP: 29.95		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1355	841.500	—	5.775	.15	79	600	79	2.0
5	1400	843.006	—	12.599	.72	79	275	79	5.0
10	05	846.329	846.329	6.003	.16	81	575	81	2.0
15	10	847.937	847.937	5.753	.15	81	600	81	2.0
20	15	849.479	849.479	5.523	.14	81	625	81	2.0
25	20	850.959	850.959	5.301	.13	82	650	82	2.0
30	25	852.387	852.387	5.301	.13	82	650	82	2.0
35	30	853.815	853.815	5.301	.13	82	650	82	2.0
40	35	855.243	855.243	6.276	.18	81	550	81	2.0
45	40	856.925	856.925	6.575	.20	81	525	81	2.0
50	45	858.686	858.686	7.267	.24	81	475	81	2.0
55	50	860.632	860.632	8.122	.30	81	425	81	2.0
ROTO PRESS: .16			TOTALS:	79.796	2.63	971	BP.: 29.95		
60	1455	862.807	862.807	9.205	.38	81	375	81	2.0
65	1500	865.270	865.270	9.205	.38	81	375	81	2.0
70	05	867.734	867.734	9.205	.38	81	375	81	2.0
75	10	870.197	870.197	9.863	.44	81	350	81	3.0
80	15	872.836	872.836	9.863	.44	81	350	81	3.0
85	20	875.475	875.475	9.205	.38	81	375	81	3.0
90	25	877.938	877.938	9.205	.38	81	375	81	3.0
95	30	880.402	880.402	9.205	.38	81	375	81	3.0
100	35	882.865	882.865	8.122	.30	81	425	81	3.0
105	40	885.040	885.040	7.671	.27	81	450	81	3.0
110	45	887.094	887.094	7.671	.27	81	450	81	4.0
115	50	889.148	889.148	8.614	.33	82	400	82	4.0
			TOTALS:	107.034	4.33	973	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	186.830	6.96	1944	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 2 of 3

UNIT: F600 RUN: 6 DATE: 5-7-03

Meter Box: SH Y Factor: .990

Leak checks: 15 " Hg @ .010 cfm _____ " Hg @ _____ cfm

15 " Hg @ .017 cfm _____ " Hg @ _____ cfm

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

ROTO: PRESS: .15			SAMPLING RATIO: 19 : 1				BP: 29.95		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1555	891.466	891.466	8.614	.33	82	400	82	4.0
125	1600	893.785	893.785	9.188	.38	82	375	82	4.0
130	05	896.258	896.258	9.188	.38	82	375	82	4.0
135	10	898.730	898.730	8.107	.30	82	425	82	3.0
140	15	900.913	900.913	8.614	.33	82	400	82	3.0
145	20	903.231	903.231	8.614	.33	82	400	82	3.0
150	25	905.550	905.550	8.107	.30	82	425	82	3.0
155	30	907.733	907.733	7.254	.24	82	475	82	3.0
160	35	909.686	909.686	7.254	.24	82	475	82	3.0
165	40	911.639	911.639	6.863	.19	82	525	82	3.0
170	45	913.407	913.407	6.265	.18	82	550	82	3.0
175	50	915.093	915.095	6.265	.18	83	550	82	3.0
ROTO PRESS: .15			TOTALS:	94.033	3.38	985	BP.: 29.93		
180	1655	916.782	916.782	6.559	.19	82	525	82	3.0
185	1700	918.551	918.551	6.559	.19	82	525	82	3.0
190	05	920.320	920.320	6.559	.19	82	525	82	3.0
195	10	922.089	922.089	6.559	.19	82	525	82	3.0
200	15	923.858	923.858	6.559	.19	82	525	82	2.0
205	20	925.627	925.627	6.559	.19	82	525	82	2.0
210	25	927.396	927.396	6.571	.20	81	525	81	2.0
215	30	929.159	929.159	6.571	.20	81	525	81	2.0
220	35	930.921	930.921	6.571	.20	81	525	81	2.0
225	40	932.683	932.683	6.571	.20	81	525	81	2.0
230	45	934.445	934.445	6.272	.18	81	550	81	2.0
235	50	936.128	936.128	6.272	.18	81	550	81	2.0
			TOTALS:	78.182	2.30	978	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	172.215	5.68	1963	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 3 of 3

UNIT: F600 RUN: 6 DATE: 5-7-03

Meter Box: 5H Y Factor: .990

Leak checks: 15 " Hg @ 1010 cfm _____ " Hg @ _____ cfm

15 " Hg @ 1017 cfm _____ " Hg @ _____ cfm

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

ROTO: PRESS: .15			SAMPLING RATIO: 19		: 1		BP: 29.93		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
240	1755	937.810	937.810	6.284	.18	80	550	80	2.0
245	1800	939.486	939.486	6.284	.18	80	550	80	2.0
250	05	941.163	941.163	6.284	.18	80	550	80	2.0
255	10	942.839	942.839	6.284	.18	80	550	80	2.0
260	15	944.515	944.515	6.284	.18	80	550	80	2.0
265	20	946.191	946.191	6.284	.18	80	550	80	2.0
270	25	947.868	947.868	6.284	.18	80	550	80	2.0
275	30	949.544	949.544	6.284	.18	80	550	80	2.0
280	35	951.220	951.220	6.284	.18	80	550	80	2.0
285	40	952.896	952.896	6.284	.18	80	550	80	2.0
290	45	954.572	954.572	6.010	.16	80	575	80	2.0
295	50	956.176	956.176	6.284	.18	80	550	80	2.0
ROTO PRESS: .15			TOTALS:	75.134	2.14	960	BP.: 29.93		
300	1855	957.852	957.852	6.284	.18	80	550	80	2.0
305	1900	959.528	959.528	6.284	.18	80	550	80	2.0
310	05	961.205	961.205	6.284	.18	80	550	80	2.0
315	10	962.881	962.881	6.284	.18	80	550	80	2.0
320	15	964.557	964.557	6.284	.18	80	550	80	2.0
325	20	966.233	966.233	6.284	.18	80	550	80	2.0
330	25	967.909	967.909	6.284	.18	80	550	80	2.0
335	30	969.586	969.586	6.583	.20	80	525	80	2.0
340	35	971.342	971.342	6.583	.20	80	525	80	2.0
345	40	973.097	973.097	6.583	.20	80	525	80	2.0
350	45	974.853	974.853	6.583	.20	80	525	80	2.0
355	50	976.609	976.609	6.583	.20	80	525	80	2.0
			TOTALS:	76,903	2.26	960	MAX VACC =		5.0
TOTAL Cu Ft.		135.109	TOTALS:	511.082	17.04	5821	AVG. BP: 29.94		

÷12 7.098 .237 81 (541)

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : F600 RUN : 6 DATE : 5-7-03

SCALE CHECK	LEVEL	ZEROED
INITIAL :	V	V
FINAL :		

SCALE	WEIGHT
295.0 g	295.0
590.0 g	590.0
885.0 g	885.6

IMPINGER	#1	#2	#3	#4
FINAL WT	765.5	696.3	488.1	854.9
INITIAL WT	620.8	586.2	484.0	827.3
NET WT GRAMS	144.7	110.1	4.1	27.6

TOTAL CATCH : 286.5 GRAMS H_2O

FRONT HALF

FILTER #	152F	
FINAL WT g	1.0525	
INITIAL WT g	.6982	
NET WT g	.3543	

BEAKER #	21
DESC.	ACETONE
FINAL WT g	108.3299
INITIAL WT g	108.2361
NET WT g	.0938
VOL. DESC. ml	65

BACK HALF

FILTER #	152B	
FINAL WT g	.5670	
INITIAL WT g	.4316	
NET WT g	.1354	

BEAKER #	22	23	24	25	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	106.3533	104.7183	106.5517	97.6035	
INITIAL WT g	105.9358	104.5890	106.4081	97.4858	
NET WT g	.4175	.1293	.1436	.1177	.2613
VOL. DESC ml	200	75	200	175	(375)

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 01/17/03 Time : 2055 By : [signature]

Manufacturer S & S Grade : # 25 Glass Front Size : 11 cm Lot No. : ZB921

Back Size: 8.2 cm Lot No. : ZB911

	DATE: 01/21/03	BY: [signature]	DATE: 01/22/03	BY: [signature]	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
151F	.6940	0954	.6941	1128	JOEL F600	R-5
152F	.6984	0955	.6982	1129	" "	R-6
153F	.6999	0955	.6998	1130		
154F	.6969	0956	.6968	1131		
155F	.6984	0957	.6985	1131		
156F	.6915	0958	.6914	1132		
157F	.6974	0959	.6976	1133		
158F	.6990	0959	.6990	1134		
159F	.6931	1000	.6932	1135		
160F	.6989	1001	.6992	1135		
151B	.4360	1002	.4359	1136	JOEL F600	R-5
152B	.4316	1002	.4316	1137	" "	R-6
153B	.4307	1003	.4311	1138		
154B	.4295	1004	.4293	1138		
155B	.4321	1005	.4323	1139		
156B	.4243	1006	.4245	1140		
157B	.4294	1006	.4294	1141		
158B	.4350	1007	.4354	1142		
159B	.4290	1008	.4290	1142		
160B	.4274	1009	.4274	1143		

Checked by: [signature] Date: 1-22-03 Time: 1149

SCALE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	DB	% RH
01/21	0935	[signature]	75	44
01/22	1125	[signature]	77	46

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 02-13-03 Time : 1130 By : [illegible]

	DATE: 02-24-03	BY: [illegible]	DATE: 02-25-03	BY: [illegible]	DATE:	BY:
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
21	108.2356	1057	108.2361	1703		
22	105.9359	1058	105.9358	1704	JOUL FLOW	
23	104.5887	1059	104.5890	1706	R-6	
24	106.4077	1100	106.4081	1707		
25	97.4855	1101	97.4858	1708		
26	101.0348	1103	101.0350	1709		
27	106.3729	1104	106.3733	1710		
28	105.7468	1105	105.7471	1711		
29	104.4553	1106	104.4556	1712		
30	107.3596	1108	107.3595	1713		
31	95.5543	1109	95.5545	1714		
32	107.8687	1110	107.8685	1716		
33	101.1768	1111	101.1772	1717		
34	106.4685	1113	106.4688	1718		
35	96.5633	1114	96.5636	1720		
36	94.4608	1115	94.4611	1721		
37	106.6052	1117	106.6054	1722		
38	96.2539	1118	96.2540	1724		
39	97.1420	1119	97.1424	1725		
40	106.4705	1120	106.4706	1726		
41	105.4920	1122	105.4918	1728		
42	104.6722	1123	104.6725	1729		
43	107.3611	1124	107.3613	1730		
44	107.7968	1126	107.7971	1732		
45	94.9420	1127	94.9423	1733		

SCALE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	DB	% RH
02-24	1055	[illegible]	74	44
02-25	1700	[illegible]	77	45

Checked by : [illegible]
Date : 2-27-03
Time : 13:14

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : F600 **RUN :** 6 **DATE :** 5-7-03 **Page :** 1 **of** 1

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
21	05/08	2000		108.3303	05/10	1501		(108.3299)	05/11	1226					
22	05/08	2000		106.3543	05/10	1502		106.3536	05/11	1227		(106.3533)	05/12	0948	
23	05/09	1400		104.7211	05/10	1503		104.7200	05/11	1228		104.7186	05/12	0949	
				(104.7183)	05/13	0913									
24	05/08	2000		106.5522	05/10	1504		106.5513	05/11	1230		(106.5517)	05/12	0951	
25	05/08	2000		97.6038	05/10	1506		97.6031	05/11	1231		(97.6035)	05/12	0952	

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
152F	5-7	2000		1.0527	05/09	0749		(1.0525)	05/10	1507					
152B	5-7	2000		.5693	05/09	0750		.5682	05/10	1508		.5672	05/11	1232	
				(.5670)	05/12	0954									

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	05/09	0715		77	45
2	05/10	1435		78	47
3	05/11	1210		77	46
4	05/12	0940		76	45
5	05/13	0910		77	46

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

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 05-18-2002 Through 10-27-2002	Scale: Sartorius	Model: A 120 S	SN: 37010004

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9999	10.0000	.9999	.0999		05-18	1905	77	49
99.9997	9.9998	.9999	.0998		05-19	1500	77	48
99.9999	10.0000	.9998	.0999		05-20	0855	77	47
99.9998	9.9998	1.0000	.0999		05-21	0930	78	49
99.9998	9.9999	1.0000	.1000		05-22	1155	78	48
99.9999	9.9999	1.0000	.1001		05-22	1920	78	49
99.9999	10.0001	1.0001	.0998		05-23	2105	77	48
99.9998	9.9998	.9998	.0999		05-28	1225	78	49
99.9998	9.9997	1.0001	.0999		05-28	1625	78	47
99.9997	10.0001	1.0002	.1000		06-27	1950	78	49
99.9998	10.0001	1.0002	.1001		06-29	1830	78	49
99.9997	9.9999	1.0000	.0998		07-01	0845	77	49
100.0000	9.9999	1.0002	.1000		07-01	2220	78	47
99.9998	10.0000	.9999	.0999		08-14	1130	78	49
100.0001	9.9999	1.0000	.1000		08-16	1045	78	49
100.0000	9.9998	1.0000	.0998		08-22	1040	78	49
99.9997	9.9999	.9999	.0997		08-23	0700	78	49
99.9998	10.0000	1.0000	.0998		08-29	0915	78	49
100.0000	10.0000	1.0002	.1001		08-29	2225	78	49
99.9998	9.9999	1.0001	.0998		09-03	1120	78	49
99.9997	9.9998	.9999	.0998		09-03	2230	78	49
100.0000	10.0001	.9999	.0999		09-05	1915	78	49
99.9999	9.9999	1.0000	.0999		09-06	1815	78	48
99.9997	9.9999	1.0000	.0998		09-07	1355	78	47
100.0000	10.0002	.9998	.0997		9-10	1110	77	42
99.9997	10.0002	1.0000	.0100		9-11	1500	74	47
99.9999	9.9999	1.0000	.0997		9-13	2020	76	38
100.0003	10.0002	1.0002	.0998		9-14	1300	76	41
100.0000	10.0001	1.0000	.0999		9-16	1930	74	44
100.0000	9.9999	.9998	.0999		9-17	1710	77	42
100.0000	10.0001	1.0000	.1000		9-19	1000	74	47
100.0001	10.0000	.9998	.0999		9-20	1115	74	44
99.9998	9.9999	1.0001	.0999		10-18	2155	77	44
99.9997	9.9999	1.0000	.1000		10-22	2255	77	46
100.0001	10.0002	1.0000	.0999		10-23	2315	77	42
99.9997	9.9998	.9999	.1000		10-25	1350	77	43
99.9998	9.9999	1.0000	.1000		10-26	1735	77	41
99.9998	9.9998	.9999	.1000		10-27	1130	77	36
99.9998	9.9999	.9999	.0999		10-27	1435	77	38

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 12-05-2002 Through 02-23-2003	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	9.9998	1.0000	.0997		12-05	1825	77	47
99.9998	10.0000	.9999	.1000		12-06	1125	77	45
99.9997	10.0001	1.0000	.1000		12-07	1310	76	41
99.9997	10.0001	1.0000	.0999		12-08	1430	77	44
99.9998	9.9999	1.0001	.0999		12-09	1125	78	44
99.9998	10.0000	.9999	.0998		12-10	1220	78	43
99.9997	10.0000	.9998	.0998		12-11	1650	77	45
99.9997	10.0001	.9999	.0999		12-12	1445	77	47
99.9998	10.0000	.9999	.1000		12-14	1530	78	47
99.9997	10.0000	1.0000	.0999		01-10	2300	78	48
99.9998	9.9999	1.0001	.1000		01-14	1175	77	48
99.9999	10.0000	.9999	.1000		01-15	1705	77	48
99.9999	10.0001	.9999	.0998		01-16	1830	78	46
99.9997	10.0000	1.0000	.0999		01-17	1215	77	41
99.9997	9.9999	1.0000	.0999		01-17	2035	76	42
99.9996	10.0000	.9999	.0999		01-18	1730	77	43
99.9999	9.9999	.9998	.0999		01-19	1210	76	42
99.9998	10.0000	1.0000	.0999		01-20	2105	76	44
99.9999	10.0000	.9999	.0998		01-21	0935	75	44
99.9998	10.0000	.9999	.0999		01-22	1125	77	46
100.0000	9.9998	.9999	.1000		01-23	1430	77	48
99.9999	10.0001	1.0001	.1000		01-24	1200	76	48
99.9998	9.9999	.9999	.0999		01-25	1140	76	47
99.9997	10.0000	1.0000	.0999		01-25	1850	78	48
99.9998	9.9998	1.0000	.1000		01-27	1415	75	47
99.9999	9.9999	1.0000	.1000		01-30	1920	77	48
99.9998	10.0000	.9998	.0999		01-31	2205	78	47
99.9999	9.9998	.9998	.1000		02-01	1855	77	47
99.9997	9.9998	.9999	.1001		02-02	1420	76	46
99.9997	10.0001	.9998	.0999		02-18	1155	77	49
99.9999	9.9999	.9999	.0999		02-19	1925	77	48
99.9997	10.0000	1.0000	.0999		02-22	2010	78	45
99.9997	10.0000	.9999	.1000		02-23	1130	78	44

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates: From 02-24-2003 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
99.9998	10.000	1.0000	.0999		02-24	1055	74	44
99.9997	9.9998	1.0001	.0999		02-25	1700	77	45
100.0000	10.0001	1.0000	.0998		03-01	1010	71	44
99.9997	10.0001	.9998	.0999		03-02	1420	75	45
99.9998	10.0000	.9999	.1000		03-03	1205	76	45
99.9998	10.0000	1.0000	.1000		03-03	2005	77	47
100.0000	10.0001	1.0001	.0999		03-04	1035	75	47
99.9996	10.0001	1.0000	.0999		03-05	0945	71	47
99.9997	10.0001	1.0000	.1000		03-06	1340	74	46
99.9998	9.9999	1.0000	.0998		03-07	2050	76	45
99.9998	9.9999	1.0000	.0999		03-08	1150	77	45
99.9997	9.9998	1.0000	.1000		03-09	1350	76	45
99.9998	10.0000	.9999	.1000		03-10	1220	77	47
99.9997	9.9999	1.0000	.1000		03-18	1740	77	46
99.9997	9.9999	1.0000	.0999		03-20	2145	74	45
99.9998	10.0000	1.0000	.0998		03-22	1725	76	47
99.9997	10.0000	.9999	.1000		03-23	1405	77	47
99.9998	9.9998	.9999	.0999		03-24	1450	74	44
100.0000	9.9998	1.0000	.0998		03-25	1120	75	45
99.9998	10.0000	.9999	.0999		04-30	2300	75	47
99.9997	10.0001	.9999	.1000		05-02	1130	77	49
99.9998	9.9998	1.0000	.0999		05-06	2135	77	46
99.9997	9.9999	1.0001	.0999		05-09	0715	77	45
99.9998	10.0000	.9999	.0999		05-10	1435	78	47
99.9998	9.9999	1.0000	.0998		05-11	1210	77	46
99.9999	10.0001	.9999	.0999		05-12	0940	76	45
10.0001	10.0000	.9999	1.0000		05-13	0910	77	46

BLANK PROCESSING DATA SHEET # 5

UNIT : F600 RUN : 6 DATE : 05/07/03

DATE BLANKS DONE : 02-23-03

BEAKER	A	B	C
	200 ml ACETONE	75 ml DICHLOR	200 ml WATER
	FISHER OPTIMA LOT # 011755	FISHER OPTIMA LOT # 994669	DWNA, INC. SPARKLETTES DISTILLED
FINAL WEIGHT	108.9007	106.3074	106.9660
TARE WEIGHT	108.8995	106.3057	106.9646
NET WEIGHT	.0012 ✓	.0017 ✓	.0014 ✓

TARE BEAKERS INTO DESC : TIME : 1430 DATE : 02-12-03

DATE : 02-18 BY : [redacted] DATE : 02-19 BY : [redacted] DATE : BY :

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.8996	1158	108.8995	1928	✓	
B	106.3060	1159	106.3057	1930	✓	
C	106.9649	1200	106.9646	1931	✓	

FINAL BEAKERS INTO DESC : TIME : 1600 DATE : 02-20-03

DATE : 02-22 BY : [redacted] DATE : 02-23 BY : [redacted] DATE : BY :

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9010	2013	108.9007	1132	✓	
B	106.3078	2015	106.3074	1133	✓	
C	106.9661	2016	106.9660	1134	✓	

TARE QC

DATE	TIME	BY	WB	DB	%
02-18	1155	[redacted]	(	77	49
02-19	1925	[redacted]	)	77	48

FINAL QC

DATE	TIME	BY	WB	DB	%
02-22	2010	[redacted]	(	78	45
02-23	1130	[redacted]	)	78	44

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT: F600 RUN: 6 DATE: 05/07/03

BLANK CALCULATIONS

Acetone: .0012 g ÷ 200 ml = .000006 g/ml
Dicholoromethane: .0017 g ÷ 75 ml = .000023 g/ml
Distilled Water: .0014 g ÷ 200 ml = .000007 g/ml

FRONT HALF CATCH

FILTERS: .3543 g (Total Catch) - 1 (# of Filters) (.0000 g (Blank Value / Filter)) = .3543 g

BEAKERS: .0938 g (Total Catch) - 65 (ml Acetone) (.000006 g (Blank Value / ml Acetone)) = .0934 g

TOTAL FRONT HALF CATCH: .4477 g

BACK HALF CATCH

FILTERS: .1354 g (Total Catch) - 1 (# of Filters) (.0000 g (Blank Value / Filter)) = .1354 g

BEAKERS:

Acetone: .4175 g (Total Catch) - 200 (ml Acetone) (.000006 g (Blank Value / ml Acetone)) = .4163 g

Extract: .1293 g (Total Catch) - 75 (ml Dichloromethane) (.0017 .000023 g (Blank Value / Dichloromethane)) = .1276 g

Water: .2613 g (Total Catch) - 375 (ml Water) (.000007 g (Blank Value / Water)) = .2587 g

TOTAL BACK HALF CATCH: .9380 g

TOTAL CATCH: 1.3857 g

% FRONT HALF: 32.3 % (00.0)

CALCULATIONS DATA SHEET # 7

UNIT : JOTUL F6000 RUN : 6 DATE : 05/07/03

1) $Vm(std) = \dfrac{(135.109\ Vm)(17.64)(.990\ mcf)\left(29.94\ "Hg + \frac{.237\ "H_2O}{13.6}\right)}{(541\ TmA)} = \dfrac{130.6548}{000.0000}$ dscf

2) $Vw(std) = (.04707)(286.5\ ml\ H_2O) = \dfrac{13.4856}{00.0000}$ scf

3) $Asw = \dfrac{(13.4856\ scf)}{(13.4856\ scf + 130.6548\ dscf)} = \dfrac{.0936}{.0000}$ Bws × 100 = $\dfrac{9.3558}{00.0000}$ % H_2O

4) $Cs = \dfrac{(1.3857\ g.)}{(130.6548\ dscf)}(15.43) = \dfrac{.1636}{0.0000}$ gr / dscf

5) Estimated g / hr = $\dfrac{(1.3857\ g.)}{(130.6548\ dscf)}\left(\dfrac{7.098}{00.0000}\ dscfm\right)(60) = \dfrac{4.5168}{00.0000}$ 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: F600 RUN: 6 DATE: 5-7-03

Test Chamber Air Velocity Start: 0 Stop: 0 Avg.: 0

Wet Bulb / Dry Bulb

Pre : WB: 58 DB: 77 = 29 % RH 1.0 % H_2O

Post : WB: 59 DB: 77 = 32 % RH 1.0 % H_2O

Average: 30.5 % RH 1.0 % H_2O

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

Kindling Weight (lbs): Paper: .3 Wood: 3.8

Preburn Fuel Weight: 20.0 + 14.5 + 17.8 Total: 52.3

Kindling & Preburn Fuel Weight (wood only) (lbs): **Total:** 56.1

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

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

Lower : .20 x fuel weight : Always round UP to nearest tenth **Actual Coal Bed Weight:** 4.4

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

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

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" x 4"	17	4	9.5	53.4
4" x 4"	17	2	8.3	46.6

Test Fuel Weight: 17.8 lbs

Estimated Dry Burn Rate:

$$\frac{17.8 - (17.8 \times .18345)}{2.2046} \times \frac{60}{\frac{355}{\text{TIME}}} = 1.114 \text{ kg / hr}$$

Estimated BTU's/hr: 19,140 $\times \frac{63}{100} \times \frac{1.114}{\text{DBR}} =$ 13,436.3 BTU's/hr

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

WOOD STOVE OPERATING DATA PAGE #9

Unit : F600 Run : 6 Date : 5-703

FIRE STARTED: 0915

WARM UP AND PREBURN:

PRIMARY AIR : Set wide open for all warm-up / preburn fuel charges. Then set to 3/16" 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 ½ min. prior to loading last fuel, raked and leveled. In stove 35 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 3/16".

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

FAN:

ON / OFF during warm-up

ON / OFF during preburn

ON / OFF first ALL minutes of test

ON / OFF balance of test run

Fan speed set at OFF

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 16 or — inches.

1st warm up / pre-burn fuel charge (20.0 ✓ lbs.) added at 0925

2nd warm up / pre-burn fuel charge (14.5 ✓ lbs.) added at 1030

3rd warm up / pre-burn fuel charge (17.8 ✓ lbs.) added at 1135

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 : F600 Run : 6 Date : 5-7-03

Room Temperature : 72 °F Correction Factor : Ø

Uncorrected Values are corrected for room temperature : Yes _____ No ✓

Time Test Fuel moisture reading taken : 1040

Calibration Checks : X ✓ Y ✓ 12.0 12.1 22.0 22.1

pc #	Dimen.	Use	TOP		BOTTOM		SIDE		Average Corrected
			Uncor.	Cor.	Uncor.	Cor.	Uncor.	Cor.	
1	2"x4"x8'	K	17.0	18.2	16.5	17.6	16.5	17.6	17.800
2									
3									
4	2"x4"x8'	P	18.5	19.8	19.5	20.9	19.5	20.9	20.533
5	2"x4"x8'	P	20.0	21.4	20.0	21.4	20.0	21.4	21.400
6	2"x4"x8'	P	22.5	24.1	21.0	22.5	21.5	23.1	23.233
7	2"x4"x8'	P	18.0	19.2	19.5	20.9	18.5	19.8	19.967
8	2"x4"x8'	P							85.133
9									
10		T	17.5	18.7	18.5	19.8	18.5	19.8	19.433
11		T	21.5	23.1	21.5	23.1	21.5	23.1	23.100
12		T	21.5	23.1	20.0	21.4	22.0	23.7	22.733
13		T	23.5	25.2	23.5	25.2	23.5	25.2	25.200
14	4x4x17	T	20.5	22.0	20.5	22.0	20.5	22.0	22.000
15	"	T	20.5	22.0	21.0	22.5	21.0	22.5	22.333
16									134.799
17									
18									
19									
20	Spacers	T	21.5	23.1	22.0	23.7	22.0	23.7	23.500

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	17.800 %	21.283 %	22.467 %
Wet Moisture % :	15.110 %	17.548 %	18.345 %

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

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

GAS DATA SHEET #12

WEIGHT: 4.4 DATE: 05/07/03

UNIT: F600 RUN: 6 PAGE: 1 OF 2

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
0 1355	22.2	17.8	-	.061	1.5	.746	18.6	.066	.67	-.024	600
5 1400	21.7	17.3	.5	.193	4.8	.622	15.6	.044	.45	-.032	275
10 05	21.5	17.1	.2	.122	3.0	.684	17.1	.066	.67	-.027	575
15 10	21.3	16.9	.2	.133	3.3	.671	16.8	.072	.73	-.025	600
20 15	21.1	16.7	.2	.147	3.6	.653	16.3	.081	.82	-.025	625
25 20	20.9	16.5	.2	.161	4.0	.636	15.9	.090	.91	-.024	650
30 25	20.6	16.2	.3	.176	4.4	.622	15.5	.088	.89	-.024	650
35 30	20.2	15.8	.4	.227	5.6	.553	13.8	.133	1.34	-.027	650
40 35	19.7	15.3	.5	.256	6.4	.528	13.2	.122	1.23	-.029	550
45 40	19.2	14.8	.5	.228	5.7	.564	14.1	.103	1.04	-.031	525
50 45	18.8	14.4	.4	.328	8.2	.467	11.7	.094	.95	-.035	475
55 50	18.0	13.6	.8	.367	9.1	.439	11.0	.067	.68	-.038	425
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.341	*****
60 1455	17.4	13.0	.6	.398	9.9	.417	10.4	.044	.45	-.041	375
65 1500	16.7	12.3	.7	.389	9.7	.432	10.8	.028	.29	-.045	375
70 05	16.2	11.8	.5	.321	8.0	.485	12.1	.066	.67	-.043	375
75 10	15.6	11.2	.6	.352	8.8	.462	11.5	.047	.48	-.045	350
80 15	15.0	10.6	.6	.387	9.6	.431	10.8	.036	.37	-.046	350
85 20	14.4	10.0	.6	.392	9.8	.427	10.7	.035	.36	-.046	375
90 25	13.7	9.3	.7	.394	9.8	.423	10.6	.039	.40	-.047	375
95 30	13.1	8.7	.6	.401	10.0	.415	10.4	.041	.42	-.048	375
100 35	12.6	8.2	.5	.354	8.8	.463	11.6	.036	.39	-.045	425
105 40	12.2	7.8	.4	.293	7.3	.503	12.6	.092	.93	-.042	450
110 45	11.8	7.4	.4	.288	7.2	.501	12.5	.109	1.10	-.041	450
115 50	11.3	6.9	.5	.359	8.9	.448	11.2	.064	.65	-.043	400
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.532	*****
120 1555	10.7	6.3	.6	.415	10.3	.400	10.0	.044	.45	-.046	400
125 1600	10.1	5.7	.6	.469	11.7	.349	8.7	.036	.37	-.047	375
130 05	9.4	5.0	.7	.471	11.7	.345	8.6	.042	.43	-.048	375
135 10	8.9	4.5	.5	.433	10.8	.385	9.6	.036	.37	-.046	425
140 15	8.5	4.1	.4	.350	8.7	.476	11.9	.017	.18	-.045	400
145 20	8.2	3.8	.3	.348	8.7	.473	11.8	.028	.29	-.043	400
150 25	7.9	3.5	.3	.326	8.1	.489	12.2	.045	.46	-.042	425
155 30	7.7	3.3	.2	.265	6.6	.519	13.0	.121	1.22	-.039	475
160 35	7.5	3.1	.2	.265	6.6	.521	13.0	.116	1.17	-.038	475
165 40	7.4	3.0	.1	.222	5.5	.535	13.4	.188	1.89	-.036	525
170 45	7.2	2.8	.2	.198	4.9	.548	13.7	.216	2.17	-.033	550
175 50	7.1	2.7	.1	.189	4.7	.553	13.8	.228	2.29	-.031	550
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.494	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-1.367	*****

GAS DATA SHEET #12

WEIGHT: 4.4 DATE: 05/07/03

UNIT: F600 RUN: 6 PAGE: 2 OF 2

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	STATIC	SO_2PPM
180 1655	7.0	2.6	.1	.178	4.4	.562	14.0	.232	2.33	-.030	525
185 1700	7.0	2.6	⊖	.176	4.4	.561	14.0	.240	2.41	-.030	525
190 05	6.9	2.5	.1	.182	4.5	.551	13.8	.249	2.50	-.028	525
195 10	6.9	2.5	⊖	.182	4.5	.552	13.8	.247	2.48	-.028	525
200 15	6.8	2.4	.1	.184	4.6	.549	13.7	.249	2.50	-.027	525
205 20	6.7	2.3	.1	.189	4.7	.540	13.5	.259	2.60	-.026	525
210 25	6.7	2.3	⊖	.185	4.6	.553	13.8	.237	2.38	-.026	525
215 30	6.6	2.2	.1	.186	4.6	.553	13.8	.234	2.35	-.026	525
220 35	6.5	2.1	.1	.183	4.5	.552	13.8	.245	2.46	-.025	525
225 40	6.4	2.0	.1	.183	4.5	.551	13.8	.246	2.47	-.025	525
230 45	6.3	1.9	.1	.181	4.5	.556	13.9	.240	2.41	-.025	550
235 50	6.3	1.9	⊖	.181	4.5	.559	14.0	.231	2.32	-.025	550
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.321	*****
240 1755	6.1	1.7	.2	.181	4.5	.561	14.0	.226	2.27	-.024	550
245 1800	6.1	1.7	⊖	.180	4.5	.563	14.1	.225	2.26	-.024	550
250 05	6.0	1.6	.1	.179	4.4	.563	14.1	.226	2.27	-.023	550
255 10	6.0	1.6	⊖	.174	4.3	.570	14.2	.222	2.23	-.022	550
260 15	5.9	1.5	.1	.174	4.3	.568	14.2	.227	2.28	-.022	550
265 20	5.9	1.5	⊖	.170	4.2	.576	14.4	.218	2.19	-.022	550
270 25	5.8	1.4	.1	.173	4.3	.572	14.3	.219	2.20	-.021	550
275 30	5.7	1.3	.1	.172	4.3	.572	14.3	.221	2.22	-.021	550
280 35	5.7	1.3	⊖	.173	4.3	.571	14.3	.223	2.24	-.021	550
285 40	5.5	1.1	.2	.173	4.3	.573	14.3	.218	2.19	-.021	550
290 45	5.5	1.1	⊖	.170	4.2	.577	14.4	.215	2.16	-.021	575
295 50	5.5	1.1	⊖	.169	4.2	.579	14.5	.213	2.14	-.022	550
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.264	*****
300 1855	5.4	1.0	.1	.168	4.2	.580	14.5	.211	2.12	-.021	550
305 1900	5.3	.9	.1	.170	4.2	.577	14.4	.214	2.15	-.021	550
310 05	5.2	.8	.1	.172	4.3	.572	14.3	.222	2.23	-.021	550
315 10	5.1	.7	.1	.172	4.3	.573	14.3	.219	2.20	-.021	550
320 15	5.1	.7	⊖	.171	4.2	.576	14.4	.214	2.15	-.021	550
325 20	5.0	.6	.1	.170	4.2	.580	14.5	.208	2.09	-.021	550
330 25	4.9	.5	.1	.248	6.2	.515	12.9	.173	1.74	-.021	550
335 30	4.8	.4	.1	.240	6.0	.527	13.2	.163	1.64	-.021	525
340 35	4.7	.3	.1	.223	5.5	.541	13.5	.171	1.72	-.021	525
345 40	4.6	.2	.1	.203	5.0	.556	13.9	.185	1.86	-.021	525
350 45	4.5	.1	.1	.193	4.8	.560	14.0	.201	2.01	-.021	525
355 50	4.4	⊖	.1	.184	4.6	.569	14.2	.200	2.01	-.021	525
SUBTOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-.837	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	-2.204	*****

-.031 ÷ 72 ✓

PREBURN DATA SHEET #15

UNIT: F600 RUN: 6 DATE: 05/07/03 PAGE: 1 of 1

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
0 / 1245	5.4	—	446	460	500	424	439	293	937	1159	73	-.048	PREBURN START: # 1.0 UP
5 / 50	5.2	.2	321	432	487	449	427	304	865	1061	76	-.040	COAL BED SCALE RANGE:
10 / 55	5.1	.1	288	402	461	439	413	314	805	974	76	-.036	4.4 - 3.6
15 / 1300	5.1	0	269	374	434	425	392	317	759	904	78	-.035	PRIMARY AIR: 3/16"
20 / 05	5.0	.1	258	354	414	413	375	316	729	861	76	-.033	SECONDARY AIR: N/A
25 / 10	5.0	0	247	336	393	400	357	315	698	820	75	-.032	FAN: OFF
30 / 15	4.9	.1	239	319	377	390	344	311	676	795	75	-.030	PUMPS ON AT: 1325
35 / 20	4.8	.1	230	300	358	377	329	307	640	767	75	-.029	CHECK WB/DB: N/A
40 / 25	4.8	0	225	290	347	371	321	304	621	742	75	-.028	
45 / 30	4.7	.1	220	280	335	364	313	303	603	720	74	-.027	
50 / 35	4.6	.1	207	269	323	355	303	295	582	694	74	-.026	
55 / 40	4.6	0	202	262	313	349	295	293	571	681	74	-.025	
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	
60 / 1345	4.5	.1	198	252	304	344	288	289	559	668	74	-.025	
65 / 50	4.5	0	194	246	297	339	280	284	550	656	75	-.025	
70 / 55	4.4	.1	217	235	287	334	271	281	516	626	73	-.024	
75 / 1400													
80 / 05													

TEMPERATURE DATA SHEET #14

		TEST TIME	355		
STACK AVG	244	TOP AVG	275	LT SIDE AVG	276
BACK AVG	284	RT SIDE AVG	257	BOTTOM AVG	204
FIREBOX AVG	549	SEC/CAT AVG	775	AMBIENT AVG	72

END	221.4
START	281.7
	-60.3 DELTA T

CIRCLE: (LOSS) / GAIN

Jotul U.S.A., Inc. TEMPERATURE DATA SHEET #14A Run 6 05/07/2003

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
0	217	235	287	334	271	281	516	626	73	1296	237	58	248	38	39
5	364	241	274	317	261	271	429	1015	74	1303	237	42	248	38	37
10	207	235	261	294	251	260	406	598	72	1307	236	40	249	38	37
15	191	224	248	276	241	254	382	576	73	1310	236	41	248	39	38
20	185	216	237	261	231	248	366	584	72	1311	236	41	248	39	35
25	182	211	227	250	221	242	353	592	73	1311	236	41	248	37	35
30	181	206	219	239	214	237	343	859	73	1311	236	42	249	37	36
35	199	214	212	230	209	232	342	716	73	1311	236	42	249	36	37
40	222	221	207	223	204	227	344	875	73	1312	236	42	248	37	37
45	235	231	204	217	202	222	357	845	73	1317	237	42	249	36	38
50	257	240	202	213	201	216	367	1139	73	1322	237	42	248	37	38
55	296	273	204	211	204	213	382	1080	73	1330	237	43	248	36	37
60	327	312	209	210	210	207	403	1115	72	1338	238	43	248	36	36
65	351	343	217	212	220	205	437	1074	72	1342	238	43	249	34	37
70	337	352	225	214	231	203	458	947	73	1338	239	43	250	34	37
75	349	357	234	217	242	200	484	949	72	1331	238	43	249	34	35
80	369	372	246	221	252	199	512	997	73	1325	238	44	249	35	36
85	375	385	258	225	262	196	542	997	72	1322	238	44	249	35	37
90	377	393	271	231	272	197	568	1013	73	1319	238	44	249	35	37
95	382	401	283	237	282	196	597	1058	73	1316	239	45	249	35	36
100	345	404	296	245	292	197	615	998	73	1318	239	46	249	37	37
105	315	391	304	251	297	197	615	937	73	1321	238	46	249	37	37
110	308	379	306	256	298	196	616	920	73	1325	238	47	248	37	37
115	352	382	310	262	302	197	641	1023	73	1326	238	48	247	36	37
120	378	390	319	269	307	198	668	1064	73	1327	238	48	247	36	37
125	398	412	331	280	318	200	696	1099	74	1328	238	48	247	38	37
130	411	432	344	293	328	202	725	1134	74	1330	238	48	248	38	38
135	371	442	356	308	338	204	732	1122	75	1331	238	48	249	37	37
140	346	428	362	318	344	205	723	1050	75	1333	239	49	248	37	37
145	333	418	363	325	346	206	720	1041	74	1335	238	50	248	37	37
150	322	411	364	330	345	209	733	1021	75	1336	237	51	247	37	36
155	296	388	363	335	343	212	731	953	75	1337	236	51	246	37	37
160	284	368	361	339	341	212	733	919	75	1337	236	51	246	37	37
165	273	350	358	343	337	212	719	892	75	1337	235	51	245	37	38
170	247	333	353	342	333	214	693	842	75	1338	234	51	245	37	38
175	236	318	347	337	326	216	672	800	76	1337	234	52	244	38	38

Jotul U.S.A., Inc. TEMPERATURE DATA SHEET #14A Run 6 05/07/2003

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
180	228	304	338	332	319	215	653	768	74	1336	234	53	243	38	37
185	222	291	329	326	310	213	638	737	74	1335	233	53	243	36	37
190	216	280	321	322	301	213	626	716	74	1333	232	53	241	36	37
195	212	271	314	319	294	213	614	701	74	1331	232	53	242	37	37
200	207	261	308	316	286	212	604	687	73	1325	232	53	241	36	36
205	204	253	302	314	281	210	595	677	73	1320	234	53	243	35	36
210	202	246	296	313	272	209	587	671	73	1316	234	53	243	35	36
215	198	241	291	311	267	207	580	663	72	1311	234	53	242	35	36
220	195	236	287	310	261	205	572	655	71	1306	234	53	242	35	35
225	193	232	283	310	258	205	565	647	72	1303	235	53	242	35	35
230	191	227	280	309	253	203	558	640	71	1300	235	53	243	35	35
235	189	225	275	308	249	199	551	634	70	1297	235	52	242	34	35
240	188	221	273	308	245	198	544	628	70	1294	235	52	243	34	35
245	186	217	269	307	242	197	539	626	70	1292	235	53	242	35	34
250	185	215	266	306	238	196	535	621	70	1292	236	53	242	35	35
255	183	213	264	305	235	194	530	616	70	1292	236	53	243	35	35
260	182	211	260	303	233	191	527	611	70	1292	237	53	243	34	36
265	181	208	258	301	230	189	523	605	70	1293	237	53	243	34	36
270	179	206	257	299	227	190	521	598	71	1293	237	53	243	35	36
275	178	204	255	296	225	189	520	591	71	1292	236	53	243	35	35
280	178	201	252	292	222	186	520	586	69	1291	237	54	242	35	36
285	176	200	252	291	220	187	520	581	70	1290	236	54	243	36	35
290	176	199	250	290	217	183	518	575	69	1290	236	54	242	35	37
295	175	197	248	288	215	181	518	570	68	1296	236	55	242	36	36
300	173	196	247	286	214	179	517	565	67	1300	236	55	241	37	35
305	173	195	246	285	212	177	520	560	67	1303	235	55	240	37	37
310	174	193	246	286	211	179	525	556	69	1305	236	55	242	37	36
315	174	192	247	286	210	177	528	553	69	1307	236	57	243	37	37
320	174	191	248	287	209	175	530	551	69	1307	237	57	243	38	38
325	173	190	248	286	208	173	531	548	69	1307	237	57	243	38	36
330	176	189	248	285	208	174	539	580	69	1308	237	57	244	36	36
335	180	190	251	281	207	172	558	615	70	1309	237	57	244	36	38
340	180	191	252	278	207	174	560	610	69	1312	237	54	244	36	36
345	178	191	254	277	208	174	555	604	70	1313	236	53	244	36	36
350	178	192	255	275	208	174	547	596	69	1312	236	54	244	36	36
355	177	191	256	274	210	177	539	588	70	1313	236	54	245	37	36

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 05/07/03 Analyte : CO_2 (15-1)

Unit : FL000 Run # : 6

Zero Cyl. # : 042JAC 2-A Conc. : 0.00 % CO_2 Cyl. Press. : 900 PSI

Certified by : AIR LIQUIDE Date : 02-20-02

Span Cyl. # : CC-3131 Conc. : 12.40 % CO_2 Cyl. Press. : 1625 PSI

Certified by : AIR LIQUIDE Date : 03-13-03

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 : D. Wadsworth Time : 1215 Temp : 78 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.001	.048	.048	.191
SPAN	49.6	.496	12.40	49.4	.494	12.317	.083	.333

POST RUN Audit : by : D. Wadsworth Time : 2005 Temp : 70 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.023	.023	.091
SPAN	49.6	.496	12.40	49.5	.495	12.342	.058	.233

± 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 : 05/07/03 Analyte : O_2 (15-2)

Unit : F600 Run # : 6

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 % O_2 Cyl. Press. : 900 PSI

Certified by : AIR LIQUIDE Date : 02-20-02

Span Cyl. # : CC-3131 Conc. : 12.40 % O_2 Cyl. Press. : 1625 PSI

Certified by : AIR LIQUIDE Date : 03-13-03

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 : D. Washington Time : 1215 ✓ Temp : 78 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %	
	Meter	DVM	%	Meter	DVM	%			
ZERO	00.0	.000	00.0	00.0	.000	.025	+.025	+.101	✓
SPAN	12.50	.500	12.50	12.55	.501	12.526	+.026	+.105	✓

POST RUN Audit : by : D Washington Time : 2005 ✓ Temp : 70 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %	
	Meter	DVM	%	Meter	DVM	%			
ZERO	00.0	.000	00.0	00.0	.001	.050	+.050	+.201	✓
SPAN	12.50	.500	12.50	12.55	.501	12.526	+.026	+.105	✓

± 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 : 05/07/03 Analyte : CO (15-3)

Unit : F600 Run # : 6

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 % CO Cyl. Press. : 900 PSI

Certified by : AIR LIQUIDE Date : 02-20-02

Span Cyl. # : CC-3131 Conc. : 12.40 % CO Cyl. Press. : 1625 PSI

Certified by : AIR LIQUIDE Date : 03-13-03

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 : D. Wadington Time : 1215 Temp : 78 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.011	+.011	+.110
SPAN	50.2	.502	5.02	50.1	.501	5.020	.000	+.003

POST RUN Audit : by : D. Wadington Time : 2005 Temp : 70 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	+.001	.001	+.001	+.010
SPAN	50.2	.502	5.02	50.2	.502	5.030	+.010	+.097

± 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 : 05/07/03 Analyte : SO_2 (15-4)

Unit : F600 Run # : 6

Zero Cyl. # : 042JAC 2-A Conc. : 0.00 ppm SO_2 Cyl. Press. : 900 PSI

Certified by : AIR LIQUIDE Date : 02-20-02

Span Cyl. # : CC62184 Conc. : 1290 ppm SO_2 Cyl. Press. : 1025 PSI

Certified by : AIR LIQUIDE Date : 01-29-01

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 : D. Wadsworth Time : 1210 Temp : 77 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.2	.002	11.696	+11.696	+.468
SPAN	51.6	.516	1290	51.8	.518	1295.028	+5.028	+.201

POST RUN Audit : by : D. Wadsworth Time : 2005 Temp : 70 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.2	.002	11.696	+11.696	+.468
SPAN	51.6	.516	1290	51.8	.518	1295.028	+5.028	+.201

± 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 : F600 RUN : 6 DATE : 5-7-03

Thermocouple Check:

T/C # 1	— °F	T/C # 13	59.0 °F
T/C # 2	— °F	T/C # 14	57.1 °F
T/C # 3	59.8 °F	T/C # 15	59.6 °F
T/C # 4	54.2 °F	T/C # 16	53.0 °F
T/C # 5	53.1 °F	T/C # 17	53.9 °F
T/C # 6	52.9 °F	T/C # 18	61.6 °F
T/C # 7	52.8 °F	T/C # 19	55.3 °F
T/C # 8	52.2 °F	T/C # 20	— °F
T/C # 9	53.5 °F	T/C # 21	— °F
T/C # 10	53.9 °F	T/C # 22	— °F
T/C # 11	52.0 °F	T/C # 23	54.8 °F
T/C # 12	64.0 °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 .6 °F Difference .030 %

SPAN 1996.5 °F Adj. to 2000.0 °F SPAN 2004.2 °F Difference .210 %

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 201.6 °F	400	= 399.0 °F
600	= 601.2 °F	800	= 801.4 °F	1000	= 1000.4 °F
1200	= 1198.1 °F	1400	= 1399.0 °F	1600	= 1596 °F
1800	= 1800.0 °F	2000	= 2000.0 °F		

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

Scale Check Pre : 3.2 – 13.2 ✓

Post : 3.4 – 13.4 ✓

Stack Cleaned Prior to Test Run : YES _____ NO X

Inspection Certificate

Phillips Morris Scale Company
934 Elliott Avenue W.
Seattle, WA 98119
Ph#(206)284-6090
Fax#(206)282-6612

Customer: LOKEE TESTING

Address: 13235 Prarie Circle
Sumner WA 98390

Technician: Patrick McLellan

Authorization Signature: _____

Date of Inspection: 11-26-02

Next Inspection Due: 5-03

Certification Type
- ✓ Standard
- __ ISO 9000
- __ MIL STD-45662

Equipment Tested

Indicator

Make: Weightronix
Model: WI-110
SR#: 16409
Class: III
Cap.: 1000 lbs

Base

Options Installed

Printer: _____
Score Board: _____
Computer: _____
Other: _____

Pre-test	Post-test	Manufacturer Tolerance
Ø	Ø	
	499.9	
998.7	1000.0	

Corner Test: P ✓ F __
Shift Test: P ✓ F ✓
Static Test: 2 min. __ ✓ 5 min. __

Weight Kit#: _____ NIST#: _____

Serial Numbers of Weights Used (or copy of certificate)

T23-13	T23-14			

Any changes to document or scale not authorized by Phillips & Morris Scale Company VOIDS this certificate.

WASHINGTON STATE DEPARTMENT OF **AGRICULTURE**

METROLOGY LABORATORY

Receipt Date:	January 29, 2002	State Test Number:	L2017-1
Test Date:	February 13, 2002	Group ID:	SHOP
Report Date:	February 13, 2002	Due Date:	February 13, 2004

CALIBRATION REPORT

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

Description	Value / Range	Qty	Material	Manufacture	Serial Number
Test Weight	1000 lb	5	Cast Iron	Rice Lake	OFT0, OFT1, OFT2, ~~OFSY, OFSZ~~
Test Weight	500 lb	12	Cast Iron	Rice Lake	T23-13 to T23-16, T23-20, T23-24, T23-26, T23-28 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

QUALITY CONTROL SERVICES Inc.

2340 S.E. 11Th. Avenue Portland, Oregon 97214
(503) 236-2712 / FAX:(503) 235-2535

Customer and Contact
okee Testing Labs
13235 Prairie Circle East
umner, WA. 98390
hip Wadington

Report Number: EESPC37010004030515

CERTIFICATE OF CALIBRATION AND TEST RECORD

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location	SOP Used
Balance	Sartorius	A120S	37010004	N/A	Lab	QC004
Units	**Readability**	**Range Calibrated**	**Tolerance Used**	**Cal. Date**	**Last Cal.**	**Cal. Due**
Grams	0.0001	0-100	Factory	05/15/2003	11/07/2002	11/2003

Functional Checks

CORNERLOAD: Test Wt: / Tol:	LINEARITY: Test Wt: / Tol:	REPEATABILITY: Test Wt: / Tol:	ENVIRONMENTAL CONDITIONS:
100 / 0.0003	50x2 / 0.0004	100 / 0.0001	
AS FOUND: Pass: ☑ Fail: ☐	AS FOUND: Pass: ☑ Fail: ☐	AS FOUND: Pass: ☑ Fail: ☐	☐ Good ☑ Fair ☐ Poor
AS LEFT: Pass: ☑ Fail: ☐	AS LEFT: Pass: ☑ Fail: ☐	AS LEFT: Pass: ☑ Fail: ☐	

CALIBRATION DATA

Standard	As Found Instrument	As Left Instrument
100	100.0003	100.0000
70	70.0002	70.0000
50	50.0001	50.0000
20	20.0001	20.0000
10	10.0000	10.0000
5	5.0000	5.0000

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Units	Cal. Date	Cal. Due	Traceable ID#
Weight Set	R.L./Troemner	1MG-25KG	A45	Grams	11/12/2002	11/2003	822/265349-01

Comments / Info Concerning This Calibration:

Permanent Information Concerning This Instrument:

Technician: D.Deleasa
Signature: D. Deleasa

CALIBRATIONS ARE PERFORMED UNDER AMBIENT CONDITIONS USING MANUFACTURER'S OR CUSTOMERS SPECIFICATIONS FOR THE PASS/FAIL RESULTS. RESULTS MAY BE INFLUENCED BY THE AGE OF THE INSTRUMENT AND ENVIRONMENTAL CONDITIONS. CALIBRATION DATA SHOULD BE REVIEWED TO INSURE THAT THE INSTRUMENT IS PERFORMING TO ITS INTENDED ACCURACY. CALIBRATIONS CONFORM TO ISO/IEC GUIDE 25-1990(17025) AND ANSI / NCSL Z540-1-1994 SPECIFICATIONS. INSTRUMENTS LISTED ABOVE WERE CALIBRATED USING STANDARDS TRACEABLE TO THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (N.I.S.T.).

THIS CERTIFICATE SHALL NOT BE REPRODUCED, EXCEPT IN FULL, WITHOUT THE WRITTEN APPROVAL OF QUALITY CONTROL SERVICES, INC.

QUALITY CONTROL SERVICES Inc.

2340 S.E. 11Th. Avenue Portland, Oregon 97214
(503) 236-2712 / FAX:(503) 235-2535

ıstomer and Contact
.okee Testing Labs
13235 Prairie Circle East
ɜumner, WA. 98390
Chip Wadington

Report Number: EESPC37010004021107

CERTIFICATE OF CALIBRATION AND TEST RECORD

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location	SOP Used
Balance	Sartorius	A120S	37010004	N/A	Lab	QC004
Units	**Readability**	**Range Calibrated**	**Tolerance Used**	**Cal. Date**	**Last Cal.**	**Cal. Due**
Grams	0.0001	0-100	Factory	11/07/2002	10/31/2001	05/2003

Functional Checks

CORNERLOAD: Test Wt: / Tol:	LINEARITY: Test Wt: / Tol:	REPEATABILITY: Test Wt: / Tol:	ENVIRONMENTAL CONDITIONS:
100 / 0.0003	50x2 / 0.0004	100 / 0.0001	
AS FOUND: Pass: ☑ Fail: ☐	AS FOUND: Pass: ☑ Fail: ☐	AS FOUND: Pass: ☑ Fail: ☐	☐ Good ☑ Fair ☐ Poor
AS LEFT: Pass: ☑ Fail: ☐	AS LEFT: Pass: ☑ Fail: ☐	AS LEFT: Pass: ☑ Fail: ☐	

CALIBRATION DATA

Standard	As Found Instrument	As Left Instrument
100	100.0004	100.0004
70	70.0003	70.0003
50	50.0002	50.0002
20	20.0001	20.0001
10	10.0000	10.0000
5	5.0000	5.0000
1	1.0000	1.0000

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Units	Cal. Date	Cal. Due	Traceable ID#
Weight Set	R.L./Troemner	1MG-25KG	A45	Grams	12/13/2001	12/2002	2261-1201

ɔmments / Info Concerning This Calibration:

ɪrmanent Information Concerning This Instrument:

Technician: D.Deleasa

Signature: D. Deleasa

ALIBRATIONS ARE PERFORMED UNDER AMBIENT CONDITIONS USING MANUFACTURER'S OR CUSTOMERS SPECIFICATIONS FOR THE ASS/FAIL RESULTS. RESULTS MAY BE INFLUENCED BY THE AGE OF THE INSTRUMENT AND ENVIRONMENTAL CONDITIONS. CALIBRATION DATA SHOULD BE REVIEWED TO INSURE THAT THE INSTRUMENT IS PERFORMING TO ITS INTENDED ACCURACY. CALIBRATIONS CONFORM TO ISO/IEC GUIDE 25-1990(17025) AND ANSI / NCSL Z540-1-1994 SPECIFICATIONS.

THIS CERTIFICATE SHALL NOT BE REPRODUCED, EXCEPT IN FULL, WITHOUT THE WRITTEN APPROVAL OF QUALITY CONTROL SERVICES, INC.

QUALITY CONTROL SERVICES Inc.

2340 S.E. 11Th. Avenue Portland, Oregon 97214
(503) 236-2712 / FAX:(503) 235-2535

Report Number: EESPC37010004020506

Customer and Contact
Lokee Testing Labs
13235 Prairie Circle E
umner, WA. 98390
Chip Wadington

CERTIFICATE OF CALIBRATION AND TEST RECORD

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location	SOP Used
Balance	Sartorius	A120S	37010004	N/A	Lab	QC012
Units	**Readability**	**Range Calibrated**	**Tolerance Used**	**Cal. Date**	**Last Cal.**	**Cal. Due**
Grams	0.0001	0-100	Factory	05/06/2002	10/31/2001	11/2002

Functional Checks

CORNERLOAD: Test Wt: 100 Tol: 0.0003	LINEARITY: Test Wt: 50x2 Tol: 0.0004	REPEATABILITY: Test Wt: 100 Tol: 0.0001	ENVIRONMENTAL CONDITIONS:
AS FOUND: Pass: ☑ Fail: ☐	AS FOUND: Pass: ☑ Fail: ☐	AS FOUND: Pass: ☑ Fail: ☐	☐ Good ☑ Fair ☐ Poor
AS LEFT: Pass: ☑ Fail: ☐	AS LEFT: Pass: ☑ Fail: ☐	AS LEFT: Pass: ☑ Fail: ☐	

CALIBRATION DATA

Standard	As Found Instrument	As Left Instrument
100	100.0004	100.0000
70	70.0003	70.0000
50	50.0002	50.0000
20	20.0001	20.0000
10	10.0000	10.0000
5	5.0000	5.0000

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Units	Cal. Date	Cal. Due	Traceable ID#
Weight Set	R.L./Troemner	1MG-25KG	A45	Grams	12/13/2001	12/2002	2261-1201

Comments / Info Concerning This Calibration:

Permanent Information Concerning This Instrument:

Technician: D.Deleasa

Signature: Tony Deleasa

CALIBRATIONS ARE PERFORMED UNDER AMBIENT CONDITIONS USING MANUFACTURER'S OR CUSTOMERS SPECIFICATIONS FOR THE PASS/FAIL RESULTS. RESULTS MAY BE INFLUENCED BY THE AGE OF THE INSTRUMENT AND ENVIRONMENTAL CONDITIONS. CALIBRATION DATA SHOULD BE REVIEWED TO INSURE THAT THE INSTRUMENT IS PERFORMING TO ITS INTENDED ACCURACY. CALIBRATIONS CONFORM TO ISO/IEC GUIDE 25-1990(17025) AND ANSI / NCSL Z540-1-1994 SPECIFICATIONS.

THIS CERTIFICATE SHALL NOT BE REPRODUCED, EXCEPT IN FULL, WITHOUT THE WRITTEN APPROVAL OF QUALITY CONTROL SERVICES, INC.

QUALITY CONTROL SERVICES Inc.

2340 S.E. 11Th. Avenue Portland, Oregon 97214-5306
(503) 236-2712 / FAX:(503) 235-2535

CERTIFICATE OF CALIBRATION

Customer and Contact

Lokee Testing Labs
13235 Prairie Circle East
Sumner, WA. 98390
Chip Wadington

Report Number: EESPC37010004011031

INSTRUMENT INFORMATION

Item	Make	Model	Serial Number	Customer ID	Location	SOP Used
Balance	Sartorius	A120S	37010004	N/A	Lab	QC012

Units	Readability	Range Calibrated	Tolerance Used	Cal. Date	Last Cal.	Cal. Due
Grams	0.0001	0-100	Factory	10/31/2001	04/30/2001	04/2002

Functional Checks

Cornerload ☑ **Linearity 0 - 1/2 - Full Capacity** ☑ **Reproduceability** ☑

CALIBRATION DATA

As Found Instrument	Standard	As Left Instrument
100.0002	100	100.0000
50.0001	50	50.0000
20.0000	20	20.0000
10.0000	10	10.0000
5.0000	5	5.0000
1.0000	1	1.0000

CALIBRATION STANDARDS

Item	Make	Model	Serial Number	Units	Cal. Date	Cal. Due	Traceable ID#
Weight Set	R.L./Troemner	5MG-25KG	A45	Grams	12/11/2000	12/2001	A45-2000

Comments / Info Concerning This Calibration:

Permanent Information Concerning This Instrument:
5/00 CUSTOMER REQUESTED SPECIFIC 6 POINT CHECK.100,50,20,10,5,1

Technician: D.Deleasa

Signature: D. Deleasa

CALIBRATIONS ARE PERFORMED UNDER AMBIENT CONDITIONS USING MANUFACTURER'S OR CUSTOMERS SPECIFICATIONS FOR THE PASS/FAIL RESULTS. RESULTS MAY BE INFLUENCED BY THE AGE OF THE INSTRUMENT AND ENVIRONMENTAL CONDITIONS. CALIBRATION DATA SHOULD BE REVIEWED TO INSURE THAT THE INSTRUMENT IS PERFORMING TO ITS INTENDED ACCURACY. CALIBRATIONS CONFORM TO ISO/IEC GUIDE 25-1990(17025) AND ANSI / NCSL Z540-1-1994 SPECIFICATIONS.

THIS CERTIFICATE SHALL NOT BE REPRODUCED, EXCEPT IN FULL, WITHOUT THE WRITTEN APPROVAL OF QUALITY CONTROL SERVICES, INC.

Thermocouple Calibration Record Semi-Annual

Thermocouples Check against
Reference Thermometer serial number 9123454
Ice Water Bath 32.0
Boiling Water 211.8
Room Temperature 70.1
Barometric Pressure 30.11
DATE: 11-14-02

TC	Location	Ice Bath Temp	Boiling Water Temp
1	Wet Bulb	32.2	211.7
2	Dry Bulb	32.3	211.8
3	Stack	32.0	211.7
4	Stove Top	32.1	211.9
5	Left Side	32.4	211.8
6	Back	32.1	211.8
7	Right Side	32.2	211.7
8	Bottom	32.0	211.6
9	Firebox	32.2	211.8
10	Secondary/Cat	32.2	211.6
11	Ambient	32.1	211.7
12	Tube Furnace	32.1	211.9
13	Sample Box	32.0	211.7
14	Impinger Out	32.1	211.8
15	C. Gas Box	32.0	211.8
16	C. Gas Out	32.2	211.7
17	SO2 Out	32.1	211.7
18	Upper Ambient	32.1	211.7
19			
20			
21			
22			
23	Calibrator	32.2	211.5
24	Oven	32.3	212.3

Thermocouple Readout Semi-Annual Calibration Data Sheet

Date: 11-11-02
Ambient Temperature: 69.8
Technician: Chip W.

Thermocouple Number: T/C Readout
Barometric Pressure: 30.11
Reference: Mercury in glass
FISHER #9123454
Other: OMEGA CL-300

Reference Point No. [a]	Source [b]	Reference Thermometer Temperature °F	Thermocouple Potentiometer Temperature °F	Difference (%)[c]
32	Ice Water	32.0	32.0	∅
212	Boiling Water	212.0	211.9	.047
250	Omega	250.0	250.0	∅
300	Omega	300.0	299.7	.100
400	Omega	400.0	399.8	.050
500	Omega	500.0	499.9	.020
600	Omega	600.0	598.9	.183
700	Omega	700.0	699.8	.029
800	Omega	800.0	799.4	.075
900	Omega	900.0	900.0	∅
1000	Omega	1000.0	998.8	.120
1200	Omega	1200.0	1198.7	.108
1400	Omega	1400.0	1399.7	.021
1600	Omega	1600.0	1598.9	.069
1800	Omega	1800.0	1799.9	.006
2000	Omega	2000.0	2000.0	∅

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

TRACEABILITY DOCUMENTATION Semi-Annual

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

DATE: 11.11.02

SO^2 INJECTION ROTAMETER

FISHER SN 9123454

NIST Traceable

Actual	°C = °F	°F
0.0	32.0	32.0
21.0	69.8	69.8
37.7	99.9	100.0
54.4	129.9	130.0

DRY GAS METER THERMOCOUPLES

Actual	°C = °F	5H in	5H out	KK
0.0	32.0	32.1	32.0	32.0
21.0	69.8	69.7	69.9	69.8
37.5	99.5	99.6	99.6	99.7
54.0	129.2	129.1	129.0	128.9

SLING PSYCHROMETER

Actual	°C = °F	Wet Bulb	Dry Bulb
Ø	32.0	32.0	32.0
21.0	69.8	69.8	69.8
30.5	86.9	87.0	87.0
40.8	105.4	105.4	105.4

Conversions = °F = (°C × 1.8) + 32 °C = (°F-32)÷1.8

VANEOMETER CALIBRATION

LoKee Testing Lab uses a Dwyer Model #480 Vaneometer to measure test chamber air velocity. The manufacturer's specifications for accuracy are ± 5.0% to 100 FPM and ± 10% from FPM to top of scale. LoKee Testing Lab insures that the instrument is level and clean prior to taking each reading. According to EPA personnel (Westlin, RTP) no further calibration of the instrument is necessary.

DRAFT GAUGE CALIBRATION

LoKee Testing Lab uses a Dwyer model 115-AV 0-0.25" inclined water manometer (readability resolution ± 0.001" of water) to measure the static pressure in the stack. Once leveled and zeroed as per the manufacturer's written operating instructions, the Dwyer manometer is a primary standard and requires no additional calibration.

The manometer is leveled and zeroed at the start of each test run, checked as necessary during the run to verify the settings have not changed and again at the end of each test run. The results of each check are recorded on Data Sheet #16 in each test run.

BAROMETER CALIBRATION

LoKee Testing Lab uses a Princo Model 469 NOVA Mercury Barometer to measure barometric pressure. When installed and maintained as per the manufacturer's written operating instruction, the Princo Model 469 Mercury Barometer is a primary standard and needs no further calibration.

MOISTURE METER CALIBRATION

The Delmhorst Model RC-1C, SN 16152 Moisture Meter is calibrated each time the meter is used by adjusting the zero and span calibration. The potentiometers of each calibration point (X = zero, Y = span) are adjusted until the meter is calibrated correctly. The meter is then checked against a calibration block (Delmhorst Model MCS-1, moisture content standard at 12.0% and 22.0%) in its normal operating range of 11-25%.

LoKee Testing Lab also has a second moisture meter, Delmhorst Model G-30, SN 2477 to use as a backup.

POST TEST METER BOX AUDIT DATA SHEET # 32

UNIT: JOTUL U.S.A., INC. - F600 DATE: 05/13/03

TEST DATA

RUN #	1	2	3	4	5	6	7	8	9	10
AVG. ΔH	.153	X	.163	.223	.093	.237				
MAX VAC	3.0	X	5.0	4.0	2.0	5.0				

Avg. Test Series Δ H: .174 in H_2O Test Series Max Vac: 5.0 in Hg

Audit Dry Gas Meter: K2 Correction (Y) Factor: 1.002 (mcf)

Test Dry Gas Meter: H Correction (Y) Factor: .990 (mcf)

AUDIT DATA

		Audit # 1	Audit #2	Audit #3
BP		30.28	30.28	30.28
VAC		5.0	5.0	5.0
AUDIT METER:				
VOL.	Final	454.075	460.060	470.378
(Vw)	Initial	449.000	454.075	460.060
	Vol.	5.075	5.985	10.318
TEMP (°F)	Initial	92	90	91
(Tw)	Mid	91	91	91
	Final	90	91	91
(°F / °A)	Avg.	91 551	551	551
Δ H	Initial	.174	.174	.174
	Mid	.174	.174	.174
	Final	.174	.174	.174
	Avg.	.174	.174	.174
DRY GAS METER:				
VOL.	Final	983.000	989.060	999.100
(Vd)	Initial	978.000	983.000	989.000
	Vol.	5.000	6.000	10.100
TEMP (°F)	Initial	77	81	82
(Tm)	Mid	79	81	82
	Final	81	82	82
(°F / °A)	Avg.	79 539	85 541	542

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

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

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

RUN 1

$$Y = \frac{(5.075)(1.002)(30.28)(539)}{(5.000)\left(30.28 + \frac{.174}{13.6}\right)(551)} = \frac{82994.33}{83456.65} = .994$$

$$\Delta\% = \frac{(.994 - .984)}{.984} \times 100 = 1.016\ \%$$

RUN 2

$$Y = \frac{(5.985)(1.002)(30.28)(541)}{(6.000)\left(30.28 + \frac{.174}{13.6}\right)(551)} = \frac{98239.24}{100877.24} = .974$$

$$\Delta\% = \frac{(.974 - .984)}{.984} \times 100 = -1.016\ \%$$

RUN 3

$$Y = \frac{(10.318)(1.002)(30.28)(542)}{(10.100)\left(30.28 + \frac{.174}{13.6}\right)(551)} = \frac{169675.21}{168582.43} = 1.006$$

$$\Delta\% = \frac{(1.006 - .984)}{.984} \times 100 = 2.236\ \%$$

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

INTERPOLATED Y FACTOR

$\frac{.1}{(A)}$ inch H_2O $\Delta H = \frac{.983}{(C)}$ Calculated calibration Y factor from calibrations

$\frac{.2}{(B)}$ inch H_2O $\Delta H = \frac{.984}{(D)}$ Calculated calibration Y factor from calibrations

$\frac{.2}{(B)} - \frac{.1}{(A)} = .1 \times 100 = \frac{10}{(E)}$

$\frac{.984}{(D)} - \frac{.983}{(C)} = .001 \div \frac{10}{(E)} \quad \frac{.0001}{(F)}$

$\frac{.174}{\text{Avg}\,\Delta H} - \frac{.1}{(A)} = .074 \times 100 = \frac{7.4}{(G)}$

$\left[\frac{.0001}{(F)} \times \frac{7.4}{(G)}\right] + \frac{.983}{(C)} = \frac{.984}{\text{Interpolated Y factor}}$

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

DRY GAS METER CALIBRATION

DATE: 11-15-02 DRY GAS METER: H BOX: 5

BAROMETRIC PRESSURE 30.06 in. Hg.				Wet Test Meter Correction Factor Y= 1.002			
Orifice Manometer Setting, ΔH, in. H_2O		.1	.2	.3	.5	.75	1.0
Gas Volume Wet Test Meter Vw ft^3	Final	333.848	341.361	371.404	377.421	384.963	390.000
	Initial	315.500	333.848	341.361	371.404	377.421	384.963
	Vw ft^3	18.348	7.513	30.043	6.017	7.542	5.037
Gas Volume Dry Test Meter Vd ft^3	Final	38.000	45.500	75.500	81.500	89.000	94.000
	Initial	19.500	38.000	45.500	75.500	81.500	89.000
	Vw ft^3	18.500	7.500	30.000	6.000	7.500	5.000
Wet Test Meter Temperature tw	Initial	85	97	97	97	96	97
	Middle	91	97	97	96	97	96
	Final	97	97	97	96	97	96
	Average	(551)	97 (554)	(557)	(556)	(557)	(556)
Dry Test Meter Temperature tm	Initial	81	89	87	91	90	91
	Middle	85	88	89	90	91	91
	Final	89	87	91	90	91	90
	Average	85 (545)	(548)	(549)	(550)	(551)	(551)
$Y = \frac{(W_{mcf})(Vw)\,(Pb)\,(tm)}{Vd\left(Pb + \frac{\Delta H}{13.6}\right)(tw)}$		.983	.984	.988	.993	.995	1.998

Average Y= .990

METER BOX CALIBRATION

Avg = 1.002

Date : 08/09/02
Calibrated By : J.C.
Dry Gas Meterbox ID : K2

Barometric Pressure, Pb = 27.55 in. Hg
Vacuum = 0.0 in. Hg

Orifice Manometer Setting, Delta H in. H20		0.10	0.10	0.10	0.10	0.10	0.10
Gas Volume Wet Test Meter Vw, cu. ft.		10.052	10.959	10.626	10.369	10.759	10.717
Gas Volume Dry Gas Meter							
M Final		69.409	81.103	92.442	103.393	114.942	126.250
M Initial		59.175	69.802	81.457	92.680	103.826	115.224
Vd, cu. ft.		10.234	11.301	10.985	10.713	11.116	11.026
Wet Test Meter							
tw Deg F		68	67	69	70	72	74
tw Deg A		528	527	529	530	532	534
Dry Gas Meter Outlet, tmo	**1)**	72	75	77	78	80	82
	2)	73	76	78	79	82	82
	3)	74	78	79	80	83	82
Dry Gas Meter Inlet tmi	**1)**	79	88	95	98	99	100
	2)	85	92	99	100	101	101
	3)	89	98	102	101	102	102
Mean tm, Deg F		79	85	88	89	91	92
Mean tm, Deg A		539	545	548	549	551	552
Results :							
	Y =	1.002	1.002	1.002	1.003	1.003	1.004

Averages :

Y = 1.003

METER BOX CALIBRATION

Date : 08/09/02
Calibrated By : J.C.
Dry Gas Meterbox ID : K2

Barometric Pressure, Pb = 27.55 in. Hg
Vacuum = 0.0 in. Hg

Orifice Manometer Setting, Delta H in. H20		0.20	0.20	0.20	0.20	0.20	0.20
Gas Volume Wet Test Meter Vw, cu. ft.		10.000	10.000	10.000	10.400	10.000	10.000
Gas Volume Dry Gas Meter							
M Final		125.454	135.756	146.114	156.919	167.309	177.665
M Initial		115.224	125.454	135.756	146.114	156.919	167.309
Vd, cu. ft.		10.230	10.302	10.358	10.805	10.390	10.356
Wet Test Meter							
tw Deg F		67	68	70	71	72	73
tw Deg A		527	528	530	531	532	533
Dry Gas Meter Outlet, tmo	**1)**	74	76	78	81	84	85
	2)	74	78	80	82	85	86
	3)	76	78	81	84	85	86
Dry Gas Meter Inlet tmi	**1)**	83	87	95	102	103	103
	2)	85	92	99	104	104	105
	3)	87	96	104	105	105	105
Mean tm, Deg F		80	85	90	93	94	95
Mean tm, Deg A		540	545	550	553	554	555
Results :							
	Y =	1.001	1.000	1.000	1.002	1.002	1.005

Averages :

Y = **1.002**

METER BOX CALIBRATION

Date : 08/09/02
Calibrated By : J.C.
Dry Gas Meterbox ID : K2

Barometric Pressure, Pb = 27.55 in. Hg
Vacuum = 0.0 in. Hg

Orifice Manometer Setting, Delta H in. H20		0.30	0.30	0.30	0.30	0.30	0.30
Gas Volume Wet Test Meter Vw, cu. ft.		10.000	10.900	10.600	10.000	10.000	10.800
Gas Volume Dry Gas Meter							
M Final		187.917	199.173	210.167	220.584	230.982	242.208
M Initial		177.665	187.917	199.173	210.167	220.584	230.982
Vd, cu. ft.		10.252	11.256	10.994	10.417	10.398	11.226
Wet Test Meter							
tw Deg F		67	67	68	69	70	69
tw Deg A		527	527	528	529	530	529
Dry Gas Meter Outlet, tmo	**1)**	71	73	75	76	77	77
	2)	73	74	75	76	77	77
	3)	74	75	76	77	77	77
Dry Gas Meter Inlet tmi	**1)**	85	90	94	100	105	105
	2)	88	94	98	104	106	106
	3)	93	98	102	105	106	106
Mean tm, Deg F		81	84	87	90	91	91
Mean tm, Deg A		541	544	547	550	551	551
Results :							
	Y =	1.001	0.999	0.998	0.997	1.000	1.002
Averages :							
	Y =	**1.000**					

METER BOX CALIBRATION

Date : 08/09/02
Calibrated By : J.C.
Dry Gas Meterbox ID : K2

Barometric Pressure, Pb = 27.55 in. Hg
Vacuum = 0.0 in. Hg

Orifice Manometer Setting, Delta H in. H20		0.50	0.50	0.50	0.50	0.50	0.50
Gas Volume Wet Test Meter Vw, cu. ft.		10.000	10.000	10.000	10.000	10.200	10.000
Gas Volume Dry Gas Meter							
M Final		252.471	262.818	273.200	283.635	294.271	304.672
M Initial		242.208	252.471	262.818	273.200	283.635	294.271
Vd, cu. ft.		10.263	10.347	10.382	10.435	10.636	10.401
Wet Test Meter							
tw Deg F		70	70	71	71	71	72
tw Deg A		530	530	531	531	531	532
Dry Gas Meter Outlet, tmo	**1)**	73	78	82	84	86	87
	2)	75	80	83	86	87	88
	3)	78	83	85	87	87	88
Dry Gas Meter Inlet tmi	**1)**	87	93	96	101	103	102
	2)	93	103	105	107	109	106
	3)	96	105	110	110	110	110
Mean tm, Deg F		84	90	94	96	97	97
Mean tm, Deg A		544	550	554	556	557	557
Results :							
	Y =	0.999	1.002	1.003	1.002	1.005	1.005
Averages :							
	Y =	**1.003**					

METER BOX CALIBRATION

Date : 08/09/02
Calibrated By : J.C.
Dry Gas Meterbox ID : K2

Barometric Pressure, Pb = 27.55 in. Hg
Vacuum = 0.0 in. Hg

Orifice Manometer Setting, Delta H in. H20		0.75	0.75	0.75	0.75	0.75	0.75
Gas Volume Wet Test Meter Vw, cu. ft.		10.000	10.000	10.000	10.000	10.000	10.000
Gas Volume Dry Gas Meter							
M Final		314.761	324.890	335.031	345.191	355.387	365.617
M Initial		304.672	314.761	324.890	335.031	345.191	355.387
Vd, cu. ft.		10.089	10.129	10.141	10.160	10.196	10.230
Wet Test Meter							
tw Deg F		69	69	70	71	71	71
tw Deg A		529	529	530	531	531	531
Dry Gas Meter Outlet, tmo	1)	72	74	75	77	78	79
	2)	74	75	76	77	78	79
	3)	75	75	77	78	79	80
Dry Gas Meter Inlet tmi	1)	74	78	81	84	86	88
	2)	76	80	82	85	88	91
	3)	77	81	83	87	89	93
Mean tm, Deg F		75	77	79	81	83	85
Mean tm, Deg A		535	537	539	541	543	545
Results :							
	Y =	1.000	1.001	1.001	1.001	1.001	1.001

Averages :

Y = **1.001**

METER BOX CALIBRATION

Date : 08/09/02
Calibrated By : J.C.
Dry Gas Meterbox ID : K2

Barometric Pressure, Pb = 27.55 in. Hg
Vacuum = 0.0 in. Hg

Orifice Manometer Setting, Delta H in. H20		1.00	1.00	1.00	1.00	1.00	1.00
Gas Volume Wet Test Meter Vw, cu. ft.		10.000	10.000	10.000	10.400	10.000	10.000
Gas Volume Dry Gas Meter							
M Final		375.804	386.030	396.294	406.992	417.296	427.619
M Initial		365.617	375.804	386.030	396.294	406.992	417.296
Vd, cu. ft.		10.187	10.226	10.264	10.698	10.304	10.323
Wet Test Meter							
tw Deg F		72	72	73	73	73	74
tw Deg A		532	532	533	533	533	534
Dry Gas Meter Outlet, tmo	**1)**	77	78	80	82	82	83
	2)	78	80	81	82	83	83
	3)	78	81	82	83	83	83
Dry Gas Meter Inlet tmi	**1)**	85	90	95	96	98	101
	2)	88	92	96	98	100	103
	3)	91	93	98	99	102	104
Mean tm, Deg F		83	86	89	90	91	93
Mean tm, Deg A		543	546	549	550	551	553
Results :							
	Y =	0.999	1.000	1.000	1.000	1.001	1.000
Averages :							
	Y =	**1.000**					

WET TEST METER CALIBRATION LOG

Wet Test Meter Serial Number AA455 Date 8-02-02

Range of Wet Test Meter Flow Rate 0-0.25

Volume of Test Flask Vs 37.850

Satisfactory Leak Check? ✓

Ambient Temperature of Equilibrate Liquid in Wet Test Meter and Reservoir 79°F

TEST #	MANOMETER READING, *a* mm H_2O	FINAL VOLUME (Vf), l	INITIAL VOLUME (Vi), l	TOTAL VOLUME (Vm), *b* l	FLASK VOLUME (Vs), l	PERCENT ERROR, *c* %
1	Ø	3.0	reset to Ø	3.0	3.004	-.133
2	Ø	3.0	reset to Ø	3.0	3.005	-.166
3	Ø	3.0	reset to Ø	3.0	3.007	-.233

a - Must be less than 10 mm H_2O (0.4 " H_2O)

Calculations:

b - Vm - Vf - Vi

c - % error = $\frac{100\,(V_m - V_s)}{V_s}$ = -.177 (± 1 %)

SO_2 ROTAMETER CALIBRATION

Last Cal. : 5-13-01 By : Op Date : 11-11-02 By : Op

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

Barometric Pressure : 30.12 " Hg Temperature : 72.0

RUN #	50 CC/MINUTE DIGICAL VOLUME	100 CC/MINUTE DIGICAL VOLUME	150 CC/MINUTE DIGICAL VOLUME
1	54.7	119.0	174.0
2	54.5	119.5	174.5
3	54.6	119.1	174.3
4	54.9	118.9	174.1
5	54.4	118.9	174.4
6	54.8	119.2	174.6
7	54.8	119.1	174.1
8	54.5	119.3	174.3
9	54.6	119.0	174.1
10	54.2	119.1	174.1
AVERAGE	cc/min	cc/min	cc/min

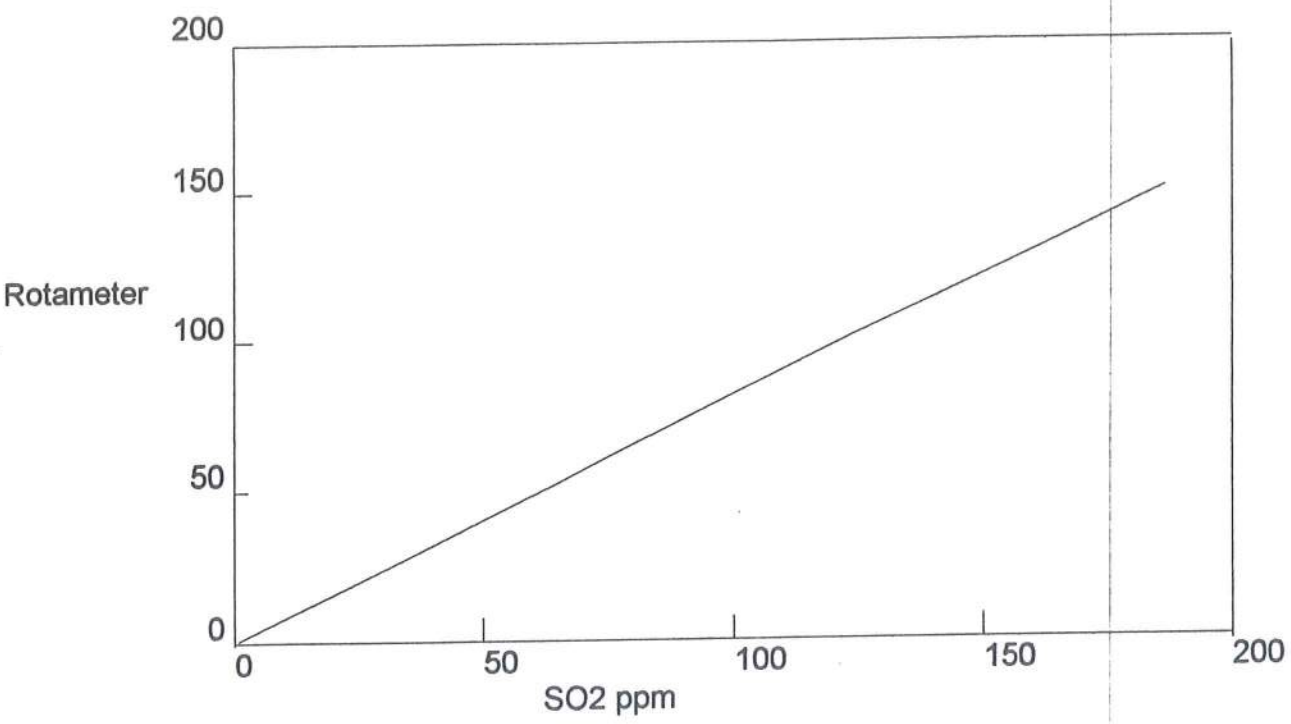
SETTING	cc/min
0	Ø
50	54.6
100	119.1
150	174.3

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

100 CC / MINUTE = 86.05

SO2 Rotameter

11/11/02



Regression Output:

Constant	-1.11
Std Err of Y Est	3.0431891167
R Squared	0.9989275329
No. of Observations	4
Degrees of Freedom	2
X Coefficient(s)	1.1748
Std Err of Coef.	0.0272191109

TRACER GAS TRAIN RESPONSE TIME

DATE: 11-12-02

Elapsed Time	SO_2 Conc. (v.)	SO_2 Conc. (v.)	SO_2 Conc. (v.)
00 sec	.512	.511	.511
15	.307	.292	.291
30	.185	.179	.181
45	.121	.115	.110
60	.060	.058	.057
75	.042	.037	.038
90	.020	.019	.018
105	.013	.011	.010
120	.008	.007	.007
135	.005	.004	.004
150	.003	.002	.002
165	.001	.001	.001
180	.001	.000	.000
Initial Response	12	12	12
95 % Response	85	85	85
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	.516	.516	.515	.500	.499	.498	.505	.504	.504
15	.485	.482	.483	.566	.565	.569	.235	.240	.237
30	.310	.308	.303	.742	.749	.742	.060	.058	.051
45	.145	.144	.150	.808	.811	.813	.019	.017	.015
60	.081	.069	.073	.821	.822	.820	.008	.005	.005
75	.035	.030	.029	.829	.827	.827	.002	.001	.002
90	.020	.018	.018	.831	.831	.830	.000	.000	.000
105	.011	.010	.009						
120	.008	.007	.006						
135	.004	.005	.004						
150	.002	.003	.002						
165	.001	.002	.001						
180	.000	.000	.000						
Initial Response	16	15	15	12	12	12	8	9	9
95 % Response	82	83	82	50	50	50	35	3.5	35
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 : 11-12-02

Gas	1	2	3	AVE	CONC	TANK ID
CO_2	0	0	0	Ø	N_2	042TAC-2-A
O_2	0	0	0	Ø	N_2	
CO	0	0	0	Ø	N_2	
CO_2	12.5	12.5	12.5	12.5	12.49	CC12767
O_2	12.5	12.5	12.5	12.5	12.50	
CO	4.8	4.8	4.8	4.8	4.80	
CO_2	21.2	21.2	21.3	21.23	21.23	CC55904
O_2	21.1	21.1	21.1	21.0	21.10	
CO	8.6	8.6	8.6	8.60	8.60	
CO_2	6.2	6.2	6.3	6.23	6.25	AAL21084
O_2	6.2	6.2	6.3	6.23	6.24	
CO	2.0	2.0	2.0	2.0	2.01	
CO_2						
O_2						
CO						

JOTUL
F600

CO_2 ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Date: 04-29-03

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

Calibration by: D. Ubaldo

Cal Gas Flow: 1.5 SCFH

Measured by: Rotameter

BP: 29.92

Instrument ID: PRINCO

Temp: 75

Instrument ID: TR

Cylinders:

1. # 042TAC 2-A Concentration: 00.00 % CO_2 Cyl. Press.: 900 PSI
   Certified by: AIR LIQUIDE Date: 02-20-02
2. # CC-3131 Concentration: 12.40 % CO_2 Cyl. Press.: 1625 PSI
   Certified by: AIR LIQUIDE Date: 03-13-03
3. # CC55904 Concentration: 21.23 % CO_2 Cyl. Press.: 700 PSI
   Certified by: AIR LIQUIDE Date: 02-14-00
4. # CC-12731 Concentration: 6.22 % CO_2 Cyl. Press.: 1725 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	00.1	.001	00.0	00.0
2	2	12.40	49.6	.496	49.8	.498	49.6	.496
3	3	21.23	84.9	.849	85.1	.851		
4	4	6.22	24.9	.249	25.2	.252		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 12.467

CO_2 Linear Regression Results:

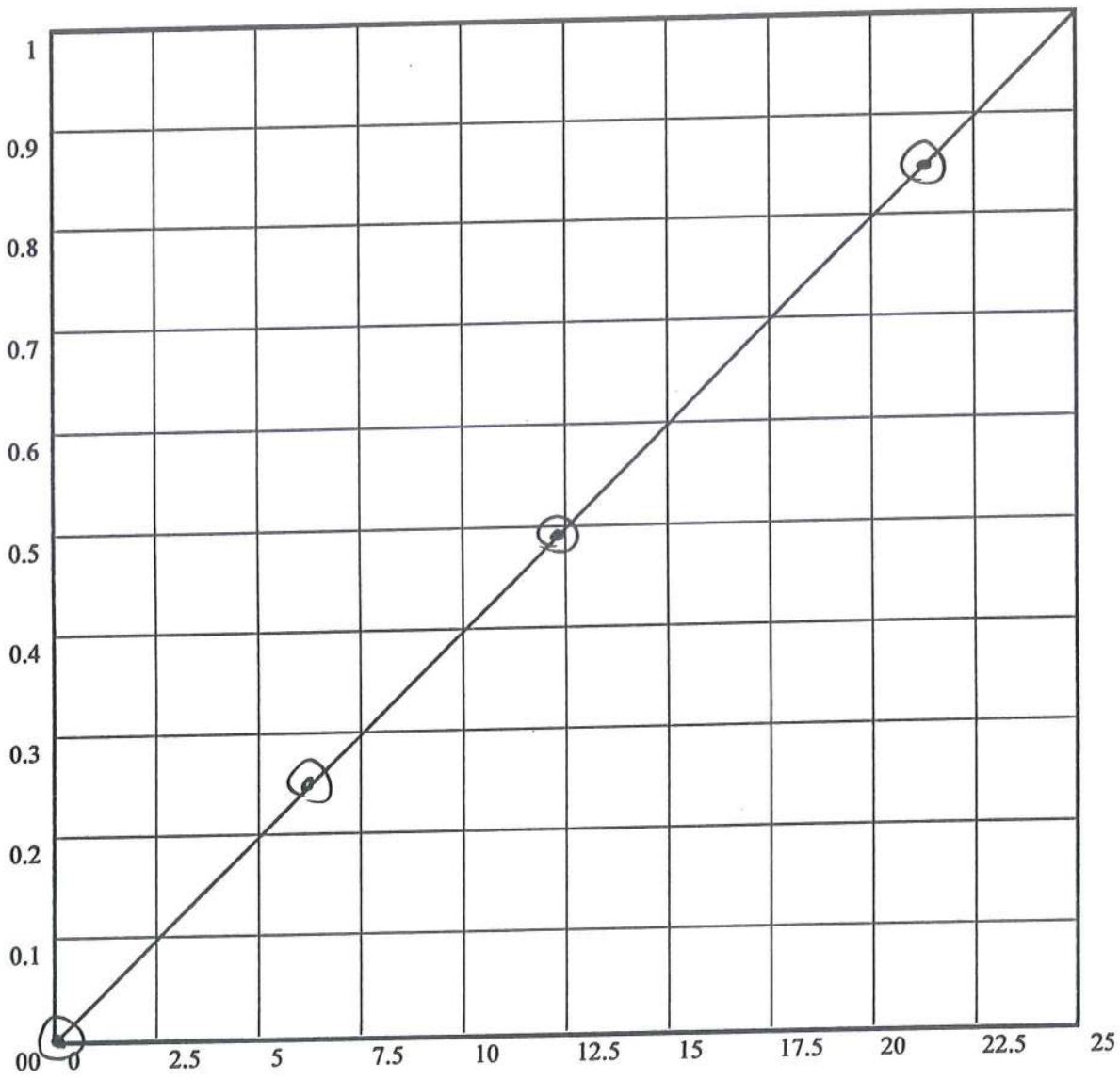
Y = MX +B

Slope (M) = .0009139

Y Intercept (B) = .0400337

Correlation Coefficient (r) = .9999912

r^2 = .9999824

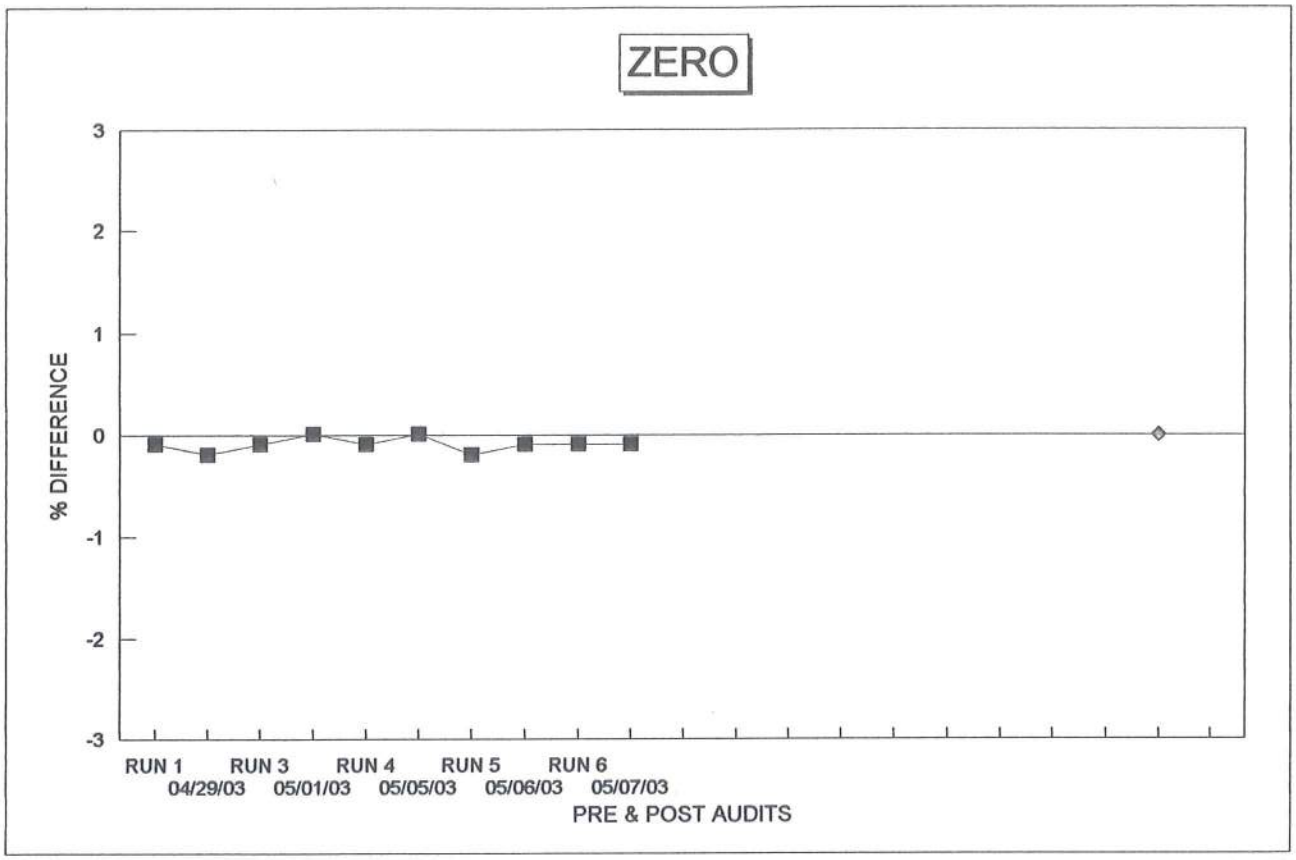


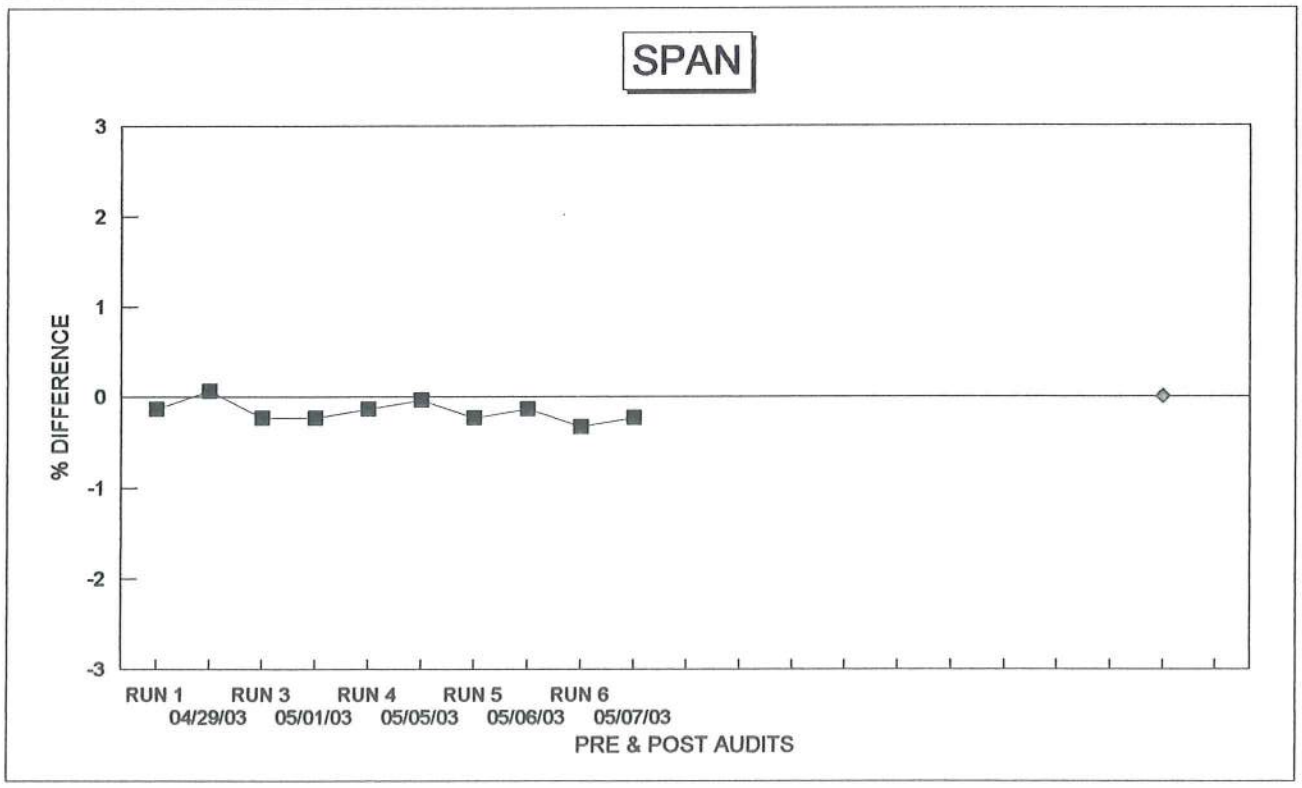
EPA Span Value = ± 2.0% of 25% CO_2 = ± .5%

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

HIGH VOLTS .851 = 21.28 - 21.23 = -.050 = .200

LOW VOLTS .252 = 6.30 - 6.22 = .080 = .320


ZERO
3
2
1
0
-1
-2
-3
% DIFFERENCE
RUN 1
04/29/03
RUN 3
05/01/03
RUN 4
05/05/03
RUN 5
05/06/03
RUN 6
05/07/03
PRE & POST AUDITS


SPAN
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-2
-3
% DIFFERENCE
RUN 1
04/29/03
RUN 3
05/01/03
RUN 4
05/05/03
RUN 5
05/06/03
RUN 6
05/07/03
PRE & POST AUDITS

O_2 ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Date: 04-29-03

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

Calibration by: D. Washington

Cal Gas Flow: 1.5 SCFH Measured by: Rotameter

BP: 29.92 Instrument ID: PRINCO

Temp: 75 Instrument ID: TR

Cylinders:

1. # 042TAC 2-A Concentration: 00.00 % O_2 Cyl. Press.: 900 PSI
   Certified by: AIR LIQUIDE Date: 02-20-02
2. # CC-3131 Concentration: 12.50 % O_2 Cyl. Press.: 1625 PSI
   Certified by: AIR LIQUIDE Date: 03-13-03
3. # CC55904 Concentration: 21.10 % O_2 Cyl. Press.: 700 PSI
   Certified by: AIR LIQUIDE Date: 02-14-00
4. # CC-12731 Concentration: 6.25 % O_2 Cyl. Press.: 1725 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	.001	00.0	.000
2	2	12.50	12.50	.500	12.45	.498	12.50	.500
3	3	21.10	21.10	.844	21.10	.845		
4	4	6.25	6.25	.250	6.20	.248		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 12.501

O_2 Linear Regression Results:

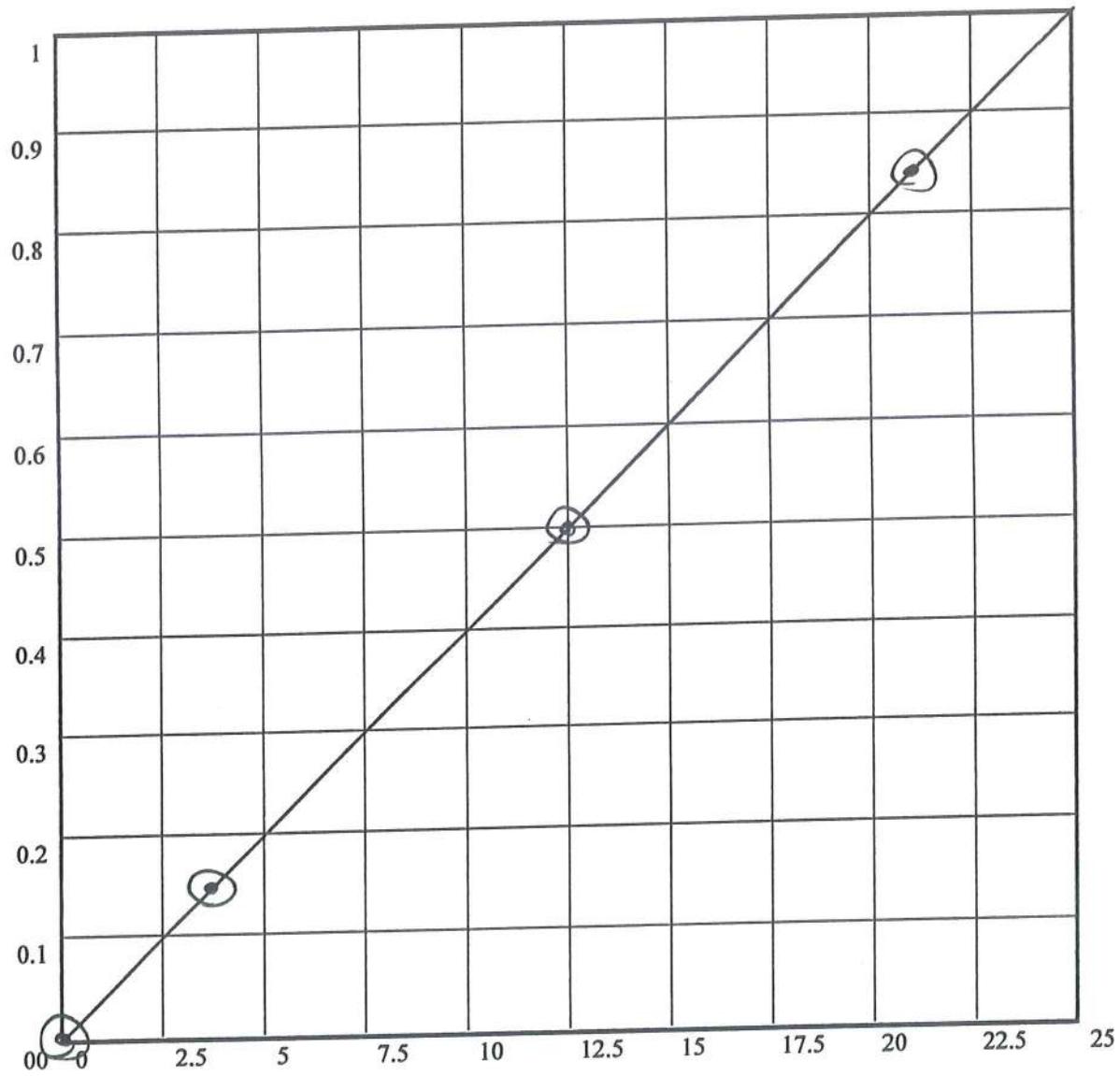
Y = MX +B

Slope (M) = -.0010094

Y Intercept (B) = .0400762

Correlation Coefficient (r) = .9999957

r^2 = .9999915

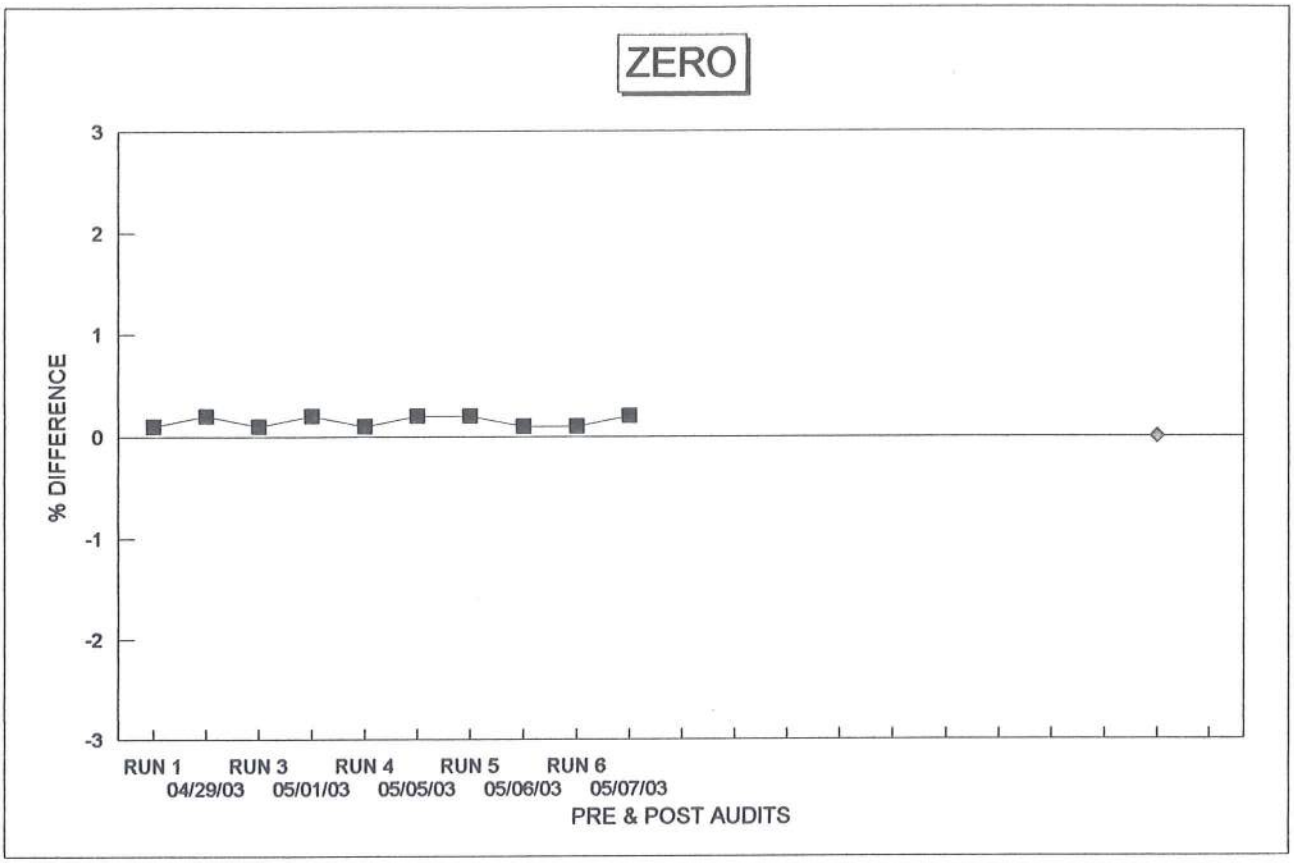


EPA Span Value = ± 2.0% of 25% O_2 = ± .5%

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

HIGH VOLTS .845 = 21.125 - 21.00 = .125 = .500

LOW VOLTS .248 = 6.200 - 6.25 = -.050 = -.200


ZERO
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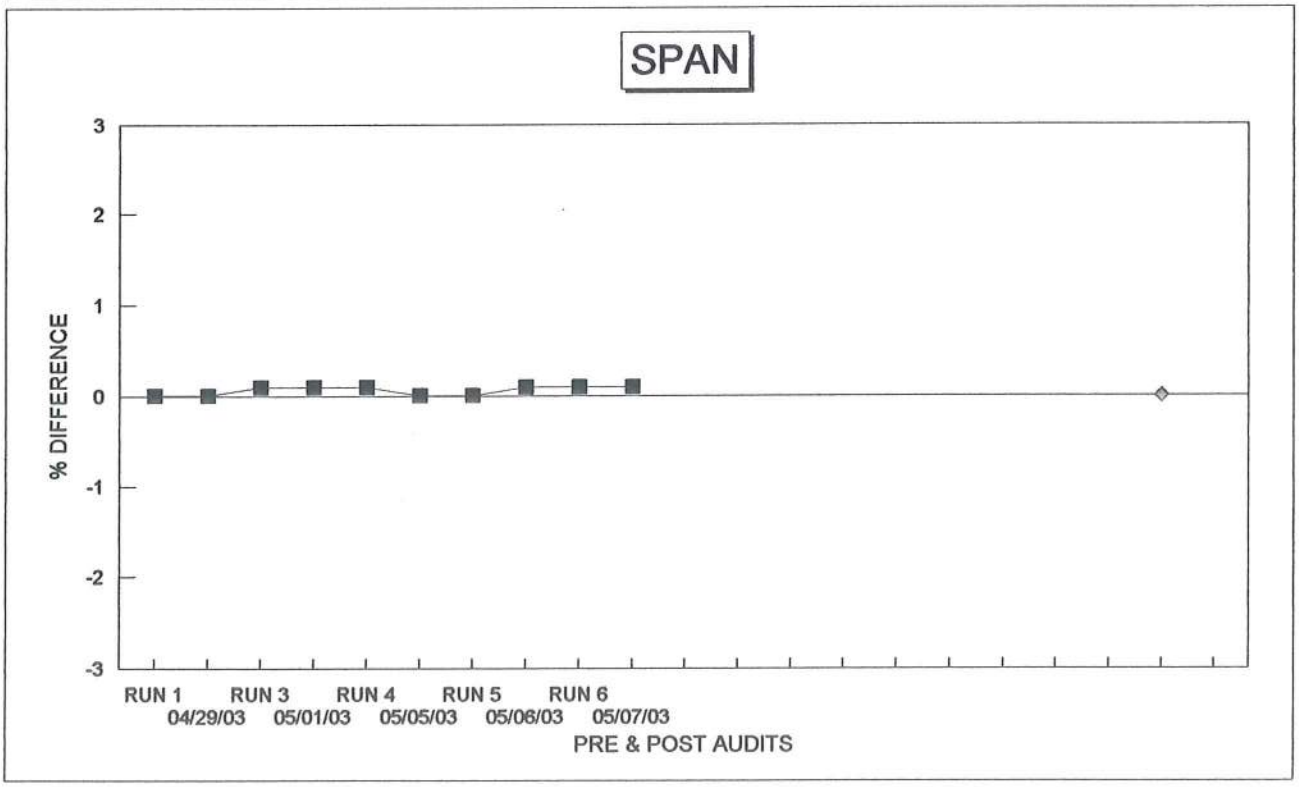
-3
% DIFFERENCE
RUN 1
04/29/03
RUN 3
05/01/03
RUN 4
05/05/03
RUN 5
05/06/03
RUN 6
05/07/03
PRE & POST AUDITS


SPAN
3
2
1
0
-1
-2
-3
% DIFFERENCE
RUN 1
04/29/03
RUN 3
05/01/03
RUN 4
05/05/03
RUN 5
05/06/03
RUN 6
05/07/03
PRE & POST AUDITS

CO ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Date: 04-29-03

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

Calibration by: D. Wade, Sta. 0

Cal Gas Flow: 1.5 SCFH

Measured by: Rotameter

BP: 29.92

Instrument ID: PRINCO

Temp: 75

Instrument ID: TR

Cylinders:

1. # 04ZTAC 2-A Concentration: 00.00 % CO Cyl. Press.: 900 PSI
   Certified by: AIR LIQUIDE Date: 02-20-02
2. # CC-3131 Concentration: 5.02 % CO Cyl. Press.: 1625 PSI
   Certified by: AIR LIQUIDE Date: 03-13-03
3. # CC55904 Concentration: 8.60 % CO Cyl. Press.: 700 PSI
   Certified by: AIR LIQUIDE Date: 02-14-00
4. # CC-12731 Concentration: 1.98 % CO Cyl. Press.: 1725 PSI
   Certified by: AIR LIQUIDE Date: 03-13-03

Analyzer: **Calibrated Range:** 0-10.0 % **Output:** 0-1.0 V.
Flow: 1.5 SCFH **Measured by:** Rotameter

Calibration Results

Point #	CYL. #	% CO	EXPECTED METER	EXPECTED DVM	ACTUAL METER	ACTUAL DVM	ADJ. METER	ADJ. DVM
1	1	0.00	00.0	.000	00.0	.000	00.0	.000
2	2	5.02	50.2	.502	49.4	.494	50.2	.502
3	3	8.60	86.0	.860	85.9	.859		
4	4	1.98	19.8	.198	19.5	.195		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 5.010

CO Linear Regression Results:

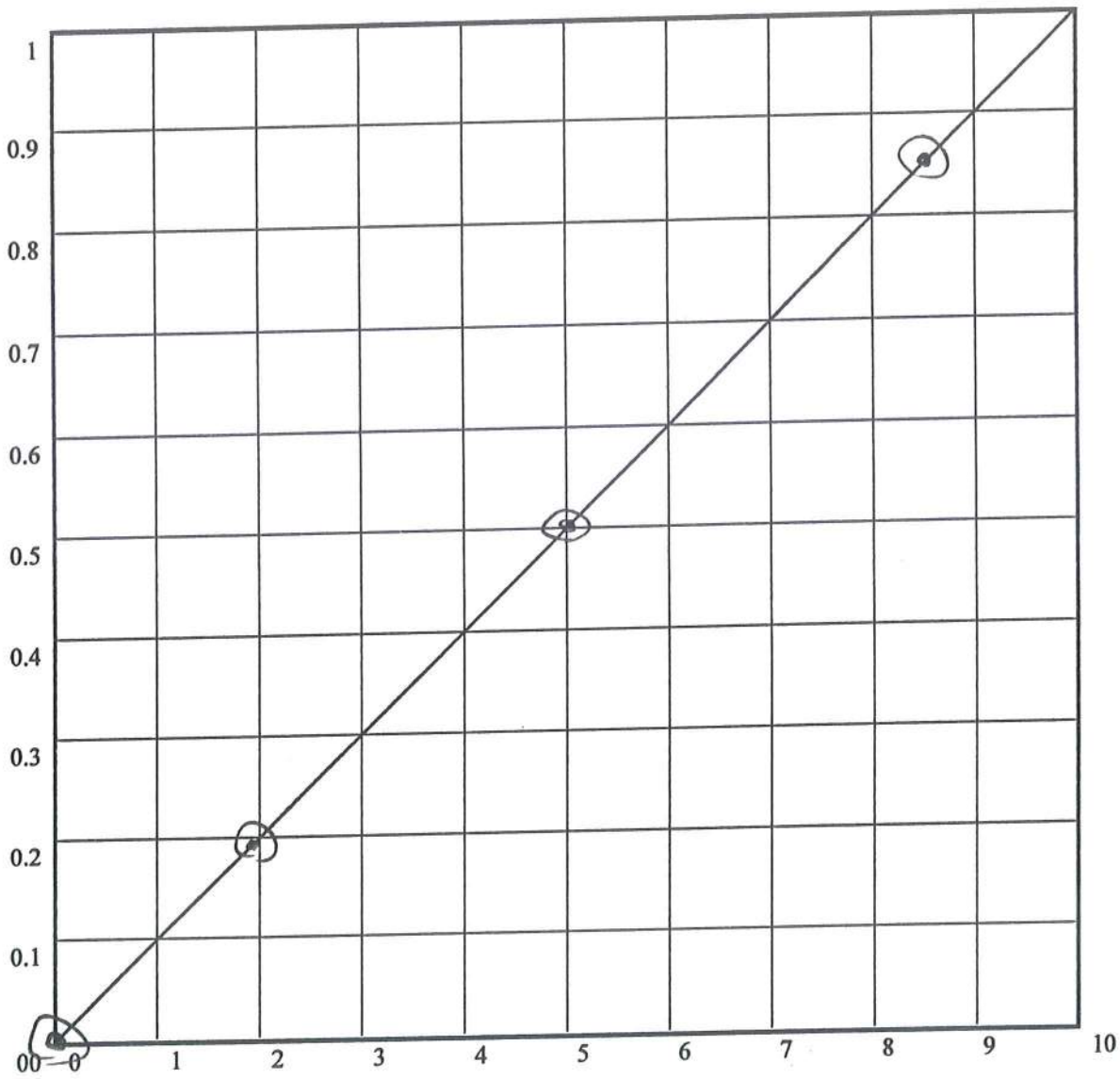
Y = MX +B

Slope (M) = -.0010979

Y Intercept (B) = .1000251

Correlation Coefficient (r) = .9999929

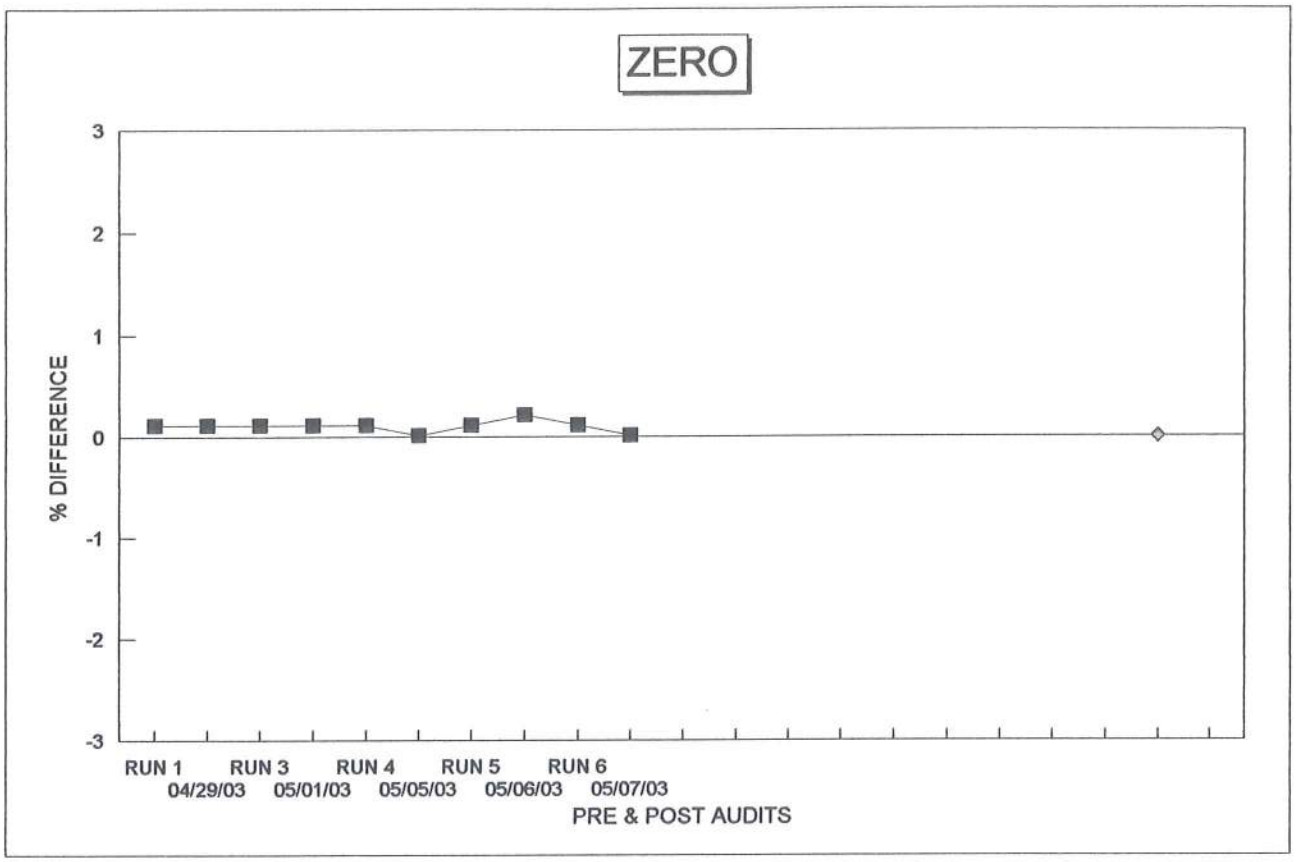
r^2 = .9999854



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

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

HIGH VOLTS	.859	= 8.59 - 8.60	= -.010	= -.100	
LOW VOLTS	.195	= 1.95 - 1.98	= -.030	= -.300	


ZERO
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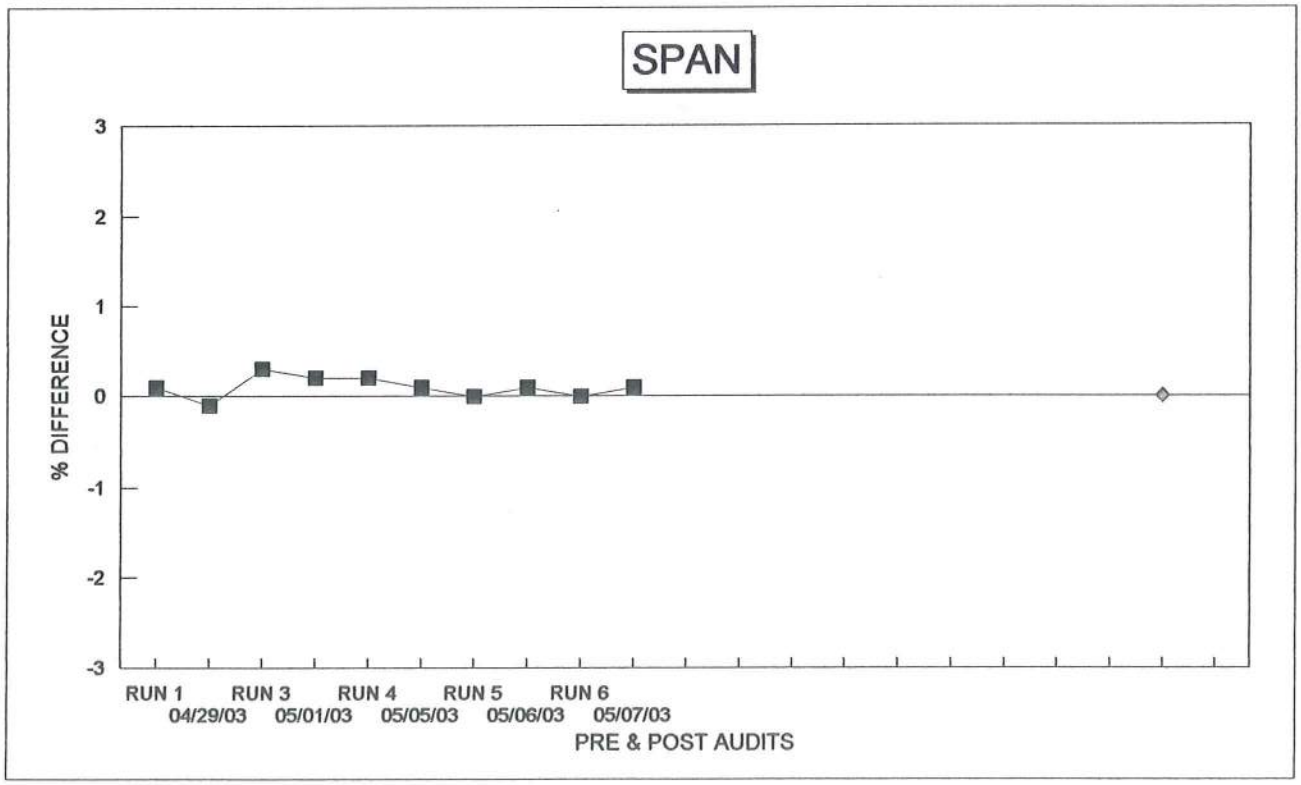
-1
-2
-3
% DIFFERENCE
RUN 1
04/29/03
RUN 3
05/01/03
RUN 4
05/05/03
RUN 5
05/06/03
RUN 6
05/07/03
PRE & POST AUDITS


SPAN
3
2
1
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-1
-2
-3
% DIFFERENCE
RUN 1
04/29/03
RUN 3
05/01/03
RUN 4
05/05/03
RUN 5
05/06/03
RUN 6
05/07/03
PRE & POST AUDITS

SO_2 ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Date: 04-29-03

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

Calibration by: D. A Tech

Cal Gas Flow: 1.5 SCFH

Measured by: Rotameter

BP: 29.92

Instrument ID: PRINCO

Temp: 75

Instrument ID: TR

Cylinders:

1. # 042TAC 2-A Concentration: 00.00 % SO_2 Cyl. Press.: 900 PSI
   Certified by: AIR LIQUIDE Date: 02-20-02
2. # CC62184 Concentration: 1290 % SO_2 Cyl. Press.: 1025 PSI
   Certified by: AIR LIQUIDE Date: 01-29-01
3. # ALM0 49127 Concentration: 1770 % SO_2 Cyl. Press.: 900 PSI
   Certified by: SCOTT SPECIALTY GASES Date: 05-15-97
4. # ALM0 52285 Concentration: 506 % SO_2 Cyl. Press.: 825 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	-.009	00.0	.000
2	2	1290	51.6	.516	51.6	.516	51.6	.516
3	3	1770	70.8	.708	71.0	.710		
4	4	506	20.2	.202	19.7	.197		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 1250.261

SO_2 Linear Regression Results:

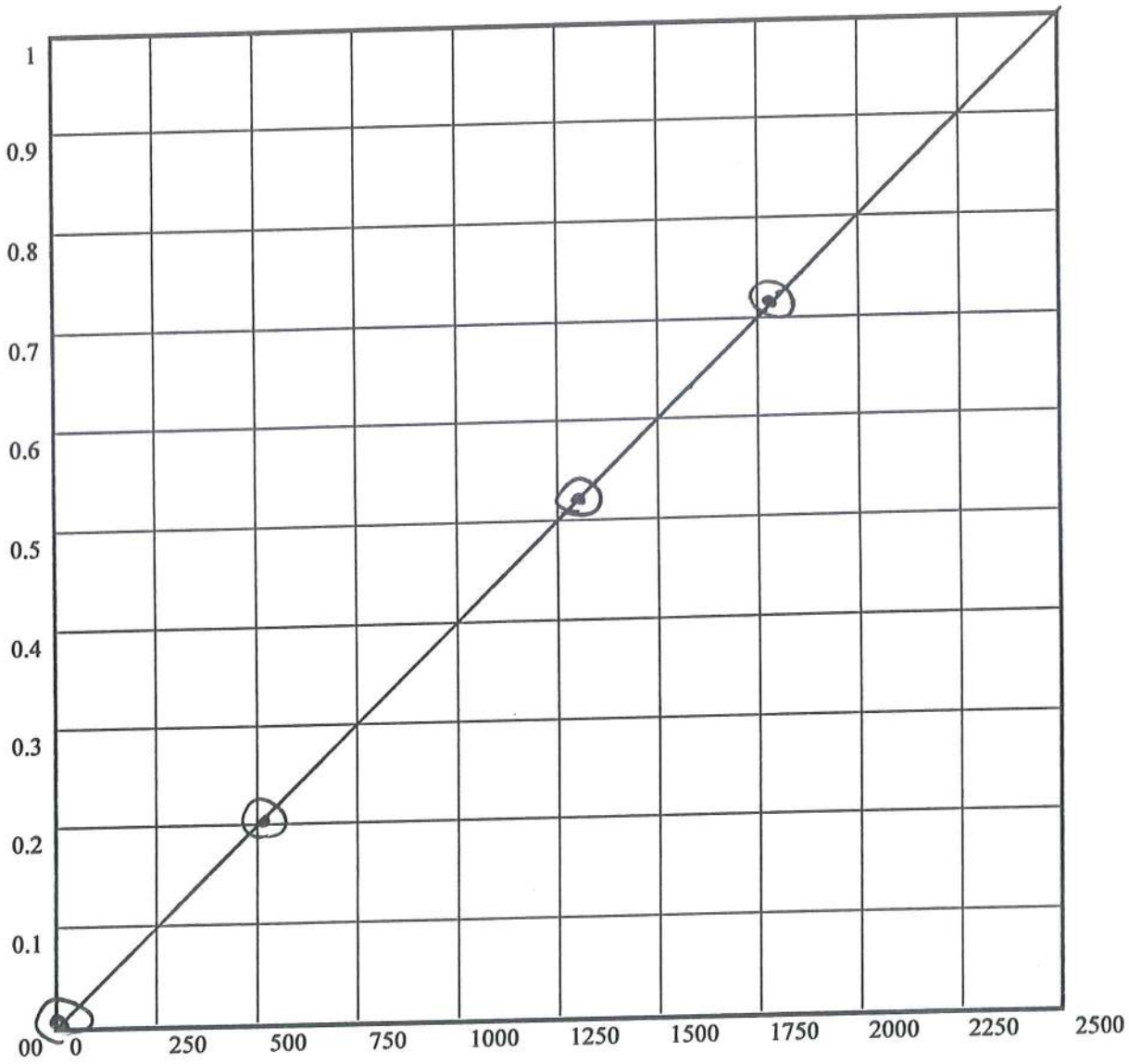
Y = MX +B

Slope (M) = -.0026762

Y Intercept (B) = .0004020

Correlation Coefficient (r) = .9999630

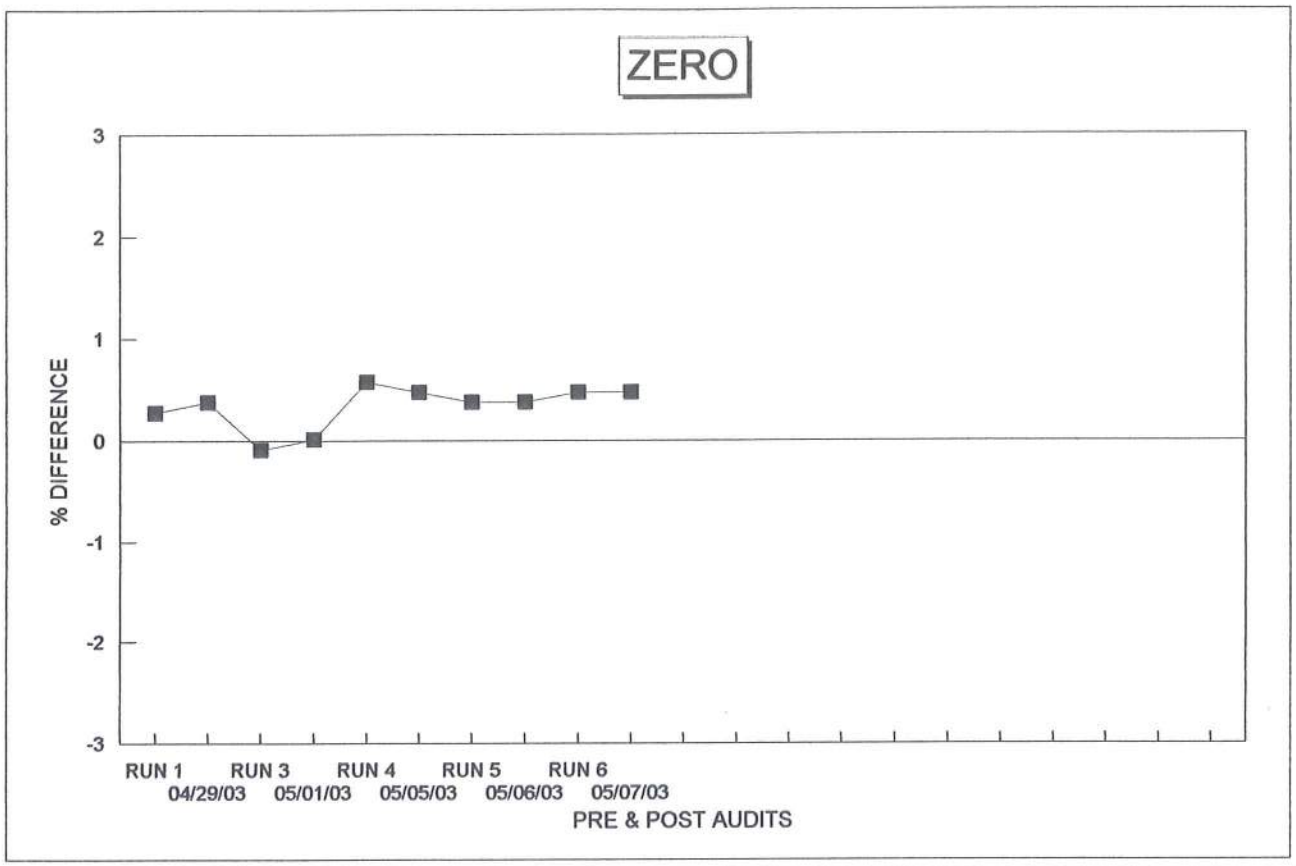
r^2 = .9999260



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

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

HIGH VOLTS	.710	= 1775.0 - 1770.0	= 5.000	=	.200
LOW VOLTS	.197	= 492.5 - 506.0	= -13.500	=	-.540


ZERO
3
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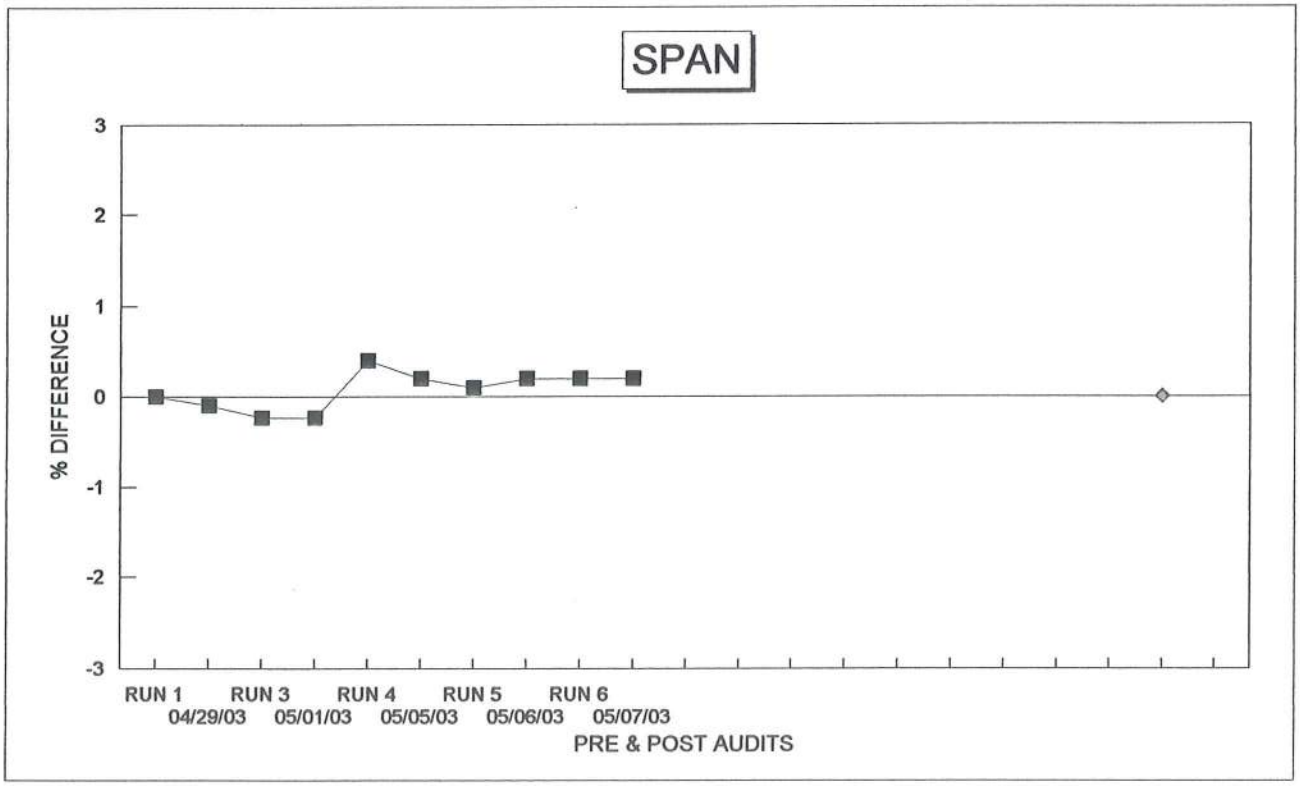
-1
-2
-3
% DIFFERENCE
RUN 1
04/29/03
RUN 3
05/01/03
RUN 4
05/05/03
RUN 5
05/06/03
RUN 6
05/07/03
PRE & POST AUDITS


SPAN
3
2
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0
-1
-2
-3
% DIFFERENCE
RUN 1
04/29/03
RUN 3
05/01/03
RUN 4
05/05/03
RUN 5
05/06/03
RUN 6
05/07/03
PRE & POST AUDITS

LOW SPAN

AIR LIQUIDE

GASES FOR RESEARCH AND DEVELOPMENT

CYL # CC-12731 CGA 590

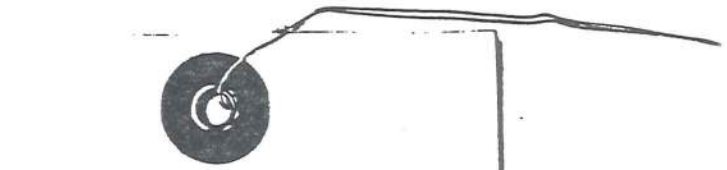
PRES 1665 VOL 130 c.f

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

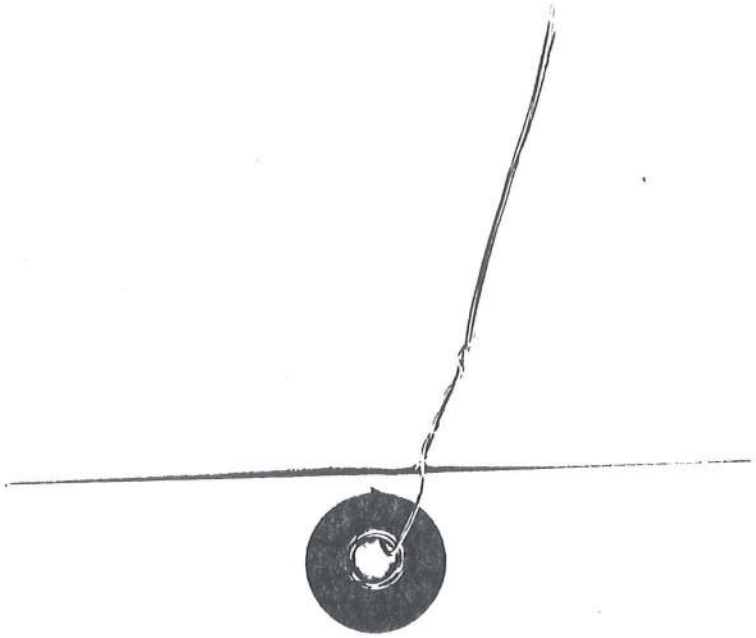


AIR LIQUIDE

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

GASES FOR RESEARCH AND DEVELOPMENT

CYL # CC55904 CGA 590

PRES 1650 VOL 150 cf

TEST # 04500 DATE 02-14-00

Analytical Method GC / Paramagnetic

	Requested	Analyzed
Hydrogen		
Nitrogen	Bal.	Bal.
Argon		
Air		
Carbon Monoxide	8.5%	8.60%
Methane		
Oxygen	21%	21.10%
Helium		
Carbon Dioxide	21%	21.23%

SIGNED

MID SPAN

AIR LIQUIDE

GASES FOR RESEARCH AND DEVELOPMENT

CYL # CC-3131 CGA 590

PRES 1665 VOL 130 Cf.

TEST # 07203 DATE 03-13-03

Analytical Method GC / Paramagnetic

	Requested	Analyzed
Hydrogen		
Nitrogen	Bal.	Bal.
Argon		
Air		
Carbon Monoxide	5%	5.02%
Methane		
Oxygen	12.5%	12.5%
Helium		
Carbon Dioxide	12.5%	12.46%

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

Scott Specialty Gases

500 WEAVER PARK RD,LONGMONT,CO 80501 Phone: 303-442-4700 Fax: 303-772-7673

CERTIFICATE OF ANALYSIS: Interference-Free™ Multi-Component EPA Protocol Gas

Customer
ENERGY & ENV MEASUREMENT

C/O ED WADINGTON
3730 N. PELLEGRINO DR.
TUCSON,AZ 85749

Assay Laboratory

SCOTT SPECIALTY GASES
500 WEAVER PARK RD
LONGMONT,CO 80501

Project No.: 08-34136-001
P.O. No.: VERBAL

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure #G1; September, 1993.

Cylinder Number: ALM052285 Certification Date: 4/21/97 Exp. Date: 4/21/2000
Cylinder Pressure***: 1996 PSIG

COMPONENT	CERTIFIED CONCENTRATION	ANALYTICAL ACCURACY**
SULFUR DIOXIDE *	506 PPM	+/- 1% NIST Traceable
NITROGEN	BALANCE	

*** Do not use when cylinder pressure is below 150 psig.
** Analytical accuracy is inclusive of usual known error sources which at least include precision of the measurement processes. Product certified as +/- 1% analytical accuracy is directly traceable to NIST standards.
* This Protocol has been certified using corrected NIST SO2 standard values, per EPA guidance dated 7/24/96 and will not correlate with uncorrected Protocols.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 1661	9/27/98	ALM059505	488.5 PPM	SO2/N2

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	LAST DATE CALIBRATED	ANALYTICAL PRINCIPLE
FTIR System/8220/AAB9400251	03/20/97	Scott Enhanced FTIR

ANALYZER READINGS

(Z = Zero Gas R = Reference Gas T = Test Gas r = Correlation Coefficient)

First Triad Analysis

SULFUR DIOXIDE *

Date: 04/14/97 Response Unit: PPM

Z1 = 0.3847	R1 = 487.72	T1 = 505.77
R2 = 488.79	Z2 = 1.6201	T2 = 505.69
Z3 = 1.8428	T3 = 505.76	R3 = 488.69
Avg. Concentration:	505.8	PPM

Second Triad Analysis

Date: 04/21/97 Response Unit: PPM

Z1 = 0.3241	R1 = 488.29	T1 = 505.43
R2 = 488.53	Z2 = 1.6098	T2 = 505.75
Z3 = 0.5340	T3 = 505.74	R3 = 488.69
Avg. Concentration:	505.8	PPM

Calibration Curve

Concentration = A + Bx + Cx2 + Dx3 + Ex4
r = 0.999990
Constants: A = 0.000000
B = 1.000000 C = 0.000000
D = 0.000000 E = 0.000000

Special Notes:

ANALYST: Devon VonFeldt
Devon VonFeldt

SO2 concentration analysis
05/14/02

Vm(std)	1.500				
mcf	1			dscf=	1.600
Hg	30.08				
DH	0.12				
temp	68	528		ppm =	510
ml BA ++	190				
Normality	0.0101		71	Run1	504
			72	Run 2	502
			72	Run3	510
Tank I.D. #	ALMO52285			avg.	505

AIR LIQUIDE™

8832 DICE ROAD, SANTA FE SPRINGS, CALIFORNIA 90670 (562) 945-1383

CERTIFIED ISO - 9002 INTERTEK CERTIFICATION

CERTIFICATE of ANALYSIS

EPA Protocol Gases

l. Number: 62184	Cyl. Pressure:* 2000PSIG	Lot Number: SFS34489
Assay Date: 01/29/01	Expiration Date: 01/29/04	Document Number: 7638112
stomer: R LIQUIDE COMA, WA	P.O. Number: LOKKEE	Item Number:

COMPONENT Name	REQUESTED Concentration	ASSAY Concentration
Sulfur Dioxide	1260 ppm	1290 ± 20 ppm
Nitrogen	Balance	Balance

*Mixture is valid only to 150 psig

EPA Protocol
ction No. 2.2, Procedure . G-1

Analyst: Thuan Tran
Approved by: John Oliveri

REFERENCE STANDARD EMPLOYED FOR ANALYSIS

Concentration	Component	Balance	Cyl. No.	Batch	Exp. Date	Sample No.	Type
1540 ± 10 ppm	Sulfur Dioxide	Nitrogen	CC 62136	L99-029	12/02/01	GL	GMIS

Sulfur Dioxide

GAS ANALYZER EMPLOYED

nufacturer:	Horiba
Model Number:	CMA-331A
Serial Number:	56674503
R Last Calibrated:	01/12/01
alytical Principle:	NDIR

ANALYSIS SUMMARY

	01/22/01 Triad 1	01/22/01 Triad 2	01/22/01 Triad 3	Sulfur Dioxide Units
Zero	0	0	0	Vdc
Reference	153	153	153	Vdc
Candidate	127	128	128	Vdc
Result	1278	1288	1288	ppm
Evaluation	VALID	VALID	VALID	
MEAN ANALYTICAL RESULT:			1285 ppm	

	01/29/01 Triad 4	01/29/01 Triad 5	01/29/01 Triad 6	Sulfur Dioxide Units
Zero	0	0	0	Vdc
Reference	153	153	153	Vdc
Candidate	128	128	128	Vdc
Result	1288	1288	1288	ppm
Evaluation	VALID	VALID	VALID	
MEAN ANALYTICAL RESULT:			1288 ppm	

Analyst:	Approved by:

Scott Specialty Gases

500 WEAVER PARK RD,LONGMONT,CO 80501 Phone: 303-442-4700 Fax: 303-772-7673

CERTIFICATE OF ANALYSIS: EPA PROTOCOL GAS

Customer
ENERGY & ENV MEASUREMENT

C/O ED WADINGTON
3730 N. PELLEGRINO DR.
TUCSON,AZ 85749

Assay Laboratory

SCOTT SPECIALTY GASES
500 WEAVER PARK RD
LONGMONT,CO 80501

Project No.: 08-34135-003
P.O. No.: VERBAL

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure #G1; September, 1993.

Cylinder Number: ALM049127 Certification Date: 4/21/97 Exp. Date: 4/21/2000
Cylinder Pressure***: 1860 PSIG

COMPONENT	CERTIFIED CONCENTRATION	ANALYTICAL ACCURACY**
SULFUR DIOXIDE *	1,770 PPM	+/- 1% NIST TRACEABLE
NITROGEN	BALANCE	

*** Do not use when cylinder pressure is below 150 psig.

** Analytical accuracy is inclusive of usual known error sources which at least include precision of the measurement processes. Product certified as +/- 1% analytical accuracy is directly traceable to NIST standards.

* This Protocol has been certified using corrected NIST SO2 standard values, per EPA guidance dated 7/24/96 and will not correlate with uncorrected Protocols.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM-R-1696	7/03/98	ALM057797	3131. PPM	SULFUR DIOXIDE

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	LAST DATE CALIBRATED	ANALYTICAL PRINCIPLE
FTIR System/8220/AAB9400251	03/20/97	Scott Enhanced FTIR

ANALYZER READINGS

(Z = Zero Gas R = Reference Gas T = Test Gas r = Correlation Coefficient)

First Triad Analysis

SULFUR DIOXIDE *

Date: 04/14/97	Response Unit: PPM	
Z1 = 0.7210	R1 = 3127.7	T1 = 1767.1
R2 = 3131.7	Z2 = 4.6770	T2 = 1768.1
Z3 = 4.6770	T3 = 1768.1	R3 = 3133.7
Avg. Concentration:	1768.	PPM

Second Triad Analysis

Date: 04/21/97	Response Unit: PPM	
Z1 = 0.4020	R1 = 3125.8	T1 = 1770.2
R2 = 3132.3	Z2 = 6.6540	T2 = 1769.3
Z3 = 4.9410	T3 = 1770.9	R3 = 3134.9
Avg. Concentration:	1770.	PPM

Calibration Curve

Concentration = A + Bx + Cx2 + Dx3 + Ex4	
r = 0.999990	1696
Constants:	A = 0.00000
B = 1.00000	C = 0.00000
D = 0.00000	E = 0.00000

Special Notes:

ANALYST: Devon VonFeldt
DEVON VONFELDT

SO2 concentration analysis
05/14/02

Vm(std)	1.500			
mcf	1		dscf=	1.500
Hg	30.08			
DH	0.12			
temp	69	529	ppm =	1778
ml BA ++	621			
Normality	0.0101			

Run1	1773
Run 2	1761
Run3	1778
avg.	1771

Tank I.D. # ALMO49127

Certificate of Analysis

ANALYTICAL CONTROL LABORATORY ANALYSIS

ACETONE - OPTIMA

Catalog No.: A-929

Lot No.: 972630

January 13, 1997

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
Aldehyde	0.0005%
Assay	99.6%
Color	5 APHA
Density (g/mL) at 25°C	0.7851
Description	Clear, Colorless Liquid
Fluorescence Background (as Quinine Sulfate)	Not More Than 1 PPB
Identification	Pass Test
Isopropyl Alcohol	0.01%
Methanol	0.03%
Optical Absorbance at 350nm	0.001
at 340nm	0.05
at 330nm	0.69
Pesticide Residue Analysis (as Heptachlor Epoxide)	Not More Than 10 ng/L
Refractive Index at 25°C	1.3560
Residue after Evaporation	0.3 PPM
Solubility in Water	Pass Test
Substances Reducing Permanganate	Pass Test
Titratable Acid	0.0003 Meq/g.
Titratable Base	0.0001 Meq/g.
Water (H_2O)	0.4%

Approved By: Robert Dowd

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Q.C. Laboratory Manager

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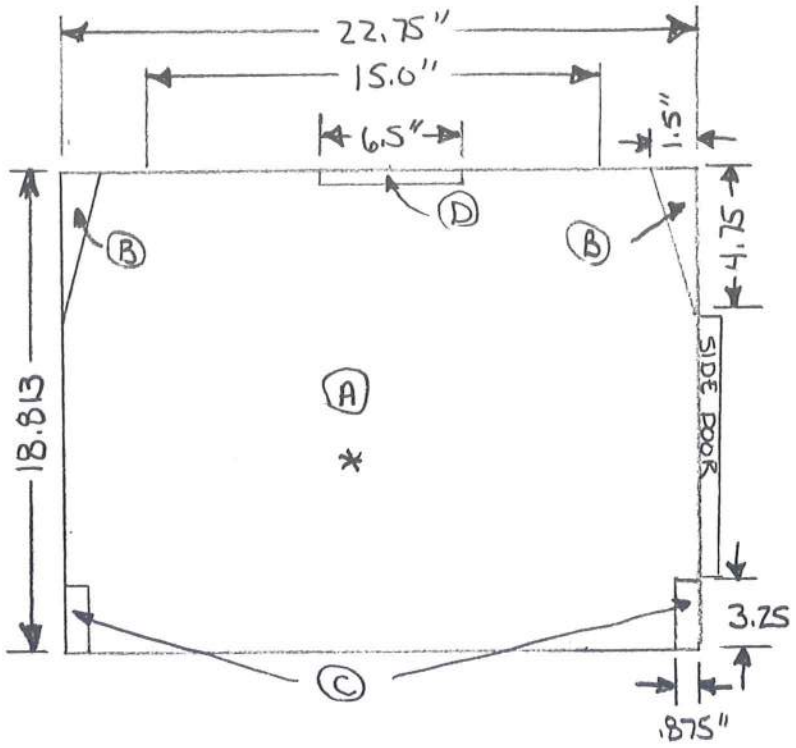
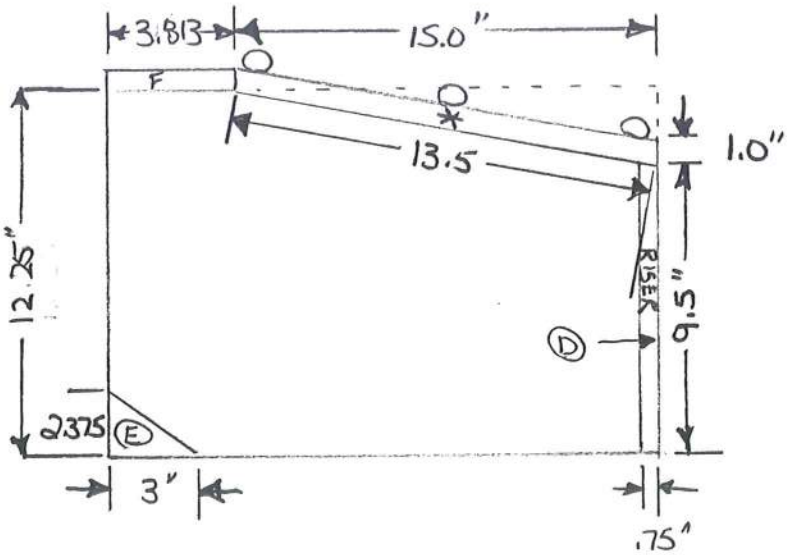
Firebox Volume Calculations - Jotul F600





	$A = 18.813 \times 22.75 \times 12.25'$	=	5242.948
minus	$B = .5(1.5 \times 4.75 \times 9.5)2$	=	-67.688
minus	$C = (.875 \times 3.25 \times 12.25)2$	=	-69.672
minus	$D = .75 \times 6.5 \times 9.5$	=	-46.313
minus	$E = .5(2.375 \times 3 \times 21)$	=	-74.813
plus	$F = 1 \times 3.813 \times 21$	=	+80.073
minus	$G = .5(3.25 \times 22.75 \times 15)$	=	-554.531
plus	$* = 13.5 \times 1 \times 115.0$	=	+202.500
plus	door $= \left(\frac{10.5 + 12.5}{2}\right) \times 10.5 \times 1$	=	+120.750
			4833.254 in^3

Fuel Load Calculations For Jotul F600

F600 Volume in cubic inches = 4833.254 in^3

cubic feet = 2.979 ft^3

Ideal Fuel Load Based on 7 lbs/ft^3 = 19.579 lbs

Fuel Load Range = Ideal +/- 10%

Low	Ideal	High
17.622	19.579	21.538

Fuel Loads

Run 1	2	3	4	5	6
17.9	N/A	18.4	17.7	17.7	17.8

APPENDIX
A

EXAMPLE CALIBRATION/DATA FLOW

All individual test run raw data sheets are organized in a manner that would allow a data reviewer to follow the data as it is being calculated in a step by step fashion. In many cases, the equations used to calculate a specific required data are given on the raw data sheets themselves.

For example, the particulate emission rate in g/dscf is calculated on Data Sheet #7. However, the data used to derive this data begins on Data Sheet #2 (Meterbox Data Sheet) where the meter volume (cubic feet), average meter temperature (°F), average ΔH (in. H_2O), and average Barometric pressure (in. Hg) are recorded and averaged. Each of the averages for these parameters are used in equation 1 on P. 7 where the volume (MCF) is converted to dscf.

The moisture catch total (g. H_2O) on the Particulate Catch/Moisture Data sheet (p. 3) is transferred to P. 7 and the percent stack moisture is calculated in equations 2 and 3.

The gross and net gravimetric (g) particulate catches are determined and calculated on PP. 3-6. Pages 4-1, 4-2 and 4-3 show the initial (tare) constant weights for filters (p. 4-1) and beakers (p. 4-2) and the final constant weights (p. 4-3) for those filters and beakers used for each run. Final and tare weight data is transferred to P. 3 and the gross gravimetric (g) catch for each filter and beaker is calculated. On P. 5 the gravimetric catch for each blank is calculated. The gross gravimetric catch for each filter and beaker is transferred to P. 6 and the net gravimetric catch (g) is calculated, as well as front half and back half catch totals. The net gravimetric catch (g) is transferred to P. 7 and the grain loading/dscf is calculated in equation 4.

Some data sheet specific information is listed below on a page by page basis.

P. 8 The % ambient moisture is determined by interpolating from psychrometric charts which are contained in the State of Oregon Department of Environmental Quality's "Standard Method for Measuring the Emissions and Efficiencies of Woodstoves".

The % relative humidity is determined from the wet bulb/dry bulb temperature readings using the tables found in Section 3.1.2.4 of the State of Montana Air Quality Bureau's Quality Assurance Manual.

P. 10 The uncorrected moisture meter readings are corrected for pin insulation and may or may not be corrected for ambient (wood) temperatures. All corrections are based upon the correction equations or tables supplied by the moisture meter manufacturer. (These are standard, known corrections.)

P. 11 The moisture meter readings are corrected as discussed above.

P. 12 The gas concentrations shown for each gas monitored (CO_2, O_2, CO and SO_2) are determined by converting the analyzer's voltage output recorded on P. 12 to the concentration shown using the analyzer's current calibration curve. The SO_2 concentration is determined using the manufacturer's calibration curve and the current calibration curve.

The cal. W/B (calculated wet bulb) temperature is obtained by first determining the % moisture in the extracted flue gas stream using the temperature data from thermocouples 1 (Wet Bulb) and 2 (Dry Bulb). Then based upon the stack temperature (thermocouple 3) and the % moisture in the extracted gas stream, a calculated wet bulb temperature is determined. All data is derived from the psychrometric tables found in the State of Oregon's "Standard Method for Measuring the Emissions and Efficiencies of Woodstoves".

The following pages contain the equations used to generate the data on Tables 3-5 on the computer printouts:

Dry Gas Volume (standard):

$$V_{m(std)} = \frac{V_m * 17.65 * mcf * \left(P_{bar} + \frac{\Delta H}{13.6} \right)}{T_m}$$

Volume of Water:

$$V_{w(std)} = (0.04707)(ml\ H_2O)$$

Moisture Content:

$$B_{ws} = \left(\frac{V_w}{V_w + V_{m(std)}} \right) * 100$$

Dry Burn Rate:

$$Br = \left(\frac{Wwt - (Wwt * \%\ H_2O)}{2.2046} \right) * \frac{60}{\theta}$$

Carbon Balance (N_t):

$$Nt = \frac{K_3 Nc}{(YCO_2 + YCO + YHC)}$$

Stack Flow Rate (Q_{sd}):

$$Q_{sd} = K_4 N_t Br$$

Particulate Concentration (C_s):

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

Particulate Emission Rate (E):

$$E = C_s Q_{sd}$$

Proportional Rate Variation (Pr):

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

Where:

Br =	dry wood burn rate, kg/hr.
B_{ws} =	Water vapor in the gas stream, proportion by volume.
c_s =	Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, g/dscm (g/dscf).
E =	Particulate Emission Rate, g/hr.
ΔH =	Average pressure differential across the orifice meter (see Figure 5-2), mm H_20 (in. H_20).
K_3 =	1.0 lb/lb (English) 1000 g/kg (metric)
K_4 =	0.02406 dsm^3/g-mole(metric) 384.8 dscf/lb-mole (English)

m_n = Total amount of particulate matter collected, mg.

mcf = Dry gas meter correction factor.

N_c = Gram atoms of carbon/gram of dry fuel (lb/lb), equal to 0.0425.

N_t = Total dry moles of exhaust gas/Kg of dry wood burned.

P_r = Percent of proportional sampling rate.

P_{bar} = Barometric pressure at the sampling site, mm Hg (in. Hg).

Q_{sd} = Total gas flow rate, dscf/hr.

S_i = Concentration measured at the SO_2 analyzer for the "i^{th}" 5 minute interval, ppm.

S_1 = Concentration measured at the SO_2 analyzer for the first 5 minute interval, ppm

T_m = Absolute average DGM temperature (see Figure 5-2), °K (°R).

T_{std} = Standard absolute temperature, 293°K (528°R).

V_m = Volume of gas sample as measured by dry gas meter, dcm (dcf).

$V_{m(std)}$ = Volume of gas sample measured by the dry gas meter, corrected to standard conditions, dscm (dscf).

$V_{w(std)}$ = Volume of water vapor in the gas sample, corrected to standard conditions, scm (scf).

W_{wt} = Wet wood weight.

Y = Dry gas meter calibration factor.

Y_{CO} = Measured mole fraction of CO (dry).

Y_{CO2} = Measured mole fraction of CO_2 (dry).

Y_{HC} = Assumed mole fraction of HC (dry);
=0.0088 for catalytic woodheaters
=0.0132 for noncatalytic woodheaters
=0.0080 for pellet fired woodheaters

θ = Total sampling time, min.

13.6 = Specific gravity of mercury.

60 = Sec/min.

100 = Conversion to percent.

M5H PARTICULATE SAMPLING TRAIN

1. Probe

   3/8" seamless SS-20" long. Outlet end of probe is attached to a SS outlet fitting with a Sweglock SS union. The probe is unheated except for the portion that is in the stack and the heated filter box. The probe is sealed to the stack with a washer.

2. Filter Holder

   A 3" or 4" standard M5 filter holder. A SS filter support with gasket.

3. Filters

   3" or 4" fiber glass (#25 glass) manufactured by Schleicher and Schuell.

4. Front Half Filter Heater

   A box containing a fan for air circulation and a cone heater. The temperature in the box is monitored with a type K thermocouple and adjusted with a voltage regulator to maintain a temperature below 248 °F.

5. Desiccant

   Indicating silica gel, 6-20 mesh. The silica gel is changed as needed.

6. Filter (Back Half) Holder

   Same as front half 3" or 4" filter.

7. Impinger Gas

   Type K thermocouple threaded into the exit "arm" of the impinger. Ice is added to the cooler whenever necessary to maintain an exit gas temperature less than 68 °F.

8. Meterbox

   RAC Stack Sampler modified by EEMC

   Ranges: 0-1.0" inclined water manometer

   0-10.0" vertical water manometer

   Accuracy: Dry gas Meter 0-999.999 cu ft ±1.0%

   Temperatures are monitored using two type K thermocouples.

APPENDIX
B

SAMPLING PROCEDURES AND INSTALLATION DESCRIPTION

This section is broken into two major parts. The first contains a brief description of the sampling and procedures used by LoKee Testing Laboratory when performing a test using EPA Methods 28, 28A and 5H. The second section contains a complete listing of all equipment in each of the major sampling trains and a diagram of each major train.

LoKee Testing Laboratory uses EPA M5H for the particulate sampling procedure and collects the required data so that efficiency of a unit can be calculated using the Oregon Method.

TEST FACILITY AND WOOD HEATER EQUIPMENT LIST

1. 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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Run 1
4-29-2003


Jotul N. America
F 600
Run 1
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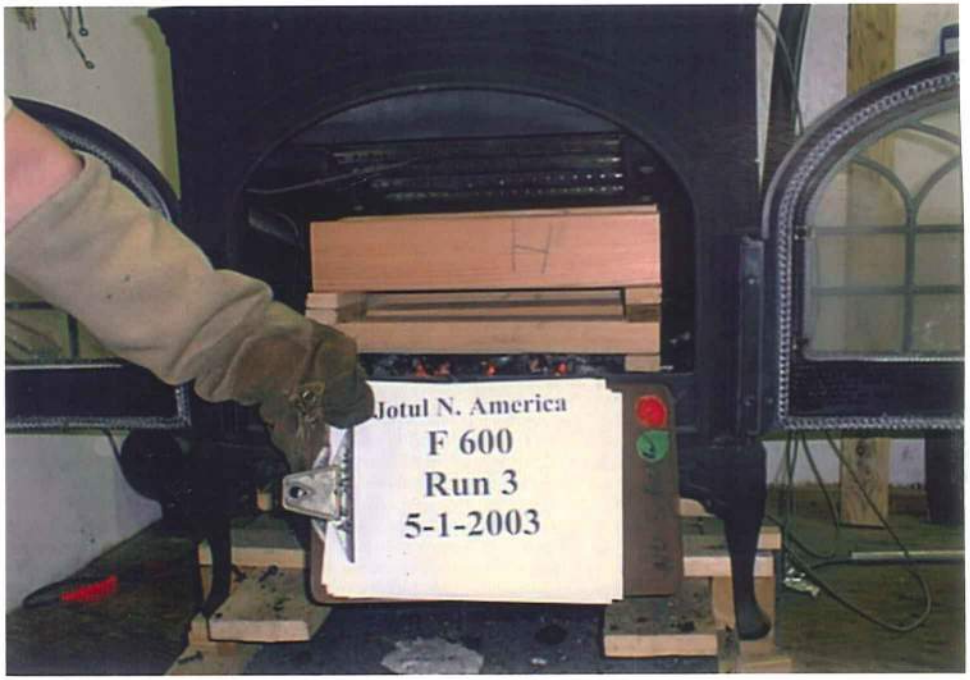
Jotul N. America
F 600
Run 3
5-1-2003


Jotul N. America
F 600
Run 3
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Run 4
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Run 4
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Run 5
5-6-2003


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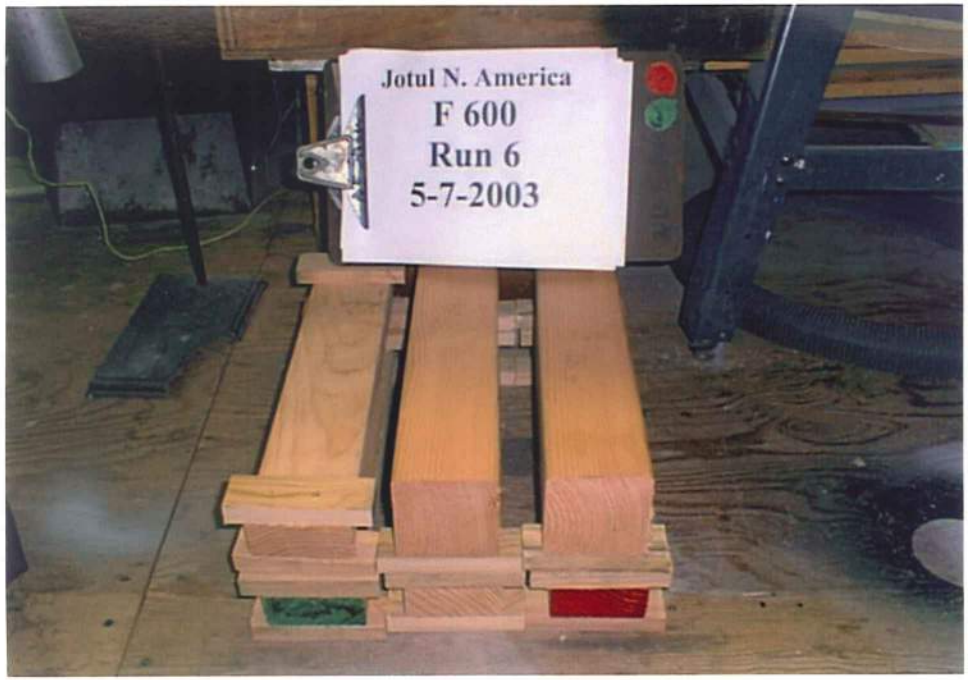
Run 5
5-6-2003


Jotul N. America
F 600
Run 6
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