LOKEE TESTING Laboratory

United States
Environmental Protection Agency
Wood Heater Certification Test Report

JOTUL U.S.A., INC.
F500

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

F500

Volume 1

Report By:

Chip Wadington
Deborah Wadington
Joy Venton

CONFIDENTIAL

RELEASED ONLY BY
AUTHORIZED PERSONNEL

May 31, 2002

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TEST SERIES INFORMATION

Unit name and model number: F500

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: 09/18/2001 Aged: 04/25-26/2002 Tested: 05/15-21/2002

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

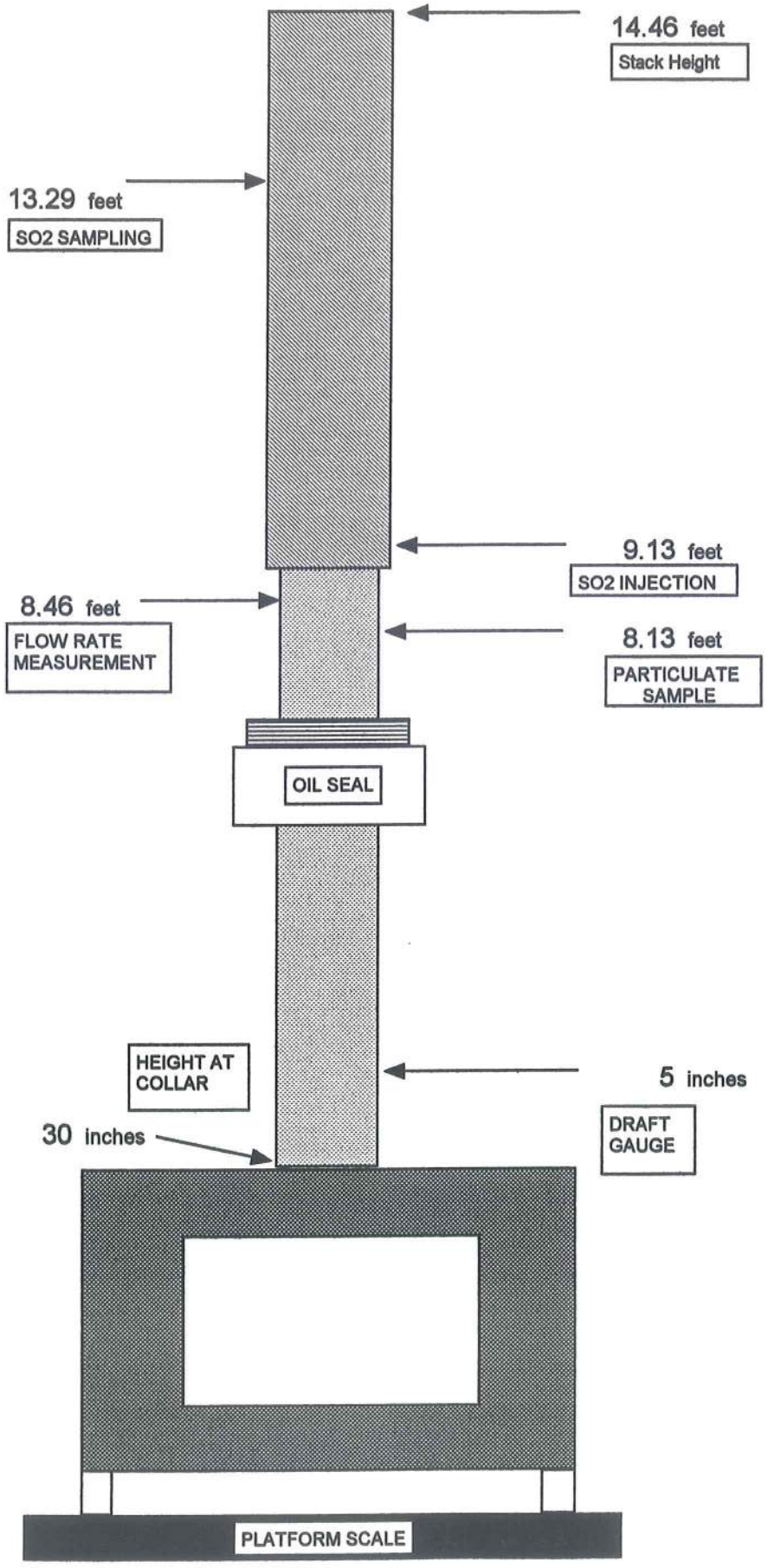
Test Location: 13235 Prairie Circle East
Sumner, WA 98390-7250
Test Site Elevation: 500 feet above sea level

LoKee's Field Team

Team Members: Chip Wadington
Deborah Wadington
Joy Venton

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: F500 **Date:** 05/21/02



AGING DATA SHEET

UNIT : F500 DATE: 4-25-02

Hr #	DATE	TIME	TEMP Fbox 1	TEMP Sec 2
1	4-25-02	1110	1028	1419
2	"	1210	671	665
3	"	1310	470	1166
4	"	1410	676	1188
5	"	1510	741	840
6	4-26-02	1210	1126	1315
7	"	1310	723	757
8	"	1410	474	1233
9	"	1510	636	1251
10	"	1610	722	901
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:

Stove lit 0830
Stove lit 0900

LOKEE TESTING LABORATORY.
13235 PRAIRIE CIRCLE EAST, SUMNER, WA 98390-7250
Phone (360)-897-9685

To: Robert C. Marshall, Jr., US EPA
From: Chip Wadington, LoKee Testing Laboratory
Subject: Wood Stove Certification Test Notification

This is to notify EPA that:

Manufacturer's Name: **JOTUL USA INC.**
Address: **400 Riverside Street**
Portland, Maine 04104

Contact: **Shawn Malloy**
Phone: **1-207-797-5912**

has scheduled the **F-500** for certification testing at LoKee according to the following:

Dates Scheduled	Date Notification Sent	Date Notification Canceled	Testing Activity (if any)
9/17-21/01	8/9/01		None
9/14-28/01	8/9/01		None
10/1-5/01	8/9/01		None
10/8-12/01	8/9/01		None
10/15/19/01	8/9/01		None
11/5-9/01	10/03/01		None
11/12-16/01	10/03/01		None
11/19-23/01	10/03/01		None
11/26-30/01	10/03/01		None
1/17,18/02	12/17/01		None
1/21-25/02	12/17/01		None
1/28-2/1/02	12/17/01		None
2/4-8/02	12/17/01		None

LOKEE TESTING LABORATORY.
13235 PRAIRIE CIRCLE EAST, SUMNER, WA 98390-7250
Phone (360)-897-9685

To: Robert C. Marshall, Jr., US EPA
From: Chip Wadington, LoKee Testing Laboratory
Subject: Wood Stove Certification Test Notification

This is to notify EPA that:

Manufacturer's Name: **JOTUL USA INC.**
Address: **400 Riverside Street**
Portland, Maine 04104

Contact: **Shawn Malloy**
Phone: **1-207-797-5912**

has scheduled the **F-500** for certification testing at LoKee according to the following:

Dates Scheduled	Date Notification Sent	Date Notification Canceled	Testing Activity (if any)
4/15-19/02	3/13/02		
4/22-26/02	3/13/02		
4/29-5/3/02	3/13/02		
5/6-10/02	3/13/02		
5/13-24/02	3/13/02		

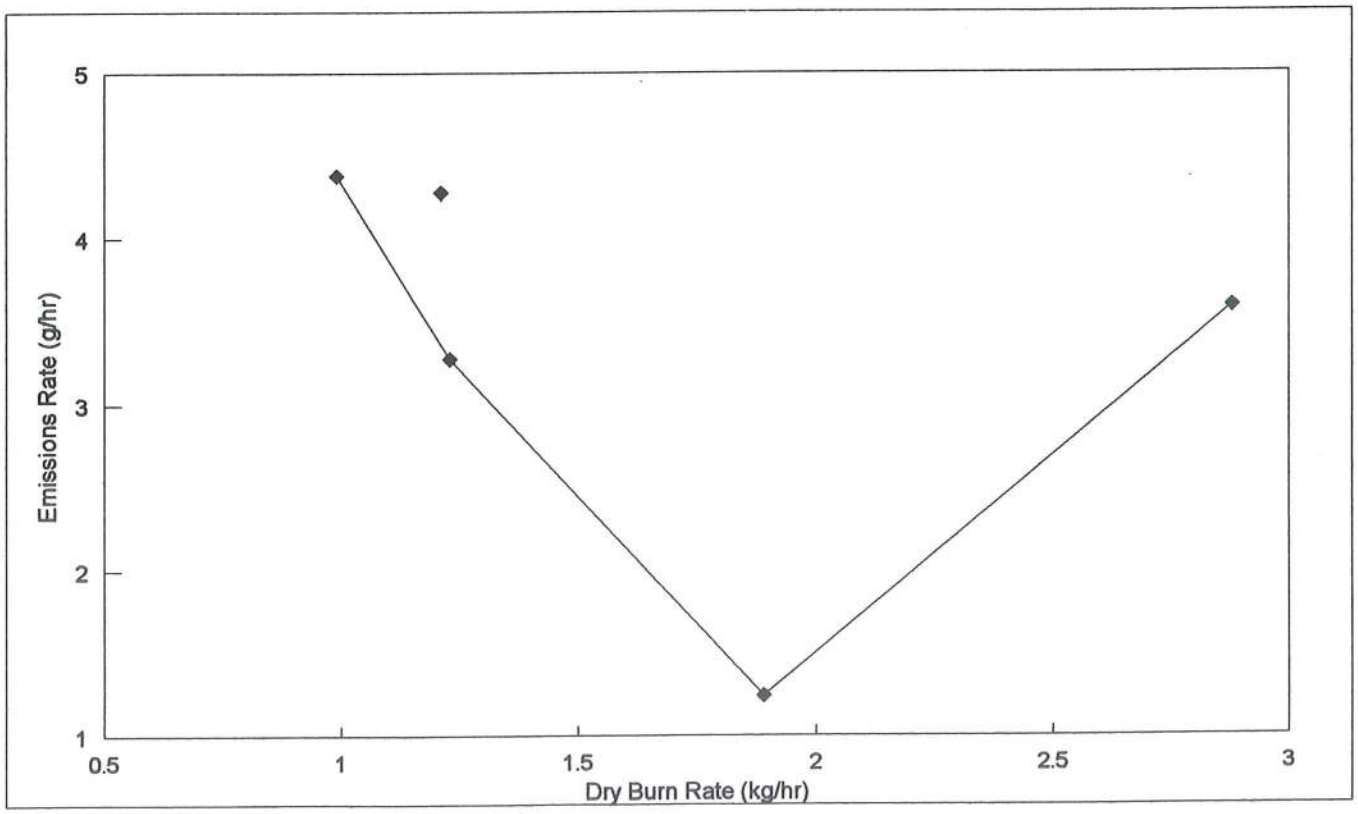
DATA
SUMMARY

Wood Heater Emission Test Summary

Laboratory/Wood Heater Information

Stove Manufacturer:	Jotul
Model Identification:	F500
Stove Type> 1=cat, 2=noncat, 3=pellet:	2
Laboratory Name:	LoKee Testing Lab
Laboratory Contact:	CHIP WADINGTON
Telephone no.:	360-897-9685
Test Dates:	5/15-21/2
Test Methods Used	
Method 28/Other:	28
Sampling Method:	5H

Run no.	Burn Rate (kg/hr)	Emission Rate (g/hr)	Heat Output (Btu/hr)	Wtd Avg (g/hr) 3.16
1	0.99	4.38	11938	
2	1.23	3.28	14832	
3	1.89	1.24	22790	
4	2.88	3.59	34728	
			NA	
			NA	
5	1.21	4.28	14590	
			NA	



DATA SUMMARY

Unit : Jotul U.S.A., Inc. – F500

	RUN #	1	4	3	2	5 Fan			
Particulate Emissions:									
Concentration:	grains/dscf:	.1830	.1142	.0314	.0630	.1529			
Emissions Rate	grams/hr:	4.39	3.28	1.24	3.59	4.28			
Emissions Factor	grams/kg:	4.43	2.66	0.65	1.25	3.54			
Front Half Catch	% of total	40.8	31.8	38.3	37.6	28.7			
Total Mass Captured	total catch:	1.3150	.7372	.1150	.1403	.9613			
Heat Output (EPA Default):	BTU/hr	11,951.4	14,864.3	22,832.1	34,690.8	14,588.4			
Fuel Burn Rates:									
Average kg/hr (dry)	Kg/hr	0.99	1.23	1.89	2.88	1.21			
Fuel Moisture Content:									
Kindling (wet basis)	%	11.739	11.032	11.164	11.583	10.608			
Pretest Fuel (wet basis)	%	17.041	16.730	16.817	17.460	16.823			
Test Fuel (wet basis)	%	17.232	17.405	17.777	17.031	16.985			
Air to Fuel Ratio		N/A	N/A	N/A	N/A	N/A			
Average Stack Gas									
Avg CO_2	%	6.78	7.57	9.19	9.78	7.50			
Avg O_2	%	N/A	N/A	N/A	N/A	N/A			
Avg CO	%	1.55	1.14	0.69	0.68	1.28			
Avg Moisture	%	5.45	7.56	8.32	8.93	7.61			
Avg Stack Gas Emissions:									
CO	g/Kg	194.05	137.02	74.68	69.54	152.53			
	g/hr	192.31	168.95	141.36	200.06	184.56			

Unit : Jotul U.S.A., Inc. – F500

	RUN #	1	4	3	2	5 Fan			
Avg Stack Gas Flow Rate									
EPA CMB	dscfm	6.16	7.38	10.14	14.67	7.19			
Tracer Gas	dscfm	6.114	6.910	9.481	11.485	7.034			
Draft (static)	in H_2O	-.036	-.044	-.054	-.061	-.044			
Proportionality Average	%	100	100	100	100	100			
Average Temperatures									
Stack Gas	°F	212	249	360	448	253			
Firebox	°F	594	668	765	849	651			
Secondary	°F	777	838	1092	1065	846			
Catalytic Combustor	°F	N/A	N/A	N/A	N/A	N/A			
Top	°F	298	355	437	502	360			
Left Side	°F	149	156	174	196	225			
Back	°F	239	263	301	325	260			
Right Side	°F	193	229	269	282	271			
Bottom	°F	217	229	306	284	242			
Temperature Change	°F	-72.6	-65.2	-36.4	-41.0	-45.8			
Test Chamber Enviroment									
Average Barometer	in. Hg	30.21	29.83	30.17	30.05	30.04			
Average Temperature	°F	77	75	75	79	76			
Ambient Moisture	% H_2O	1.10	1.35	1.50	1.15	1.25			
Relative Humidity	%RH	31.0	35.0	37.0	25.5	43.5			
Air Velocity	m/sec	0	0	0	0	0			
Fuel Weight and Burn Time									
Density (dry basis)	gm/cm^3	N/A	N/A	N/A	N/A	N/A			
Coal Bed Weight	lbs	4.1	4.2	4.0	4.1	4.0			
Pre Test Fuel (inc kindling)	lbs	47.9	50.1	49.9	48.4	51.3			
Test Fuel	lbs	16.5	17.0	16.5	17.2	16.6			
Burn Time	min	375	310	195	135	310			

MINIMUM
DBR

COMPUTER INPUT DATA SHEET #1

Client: JOTUL U.S.A., INC.

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

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

Run No.: 1 Date of Test: 05-15-2002 Burn Rate: .991

Model No.: F500 ☒ min ☐ min-1.25 ~~☐ fan~~

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

Dry Gas Meter Y Factor: 1.000 (0.000) (Data Sheet #2) Post Leak Rate: .007 (.000) (Data Sheet #2) cfm Time: 375 (000) (Data Sheet #2) min.

Dry Gas Meter Volume: 113.770 (00.000) (Data Sheet #2) cf

Stack Flow: 6.114 (00.000) (Data Sheet #2) dscfm Δ H: .142 (.000) (Data Sheet #2) in. H_2O

Maximum Vac.: 2.0 (0.0) (Data Sheet #2) Barometric Pressure: 30.21 (00.00) (Data Sheet #2) in. Hg

H_2O Captured: 135.7 (00.0) (Data Sheet #3) g

Front Half Catch % Of Total: 40.8 (00.0) (Data Sheet #6) % Total Particulate Catch: 1.3150 (0.0000) (Data Sheet #6) g

Flue Gas Moisture: 5.4470 (00.000) (Data Sheet #7) %

Particulate Emission: .1830 (0.0000) (Data Sheet #7) gr/dscf

Relative Humidity: 31.0 (00.0) (Data Sheet #8) % RH Ambient Moisture: 1.10 (0.00) (Data Sheet #8) % H_2O

Pretest Fuel Wt.: 47.9 (00.0) (Data Sheet #8) lbs. Coal Bed Wt.: 4.1 (00.0) (Data sheet #8) lbs. Test Fuel Wt.: 16.5 (00.0) (Data sheet #8) lbs.

Heat Output (EPA Default): 11,951.4 (00,000.0) (Data Sheet #8) BTU/hr

Kindling Fuel % Moisture (wet): 11.739 (00.000) (Data Sheet #10) % Pretest Fuel % Moisture (wet): 17.041 (00.000) (Data Sheet #10) %

Test Fuel % Moisture (dry): 20.820 (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove]) % Test Fuel % Moisture (wet): 17.232 %

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

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

Average Ambient Temperature: 77 (00) (Data Sheet #14) °F Stove Temperature Change: -72.6 (+/- 000.0) (Data Sheet #14) °F

TABLE 1 ----- RAW DATA

CLIENT : Jotul U.S.A., Inc. TEST No. : 1

MODEL: F500 DATE: 15-May-02

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	443.500	0.150	83	1.37	5.80	550
5	445.000	0.320	83	0.91	3.60	375
10	447.239	0.140	83	0.83	3.40	575
15	448.701	0.140	83	0.81	3.60	575
20	450.163	0.110	83	1.24	5.30	625
25	451.508	0.140	83	1.05	6.80	575
30	452.970	0.150	83	1.01	7.20	550
35	454.498	0.120	83	1.20	6.60	600
40	455.899	0.180	83	0.81	7.70	500
45	457.580	0.200	83	0.61	9.20	475
50	459.349	0.250	84	0.31	11.50	425
55	461.333	0.250	84	0.34	10.20	425
60	463.317	0.250	84	0.49	9.20	425
65	465.300	0.240	85	0.58	9.40	425
70	467.292	0.240	85	0.45	9.80	425
75	469.283	0.240	85	0.53	9.60	425
80	471.274	0.240	85	0.55	9.60	425
85	473.266	0.240	86	0.50	9.60	425
90	475.264	0.200	86	0.72	9.30	475
95	477.053	0.200	86	0.68	9.40	475
100	478.842	0.200	86	0.75	8.80	475
105	480.630	0.180	86	0.76	9.40	500
110	482.330	0.180	86	0.52	12.10	500
115	484.029	0.180	86	0.51	11.60	500
120	485.728	0.220	86	0.45	11.70	450
125	487.616	0.220	87	0.32	11.30	450
130	489.511	0.220	87	0.19	11.80	450
135	491.405	0.140	87	0.82	9.00	550
140	492.956	0.160	87	0.64	9.20	525
145	494.581	0.180	87	0.65	9.10	500
150	496.286	0.130	87	1.30	6.60	575
155	497.770	0.120	87	1.41	6.40	600
160	499.191	0.110	87	1.65	6.20	625
165	500.556	0.100	88	1.97	6.00	650
170	501.874	0.110	88	2.20	5.70	625
175	503.244	0.110	89	2.19	5.70	625
180	504.619	0.110	89	2.25	5.50	625
185	505.993	0.110	89	2.18	5.50	625
190	507.368	0.110	89	2.17	5.60	625
195	508.743	0.120	89	2.17	5.60	600
200	510.175	0.110	89	2.16	5.60	625
205	511.550	0.120	89	2.21	5.60	600
210	512.982	0.120	89	2.21	5.60	600
215	514.415	0.120	89	2.23	5.60	600

220	515.847	0.110	89	2.22	5.60	625
225	517.222	0.110	89	2.22	5.60	625
230	518.597	0.110	89	2.20	5.60	625
235	519.972	0.110	89	2.22	5.40	625
240	521.346	0.110	89	2.25	5.50	625
245	522.721	0.110	89	2.21	5.40	625
250	524.096	0.110	89	2.17	5.40	625
255	525.471	0.110	89	2.11	5.40	625
260	526.846	0.110	89	2.20	5.50	625
265	528.221	0.110	89	2.20	5.60	625
270	529.596	0.110	89	2.18	5.60	625
275	530.971	0.100	89	2.17	5.50	650
280	532.293	0.100	89	2.14	5.50	650
285	533.615	0.100	89	2.00	5.50	650
290	534.937	0.100	89	2.00	5.50	650
295	536.259	0.100	89	2.13	5.40	650
300	537.581	0.100	89	2.17	5.40	650
305	538.903	0.100	89	2.16	5.40	650
310	540.226	0.100	89	2.18	5.40	650
315	541.548	0.100	89	2.25	5.50	650
320	542.870	0.100	89	2.33	5.70	650
325	544.192	0.100	89	2.31	5.60	650
330	545.514	0.100	89	2.14	5.30	650
335	546.836	0.100	89	2.13	5.30	650
340	548.158	0.100	89	2.08	5.20	650
345	549.480	0.100	89	2.14	5.30	650
350	550.802	0.100	89	2.11	5.30	675
355	552.076	0.100	89	2.19	5.40	675
360	553.349	0.100	89	2.15	5.30	675
365	554.622	0.110	89	2.14	5.20	625
370	555.997	0.100	89	2.02	5.10	675
375	557.270	0.100	89	2.02	5.00	675
380						

TABLE 2---RAW DATA

CLIENT : Jotul U.S.A., Inc. TEST No. 1

MODEL: F500 DATE: 15-May-02

****

METER CAL. FACTOR (Y)	------ 1		Wt. WOOD BURNED(LB)	------- 16.5	Lbs
BAROMETRIC PRESS.(Pb)	------ 30.21	in Hg	WET,FUEL MOISTURE %	------- 17.232	%
LEAK RATE POST (Lp)	------ 0.007	cfm	Wt. PART. COLLECTED	------- 1.315	g
WATER VOL. (V1c)	------ 135.7	Ml	METER VOLUME Vm	------- 113.77	mcf
TEST TIME (MIN)	------ 375	min	HC MOLE FRACTION	------- 0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT :Jotul U.S.A., Inc. TEST No. 1

MODEL: F500 DATE: 15-May-02

****

AVG DELTA H	-------	0.14 in H2O		AVG PRCNT CO	-------	1.55	%
AVG METER TEMP. Tm	-------	87 deg F		AVG PRCNT CO2	-------	6.78	%
AVG PPM SO2	-------	577	PPM	AVG BAL CO2/CO	-------	4.37	%

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul U.S.A., Inc. TEST No. 1

MODEL: F500 DATE: 15-May-02

****

STD SAMPLE VOL. Vm(std) -----	110.89	dscf	STACK GAS FLOW Qsd -------	369.734	dscf/Hr
				6.16	& dscf/min
VOL. WATER VAPOR Vw(std) ----	6.387	scf	PARTICULATE CONCTRT. Cs ------	0.0119	g/dscf
PRCNT MSTR Bws -------	5.45	%	PARTC.EMISS. RATE E -------	4.39	g/Hr
BURN RATE BR -------	0.99	Kg/Hr	MOLES OF GAS PER Lb WOOD Nt --	0.44	Lb-mole/Lb
CO EMISSION RATE -------	192.31	g/Hr	PART.EMISS. RATE ------	4.43	g/Kgdry fuel
	194.05	& g/Kgdry fuel			

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Jotul U.S.A., Inc. TEST No. : 1

MODEL: F500 DATE: 15-May-02

TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR	PROPRTN RATE VAR. AVERAGE
5	810.4	97	100
10	825.1	99	
15	825.8	99	
20	825.8	99	
25	825.7	99	
30	825.8	99	
35	825.5	99	
40	825.7	99	
45	825.7	99	
50	824.8	99	
55	827.0	99	
60	827.0	99	
65	825.8	99	
70	828.8	100	
75	828.3	100	
80	828.3	100	
85	828.0	100	
90	829.7	100	
95	830.3	100	
100	830.3	100	
105	829.8	100	
110	830.4	100	
115	830.0	100	
120	830.0	100	
125	829.4	100	
130	831.7	100	
135	831.3	100	
140	831.8	100	
145	831.9	100	
150	831.4	100	
155	832.0	100	
160	831.3	100	
165	831.1	100	
170	833.8	100	
175	832.6	100	
180	834.9	100	
185	834.3	100	
190	834.9	100	
195	834.9	100	
200	834.7	100	
205	834.9	100	
210	834.7	100	
215	835.3	100	
220	834.7	100	

225	834.9	100
230	834.9	100
235	834.9	100
240	834.3	100
245	834.9	100
250	834.9	100
255	834.9	100
260	834.9	100
265	834.9	100
270	834.9	100
275	834.9	100
280	834.8	100
285	834.8	100
290	834.8	100
295	834.8	100
300	834.8	100
305	834.8	100
310	835.4	100
315	834.8	100
320	834.8	100
325	834.8	100
330	834.8	100
335	834.8	100
340	834.8	100
345	834.8	100
350	834.8	100
355	835.4	100
360	834.8	100
365	834.8	100
370	834.9	100
375	834.8	100
380		
385		

METER BOX DATA SHEET PAGE # 2

Page: 1 of 4

UNIT: F500 RUN: 1 DATE: 05-15-02

Meter Box: 5H Y Factor: 1.000

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

15 " Hg @ .007 cfm _____ " Hg @ _____ cfm

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

ROTO: PRESS: .16			SAMPLING RATIO: 21 : 1				BP: 30.21		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1205	443.500	—	6.308	.15	83	550	83	1.0
5	10	445.000	—	9.251	.32	83	375	83	2.0
10	15	447.239	447.239	6.033	.14	83	575	83	2.0
15	20	448.701	448.701	6.033	.14	83	575	83	2.0
20	25	450.163	450.163	5.551	.11	83	625	83	2.0
25	30	451.508	451.508	6.033	.14	83	575	83	2.0
30	35	452.970	452.970	6.308	.15	83	550	83	2.0
35	40	454.498	454.498	5.782	.12	83	600	83	2.0
40	45	455.899	455.899	6.938	.18	83	500	83	2.0
45	50	457.580	457.580	7.303	.20	83	475	83	2.0
50	55	459.349	459.349	8.148	.25	84	425	84	2.0
55	1300	461.333	461.333	8.148	.25	84	425	84	2.0
ROTO PRESS: .15			TOTALS:	81.836	2.15	998	BP.: 30.21		
60	1305	463.317	463.317	8.147	.25	84	425	84	2.0
65	10	465.300	465.300	8.133	.24	85	425	85	2.0
70	15	467.292	467.292	8.133	.24	85	425	85	2.0
75	20	469.283	469.283	8.133	.24	85	425	85	2.0
80	25	471.274	471.274	8.133	.24	85	425	85	2.0
85	30	473.266	473.266	8.133	.24	86	425	86	2.0
90	35	475.264	475.264	7.263	.20	86	475	86	2.0
95	40	477.053	477.053	7.263	.20	86	475	86	2.0
100	45	478.842	478.842	7.263	.20	86	475	86	2.0
105	50	480.630	480.630	6.900	.18	86	500	86	2.0
110	55	482.330	482.330	6.900	.18	86	500	86	2.0
115	1400	484.029	484.029	6.900	.18	86	500	86	2.0
			TOTALS:	91,301	2.59	1026	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	173,137	4.74	2024	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 2 of 4

UNIT: F500 RUN: 1 DATE: 05-15-02

Meter Box: 5H Y Factor: 1.000

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

15 " Hg @ .007 cfm _____ " Hg @ _____ cfm

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

ROTO: PRESS: .14			SAMPLING RATIO: 21 : 1				BP: 30.21		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1405	485.728	485.728	7.666	.22	86	450	86	2.0
125	10	487.616	487.616	7.652	.22	87	450	87	2.0
130	15	489.511	489.511	7.652	.22	87	450	87	2.0
135	20	491.405	491.405	6.261	.14	87	550	87	2.0
140	25	492.956	492.956	6.559	.16	87	525	87	2.0
145	30	494.581	494.581	6.887	.18	87	500	87	2.0
150	35	496.286	496.286	5.989	.13	87	575	87	2.0
155	40	497.770	497.770	5.739	.12	87	600	87	2.0
160	45	499.191	499.191	5.510	.11	87	625	87	2.0
165	50	500.556	500.556	5.288	.10	88	650	88	2.0
170	55	501.874	501.874	5.500	.11	88	625	88	2.0
175	1500	503.244	503.244	5.490	.11	89	625	89	2.0
ROTO PRESS: .14			TOTALS:	76.193	1.82	1047	BP.: 30.21		
180	1505	504.619	504.619	5.490	.11	89	625	89	2.0
185	10	505.993	505.993	5.490	.11	89	625	89	2.0
190	15	507.368	507.368	5.490	.11	89	625	89	2.0
195	20	508.743	508.743	5.718	.12	89	600	89	2.0
200	25	510.175	510.175	5.490	.11	89	625	89	2.0
205	30	511.550	511.550	5.718	.12	89	600	89	2.0
210	35	512.982	512.982	5.718	.12	89	600	89	2.0
215	40	514.415	514.415	5.718	.12	89	600	89	2.0
220	45	515.847	515.847	5.490	.11	89	625	89	2.0
225	50	517.222	517.222	5.490	.11	89	625	89	2.0
230	55	518.597	518.597	5.490	.11	89	625	89	2.0
235	1600	519.972	519.972	5.490	.11	89	625	89	2.0
			TOTALS:	66.792	1.36	1068	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	142.985	3.18	2115	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 3 of 4

UNIT: 1F506 RUN: 1 DATE: 05-15-02

Meter Box: 5H Y Factor: 1.000

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

15 " Hg @ .007 cfm _____ " Hg @ _____ cfm

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

ROTO: PRESS: .14			SAMPLING RATIO: 21 : 1				BP: 30.21		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
240	1605	521.346	521.346	5.490	.11	89	625	89	2.0
245	10	522.721	522.721	5.490	.11	89	625	89	2.0
250	15	524.096	524.096	5.490	.11	89	625	89	2.0
255	20	525.471	525.471	5.490	.11	89	625	89	2.0
260	25	526.846	526.846	5.490	.11	89	625	89	2.0
265	30	528.221	528.221	5.490	.11	89	625	89	2.0
270	35	529.596	529.596	5.490	.11	89	625	89	2.0
275	40	530.971	530.971	5.279	.10	89	650	89	2.0
280	45	532.293	532.293	5.279	.10	89	650	89	2.0
285	50	533.615	533.615	5.279	.10	89	650	89	2.0
290	55	534.937	534.937	5.279	.10	89	650	89	2.0
295	1700	536.259	536.259	5.279	.10	89	650	89	2.0
ROTO PRESS: .14			TOTALS:	64.825	1.27	1068	BP.: 30.21		
300	1705	537.581	537.581	5.279	.10	89	650	89	2.0
305	10	538.903	538.903	5.279	.10	89	650	89	2.0
310	15	540.226	540.226	5.279	.10	89	650	89	2.0
315	20	541.548	541.548	5.279	.10	89	650	89	2.0
320	25	542.870	542.870	5.279	.10	89	650	89	2.0
325	30	544.192	544.192	5.279	.10	89	650	89	2.0
330	35	545.514	545.514	5.279	.10	89	650	89	2.0
335	40	546.836	546.836	5.279	.10	89	650	89	2.0
340	45	548.158	548.158	5.279	.10	89	650	89	2.0
345	50	549.480	549.480	5.279	.10	89	650	89	2.0
350	55	550.802	550.802	5.083	.10	89	675	89	2.0
355	1800	552.076	552.076	5.083	.10	89	675	89	2.0
			TOTALS:	62.956	1.20	1068	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	127.781	2.47	2136	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 4 of 4

UNIT: F500 RUN: 1 DATE: 5-15-02

Meter Box: 5H Y Factor: 1.000

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

15 " Hg @.007 cfm _____ " Hg @_____ cfm

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

ROTO: PRESS: .14 SAMPLING RATIO: 21 : 1 BP: 30.21

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
360	1805	553.349	553.349	5,083	.10	89	675	89	2.0
365	10	554.622	554.622	5,490	.11	89	625	89	2.0
370	15	555.997	555.997	5,083	.10	89	675	89	2.0
375	20	557.270	557.270	5,083	.10	89	675	89	2.0
380									
385				20.739	.41	354			
390									
395									
400									
405									
410									
415									
ROTO PRESS:			TOTALS:				BP.:		
420									
425									
430									
435									
440									
445									
450									
455									
460									
465									
470				464.642		631	676		
475					10.80	87			
			TOTALS:				MAX VACC =		2.0
TOTAL Cu Ft.		113.770	TOTALS:	6.114	.142	547	AVG. BP:		30.21

76

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : F500 RUN : 1 DATE : 05 - 15 - 02

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	720.6	594.3	487.0	886.6
INITIAL WT	617.6	587.1	483.9	864.2
NET WT GRAMS	103.0	7.2	3.1	22.4

TOTAL CATCH : 135.7 GRAMS H_2O

FRONT HALF

FILTER #	117F	
FINAL WT g	1.0408	
INITIAL WT g	.6793	
NET WT g	.3615	

BEAKER #	46
DESC.	ACETONE
FINAL WT g	106.2302
INITIAL WT g	106.0544
NET WT g	.1758
VOL. DESC. ml	125

BACK HALF

FILTER #	118B	
FINAL WT g	.5999	
INITIAL WT g	.4430	
NET WT g	.1569	

BEAKER #	47	48	49	50	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	107.4663	97.8136	108.4573	96.5870	
INITIAL WT g	107.0421	97.7560	108.3626	96.5390	
NET WT g	.4242	.0576	.0947	.0480	.1427
VOL. DESC ml	200	75	200	125	(325)

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 01/29/02 Time : 1125 By : DKW

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

Back Size: 8.2 cm Lot No. : ZB911

	DATE: 02-07	BY: DKW	DATE: 02-10	BY: DKW	DATE:	BY:	
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT		TIME
111F	.6782	0934	.6780	1939	JOTUL C450		R-2
112F	.6755	0935	.6751	1940	"	"	R-3
113F	.6721	0935	.6719	1941	"	"	R-4
114F	.6843	0936	.6844	1942	"	"	R-5
115F	.6699	0937	.6700	1943	"	"	R-6
116F	.6696	0938	.6694	1943	"	"	R-7
117F	.6796	0939	.6793	1944	JOTUL F500		R-1
118F	.6715	0940	.6718	1945	"	"	R-2
119F	.6743	0941	.6746	1946	"	"	R-3
120F	.6844	0942	.6843	1947	"	"	R-4
111B	.4462	0943	.4464	1948	JOTUL C450		R-2
112B	.4448	0944	.4451	1949	"	"	R-3
113B	.4466	0945	.4464	1949	"	"	R-4
114B	.4305	0946	.4307	1950	"	"	R-5
115B	.4234	0947	.4236	1951	"	"	R-6
116B	.4444	0948	.4445	1952	"	"	R-7
117B	.4431	0949	.4430	1953	JOTUL F500		R-1
118B	.4293	0950	.4294	1954	"	"	R-2
119B	.4441	0951	.4439	1955	"	"	R-3
120B	.4427	0952	.4425	1955	"	"	R-4

Checked by: C Warlington Date: 2-10-02 Time: 2000

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
02-07	0910	DKW		74	47
02-10	1905	DKW		74	45

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 04-08-2002 Time : 1930 By :

	DATE: 04-11	BY:	DATE: 04-12	BY:	DATE:	BY:
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
41	105.4919	0944	105.4917	0953	✓	
42	104.6743	0945	104.6742	0954	✓ JOTUL C450	
43	107.3634	0950	107.3637	0956	✓ R-7	
44	107.7988	0952	107.7985	0957	✓	
45	94.9437	0953	94.9434	0958	✓	
46	106.0543	0954	106.0544	8959	✓	
47	107.0426	0955	107.0421	1000	✓ JOTUL F500	
48	97.7564	0955	97.7560	1001	✓ R-1	
49	108.3629	0956	108.3626	1003	✓	
50	96.5389	0957	96.5390	1004	✓	
51	104.8788	0958	104.8784	1005	✓	
52	107.5030	0959	107.5027	1006	✓ JOTUL F500	
53	105.7406	1000	105.7410	1007	✓ R-2	
54	107.3136	1001	107.3139	1008	✓	
55	93.4939	1001	93.4941	1009	✓	
56	104.1752	1002	104.1750	1010	✓	
57	97.4138	1003	97.4141	1011	✓ JOTUL F500	
58	96.8985	1004	96.8989	1012	✓ R-3	
59	105.3591	1005	105.3593	1013	✓	
60	106.7350	1006	106.7348	1015	✓	

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
04-11	0940			76	49
04-12	0950			78	47

Checked by :
Date : 04-12-02
Time : 1040

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : F500 **RUN :** 1 **DATE :** 05-15-02 **Page :** 1 **of** 1

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
46	05-16	1825		106.2305	05-18	1908		106.2302	05-19	1504					
47	05-17	1125		107.4663	05-18	1909		107.4663	05-19	1505					
48	05-18	1930		97.8135	05-20	0859		97.8136	05-21	0934					
49	05-16	1825		108.4571	05-18	1910		108.4573	05-19	1506					
50	05-16	1825		96.5867	05-18	1911		96.5870	05-19	1507					

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
117F	5-15	1900		1.0465	05-16	1433		1.0444	05-17	1602		1.0432	05-18	1912	
				1.0412	05-19	1509		1.0408	05-20	0900					
117B	5-15	1900		.6018	05-16	1435		.5996	05-17	1603		.5999	05-18	1913	

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	05-16	1430		76	48
2	05-17	1600		75	48
3	05-18	1905		77	49
4	05-19	1500		77	48
5	05-20	0855		77	47

Weighing Session	Date	Time	By	DB	%RH
6	05-21	0930		78	49
7					
8					
9					
10					

Dates: From 11-20-2001
Through 02-16-2002

WOODSTOVE DATA SHEET #4-4
SCALE QA SHEET

Scale: Sartorius
Model: A1205
SN : 37010004

100g weight	10 g weight	1.0 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	Wet Bulb	%.RH
99.9998	10.0002	1.0003	.1000	DKW	11-20	0945	78		48
100.0000	10.0000	1.0001	.0999	DKW	11-21	1000	75		49
99.9998	9.9998	1.0000	.1001	DKW	11-22	1050	75		49
100.0003	9.9999	1.0000	.0999	DKW	11-26	1150	74		47
100.0001	9.9997	1.0000	.1000	DKW	11-27	1155	74		48
100.0001	10.0000	.9997	.0999	DKW	11-28	1220	72		48
99.9999	10.0001	1.0000	.1000	DKW	11-28	1930	73		48
99.9998	10.0000	.9999	.0999	DKW	11-29	1015	75		46
99.9998	10.0000	.9997	.0998	DKW	11-29	1925	73		46
100.0000	10.0001	.9998	.0999	DKW	11-30	1355	74		45
99.9999	9.9999	1.0000	.1000	DKW	12-01	1210	77		45
100.0003	10.0000	.9997	.1000	DKW	01-08	2045	78		47
100.0001	10.0000	.9998	.1000	DKW	01-09	1600	78		48
99.9999	9.9999	.9999	.1000	DKW	01-12	1900	74		46
99.9998	9.9999	.9997	.1000	DKW	01-13	1730	72		43
100.0000	10.0001	1.0000	.1001	DKW	01-14	1355	78		45
99.9998	9.9999	.9999	.1000	DKW	01-26	1745	72		47
99.9998	10.0000	1.0000	.0999	DKW	01-28	1705	74		44
100.0003	10.0000	1.0000	.0998	DKW	01-29	1130	70		47
99.9998	9.9997	1.0000	.1000	DKW	01-29	2300	71		44
100.0002	10.0000	1.0000	.1000	DKW	01-30	2200	75		45
99.9999	9.9999	.9999	.1000	DKW	01-31	2205	74		47
100.0001	9.9999	1.0000	.1000	DKW	02-02	0700	75		45
100.0002	9.9999	1.0001	.1000	DKW	02-04	1045	73		47
100.0000	10.0000	.9998	.0997	DKW	02-06	0905	73		47
100.0001	10.0000	1.0000	.1000	DKW	02-07	0910	74		47
100.0002	10.0001	1.0000	.0999	DKW	02-07	1235	77		48
99.9999	10.0000	.9999	.0998	DKW	02-08	1110	72		49
99.9998	9.9999	1.0000	.0999	DKW	02-09	1045	70		49
99.9997	10.0000	.9999	.0999	DKW	0210	0920	74		48
99.9997	10.0001	.9999	.0999	DKW	02-10	1905	76		45
99.9999	9.9999	1.0000	.0997	DKW	02-11	1935	73		43
99.9998	9.9997	1.0000	.0999	DKW	02-13	1740	75		41
99.9997	10.0000	.9999	.1000	DKW	02-14	1015	74		38
99.9998	9.9999	1.0000	.1000	DKW	02-14	2010	74		43
100.0000	10.0000	1.0000	.1000	DKW	02-15	1150	74		41
99.9998	9.9999	.9997	.1000	DKW	02-16	1045	78		41

Dates: From 02-16-2002
Through 05-17-2002

WOODSTOVE DATA SHEET #4-4
SCALE QA SHEET

Scale: Sartorius
Model: A1205
SN : 37010004

100g weight	10 g weight	1.0 g weight	100 mg weight	Tech	Date	Time	Wet Bulb	Dry Bulb	% RH
100.0000	9.9999	1.0000	.0999	DFW	02-16	1845		77	46
100.0000	9.9999	.9999	.0998	DFW	02-17	1555		77	47
100.0001	9.9999	.9999	.0997	DFW	02-18	0940		77	47
100.0000	10.0000	.9999	.1000	DFW	02-19	1025		78	46
100.0000	9.9999	1.0000	.0999	DFW	02-20	0915		75	42
100.0003	10.0000	1.0000	.0999	DFW	03-14	1020		78	45
99.9999	9.9998	.9998	.0998	DFW	03-15	1725		77	45
99.9999	10.0000	1.0002	.0999	DFW	03-16	1820		77	38
100.0001	9.9999	1.0001	.1000	DFW	03-16	2130		78	43
99.9999	9.9999	.9998	.0998	DFW	03-17	1550		77	43
99.9999	10.0000	1.0001	.0999	DFW	03-17	2045		77	39
99.9998	10.0000	1.0000	.1000	DFW	03-18	1100		77	39
100.0000	9.9999	.9999	.0999	DFW	03-19	1800		76	42
100.0001	10.0000	1.0001	.1000	DFW	03-20	1835		77	45
99.9999	10.0001	.9999	.0999	DFW	03-21	2235		78	45
99.9998	9.9999	1.0000	.1000	DFW	03-24	2205		78	42
99.9998	10.0000	1.0000	.1001	DFW	03-25	1000		78	41
99.9997	10.0000	1.0001	.1000	DFW	04-04	1300		78	49
99.9998	10.0000	1.0000	.0999	DFW	04-05	1210		78	49
99.9997	10.0000	.9999	.0998	DFW	04-05	2230		78	49
99.9999	10.0001	1.0000	.0998	DFW	04-08	1135		78	47
99.9997	10.0000	1.0000	.0999	DFW	04-08	1910		78	48
99.9997	9.9998	.9999	.1000	DFW	04-09	2150		77	48
99.9999	10.0000	1.0001	.0999	DFW	04-10	2205		78	48
100.0000	10.0001	.9999	.0999	DFW	04-11	0940		76	49
99.9997	9.9998	1.0000	.0999	DFW	04-11	1705		78	48
99.9999	9.9999	.9999	.0998	DFW	04-11	2230		78	48
99.9999	10.0001	.9999	.0999	DFW	04-12	0950		78	47
100.0000	9.9998	1.0000	.0999	DFW	04-12	1810		78	48
100.0000	9.9999	.9999	.0998	DFW	04-12	2205		78	47
100.0000	9.9999	.9999	.0999	DFW	04-13	1720		78	48
99.9998	10.0000	1.0000	.0998	DFW	04-13	2325		78	46
99.9999	10.0001	1.0001	.1000	DFW	04-14	1740		78	44
99.9998	10.0000	1.0001	.0999	DFW	04-16	1925		75	44
99.9997	9.9999	1.0000	.1000	DFW	04-19	1350		78	41
100.0000	10.0001	.9998	.0999	DFW	04-20	1210		75	41
99.9998	9.9998	1.0001	.0997	DF	05-16	1430		76	48
99.9999	9.9999	1.0000	.0999	DFW	05-17	1600		75	48

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

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

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9999	10.0000	.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	DKW	05-20	0855	77	47
99.9998	9.9998	1.0000	.0999	DKW	05-21	0930	78	49
99.9998	9.9999	1.0000	.1000	DKW	05-22	1155	78	48
99.9999	9.9999	1.0000	.1001	DKW	05-22	A20	78	49
99.9999	10.0001	1.0001	.0998	DKW	05-23	2105	77	48
99.9998	9.9998	.9998	.0999	DKW	05-28	1225	78	49
99.9998	9.9997	1.0001	.0999	DKW	05-28	1625	78	47

BLANK PROCESSING DATA SHEET # 5

UNIT: F500 RUN: 1 DATE: 05-15-02

BLANKS DONE: 02-20-2002

BEAKER	A	B	C
	200 ml ACETONE	75 ml DICHLOR	200 ml WATER
	FISHER OPTIMA LOT # 011755	FISHER OPTIMA LOT # 994669	McKESSON WATER PRODUCTS CO. CERTIFIED DISTILLED
FINAL WEIGHT	108.9015	106.3081	106.9664
TARE WEIGHT	108.9007	106.3064	106.9660
NET WEIGHT	.0008 ✓	.0017 ✓	.0004 ✓

TARE BEAKERS INTO DESC: TIME: 1205 DATE: 02-15-2002

DATE: 02-16 BY: [illegible] DATE: 02-17 BY: [illegible] DATE: BY:

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9002	1849	108.9007	1611 ✓		
B	106.3068	1850	106.3064	1612 ✓		
C	106.9661	1851	106.9660	1613 ✓		

FINAL BEAKERS INTO DESC: TIME: 1125 DATE: 02-18-2002

DATE: 02-19 BY: [illegible] DATE: 02-20 BY: [illegible] DATE: BY:

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9016	1027	108.9015	0917 ✓		
B	106.3084	1028	106.3081	0918 ✓		
C	106.9664	1029	106.9664	0919 ✓		

TARE QC

DATE	TIME	BY	WB	DB	%
02-16	1845	[illegible]		77	46
02-17	1555	[illegible]		77	47

FINAL QC

DATE	TIME	BY	WB	DB	%
02-19	1025	[illegible]		78	46
02-20	0915	[illegible]		75	42

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT: F500 RUN: 1 DATE: 05-15-02

BLANK CALCULATIONS

Acetone: .0008 g ÷ 200 ml = .000004 g/ml
Dicholoromethane: .0017 g ÷ 75 ml = .000023 g/ml
Distilled Water: .0004 g ÷ 200 ml = .000002 g/ml

FRONT HALF CATCH

FILTERS: .3615 (Total Catch) g - 1 (# of Filters) * (.0000 g) (Blank Value / Filter) = .3615 g

BEAKERS: .1758 (Total Catch) g - 125 (ml Acetone) * (.000004 g) (Blank Value / ml Acetone) = .1753 g

TOTAL FRONT HALF CATCH: .5368 g

BACK HALF CATCH

FILTERS: .1569 (Total Catch) g - 1 (# of Filters) * (.0000 g) (Blank Value / Filter) = .1569 g

BEAKERS:

Acetone: .4242 (Total Catch) g - 200 (ml Acetone) * (.000004 g) (Blank Value / ml Acetone) = .4234 g

Extract: .0576 (Total Catch) g - 75 (ml Dichloromethane) * (.000023 g) (Blank Value / Dichloromethane) = .0559 g

Water: .1427 (Total Catch) g - 325 (ml Water) * (.000002 g) (Blank Value / Water) = .1420 g

TOTAL BACK HALF CATCH: .7782 g

TOTAL CATCH: 1.3150 g

% FRONT HALF: 40.8 %

CALCULATIONS DATA SHEET # 7

UNIT : F500 RUN : 1 DATE : 05-15-02

1) $Vm\ (std) = \dfrac{(113.770\ Vm)(17.64)(1.000\ mcf)\left(30.21\text{" Hg} + \frac{.142\text{" } H_2O}{13.6}\right)}{(547\ TmA)} = \dfrac{110.8766}{000.0000}$ dscf

2) $Vw\ (std) = (.04707)(135.7\ ml\ H_2O) = \dfrac{6.3874}{00.0000}$ scf

3) $Asw = \dfrac{(6.3874\ scf)}{(6.3874\ scf + 110.8766\ dscf)} = \dfrac{.0545}{.0000}$ Bws × 100 = $\dfrac{5.4470}{00.0000}$ % H_2O

4) $Cs = \dfrac{(1.3150\ g.)}{(110.8766\ dscf)}(15.43) = \dfrac{.1830}{0.0000}$ gr / dscf

5) Estimated g / hr = $\dfrac{(1.3150\ g.)}{(110.8766\ dscf)}\left(\dfrac{6.114}{00.0000}\ dscfm\right)(60) = \dfrac{4.3507}{00.0000}$ 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 : F500 RUN : 1 DATE : 05-15-02

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

Wet Bulb / Dry Bulb

Pre : WB : 62 DB : 79 = 36 % RH 1.2 % H_2O

Post : WB : 61 DB : 83 = 26 % RH 1.0 % H_2O

Average : 31.0 % RH 1.1 % H_2O

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

Kindling Weight (lbs) : Paper : .1 Wood : 4.7

Preburn Fuel Weight : 13.1 + 15.5 + 12.1 + 2.5 Total : 43.2

Kindling & Preburn Fuel Weight (wood only) (lbs) : **Total** : 47.9

Coal Bed Wt Range (lbs) : 4.1 - 3.3 **Scale** : 4.1 - 3.3

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

Lower : .20 × fuel weight : Always round UP to nearest tenth **Actual Coal Bed Weight** : 4.1

Maximum Coal Bed Removal (lbs) : ((4.1 (Upper) + 3.3 (Lower)) ÷ 2) .25 = .9 (round down to nearest tenth)

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

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" × 4"	17	3	6.7	40.6
4" × 4"	17	2	9.8	59.4

Test Fuel Weight : 16.5 lbs

Estimated Dry Burn Rate :

$$\frac{16.5 - (16.5 \times .17232)}{2.2046} \times \frac{60}{\frac{375}{\text{TIME}}} = .991 \text{ kg / hr}$$

Estimated BTU's/hr : $19{,}140 \times \frac{63}{100} \times \frac{.991}{\text{DBR}} = 11{,}951.4$ BTU's/hr

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

WOOD STOVE OPERATING DATA PAGE #9

Unit : F500 Run : 1 Date : 05-15-02

FIRE STARTED: 0800

WARM UP AND PREBURN:

PRIMARY AIR : Set wide open for all warm-up / preburn fuel charges. Then set to closed 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. 50 sec.

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

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

FAN:

ON / (OFF) during warm-up

(ON) / OFF during preburn

ON / (OFF) first 30 minutes of test

(ON) / OFF balance of test run

Fan speed set at Low

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

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

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

All Grades WCLB rules:

WARM UP INFORMATION:

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

1st warm up / pre-burn fuel charge (13.1 lbs.) added at 0812

2nd warm up / pre-burn fuel charge (15.5 lbs.) added at 0912

3rd warm up / pre-burn fuel charge (12.1 lbs.) added at 1015

4th warm up / pre-burn fuel charge (2.5 lbs.) added at 1100

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

TEST DATA SHEET #10

Unit : F500 Run : 1 Date : 05-15 -02

Room Temperature : 72 °F Correction Factor : Ø

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

Time Test Fuel moisture reading taken : 1030

Calibration Checks : X ✓ Y ✓ 12.0 12.1 22.0 22.0

pc #	Dimen.	Use	TOP		BOTTOM		SIDE		Average Corrected
			Uncor.	Cor.	Uncor.	Cor.	Uncor.	Cor.	
1	2"×4"×8'	K	14.0	14.9	12.0	12.8	11.5	12.2	13,300
2									
3									
4	2"×4"×8'	P	20.0	21.4	18.5	19.8	19.0	20.3	20,500
5	2"×4"×8'	P	18.0	19.2	18.0	19.2	18.0	19.2	19.200
6	2"×4"×8'	P	21.0	22.5	21.0	22.5	21.0	22.5	22.500
7	2"×4"×8'	P	17.5	18.7	18.0	19.2	20.5	22.0	19.967
8	2"×4"×8'	P							82.167
9									
10									
11									
12	2x4x17	T	17.5	18.7	18.5	19.8	18.5	19.8	19,433
13	"	T	18.0	19.2	18.0	19.2	18.0	19.2	19.200
14	"	T	23.5	25.2	23.0	24.7	23.5	25.2	25.033
15	4x4x17"	T	19.0	20.3	19.0	20.3	19.0	20.3	20.300
16	"	T	19.0	20.3	19.0	20.3	18.5	19.8	20,133
17									104.099
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 % :	13,300 %	20,542 %	20,820 %
Wet Moisture % :	11.739 %	17.041 %	17.232 %

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°

WEIGHT : 4.1

UNIT : F500

GAS DATA SHEET # 12

RUN : 1 DATE : 05-15-02 PAGE : 1 of 4

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	WB	DB	% H_2O	CAL WB	STACK	STATIC	SO_2PPM
0 1205	20.6	16.5	—	.233	5.8	.548	13.7	.136	1.37					243	-.035	550
5 10	20.0	15.9	.6	.145	3.6	.662	16.6	.090	.91					302	-.051	375
10 15	19.7	15.6	.3	.138	3.4	.672	16.8	.082	.83					216	-.040	575
15 20	19.4	15.3	.3	.144	3.6	.667	16.7	.080	.81					199	-.038	575
20 25	19.1	15.0	.3	.215	5.3	.595	14.9	.123	1.24					201	-.038	625
25 30	18.6	14.5	.5	.275	6.8	.532	13.3	.104	1.05					227	-.044	575
30 35	18.1	14.0	.5	.290	7.2	.520	13.0	.100	1.01					244	-.046	550
35 40	17.6	13.5	.5	.267	6.6	.540	13.5	.119	1.20					244	-.045	600
40 45	17.1	13.0	.5	.311	7.7	.488	12.2	.080	.81					260	-.048	500
45 50	16.6	12.5	.5	.370	9.2	.429	10.7	.060	.61					273	-.050	475
50 55	15.9	11.8	.7	.461	11.5	.361	9.0	.030	.31					310	-.050	425
55 1300	15.3	11.2	.6	.410	10.2	.396	9.9	.033	.34					322	-.056	425
TOTAL	*****	****	****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	3041	-.541	*****
60 1305	14.7	10.6	.6	.370	9.2	.431	10.8	.048	.49					315	-.055	425
65 10	14.2	10.1	.5	.377	9.4	.428	10.7	.057	.58					315	-.055	425
70 15	13.7	9.6	.5	.396	9.8	.409	10.2	.044	.45					317	-.056	425
75 20	13.1	9.0	.6	.386	9.6	.413	10.3	.052	.53					318	-.056	425
80 25	12.6	8.5	.5	.388	9.6	.413	10.3	.054	.55					317	-.056	425
85 30	12.1	8.0	.5	.386	9.6	.412	10.3	.049	.50					314	-.055	425
90 35	11.6	7.5	.5	.372	9.3	.422	10.6	.071	.72					300	-.053	475
95 40	11.3	7.2	.3	.378	9.4	.418	10.5	.067	.68					296	-.052	475
100 45	10.8	6.7	.5	.353	8.8	.437	10.9	.074	.75					289	-.051	475
105 50	10.4	6.3	.4	.379	9.4	.413	10.3	.075	.76					289	-.051	500
110 55	10.0	5.9	.4	.485	12.1	.329	8.2	.051	.52					291	-.051	500
115 1400	9.5	5.4	.5	.467	11.6	.349	8.7	.050	.51					298	-.052	500
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	3659	-.643	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	6700	-1.184	*****

WEIGHT : 4.1

GAS DATA SHEET # 12

UNIT : F500 RUN : 1 DATE : 05-15-02 PAGE : 2 of 4

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	WB	DB	% H_2O	CAL WB	STACK	STATIC	SO_2PPM
120 1405	9.0	4.9	.5	.470	11.7	.341	8.5	.044	.45					308	-.054	450
125 10	8.6	4.5	.4	.453	11.3	.355	8.9	.031	.32					314	-.054	450
130 15	8.2	4.1	.4	.476	11.8	.342	8.5	.018	.19					314	-.055	450
135 20	7.8	3.7	.4	.363	9.0	.422	10.6	.081	.82					276	-.050	550
140 25	7.5	3.4	.3	.371	9.2	.421	10.5	.063	.64					273	-.050	525
145 30	7.3	3.2	.2	.367	9.1	.428	10.7	.064	.65					266	-.048	500
150 35	7.1	3.0	.2	.264	6.6	.509	12.7	.129	1.30					241	-.043	575
155 40	7.0	2.9	.1	.259	6.4	.513	12.8	.140	1.41					226	-.040	600
160 45	6.9	2.8	.1	.249	6.2	.517	12.9	.164	1.65					211	-.037	625
165 50	6.8	2.7	.1	.241	6.0	.522	13.1	.196	1.97					199	-.035	650
170 55	6.7	2.6	.1	.230	5.7	.531	13.3	.220	2.20					194	-.034	625
175 1500	6.6	2.5	.1	.229	5.7	.532	13.3	.216	2.19					189	-.033	625
TOTAL	*****	****	****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	3011	-.533	*****
180 1505	6.5	2.4	.1	.220	5.5	.543	13.6	.225	2.25					185	-.032	625
185 10	6.4	2.3	.1	.223	5.5	.539	13.5	.218	2.18					181	-.031	625
190 15	6.4	2.3	0	.224	5.6	.537	13.4	.217	2.17					178	-.030	625
195 20	6.2	2.1	.2	.225	5.6	.537	13.4	.217	2.17					175	-.030	600
200 25	6.1	2.0	.1	.226	5.6	.536	13.4	.216	2.16					174	-.029	625
205 30	6.0	1.9	.1	.227	5.6	.533	13.3	.221	2.21					172	-.029	600
210 35	6.0	1.9	0	.227	5.6	.533	13.3	.221	2.21					171	-.028	600
215 40	5.9	1.8	.1	.227	5.6	.532	13.3	.223	2.23					169	-.028	600
220 45	5.8	1.7	.1	.225	5.6	.534	13.4	.222	2.22					168	-.027	625
225 50	5.7	1.6	.1	.225	5.6	.534	13.4	.222	2.22					167	-.027	625
230 55	5.7	1.6	0	.222	5.5	.542	13.6	.220	2.20					167	-.027	625
235 1600	5.6	1.5	.1	.219	5.4	.546	13.7	.222	2.22					165	-.027	625
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	2072	-.345	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	5083	-.878	*****

WEIGHT : 4.1

GAS DATA SHEET # 12

UNIT : F500 RUN : 1 DATE : 05-15-02 PAGE : 3 of 4

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	WB	DB	% H_2O	CAL WB	STACK	STATIC	SO_2PPM
240 1605	5.5	1.4	.1	.222	5.5	.543	13.6	.225	2.25					164	-.026	625
245 10	5.4	1.3	.1	.217	5.4	.544	13.6	.221	2.21					163	-.026	625
250 15	5.4	1.3	⊖	.217	5.4	.544	13.6	.217	2.17					162	-.026	625
255 20	5.3	1.2	.1	.218	5.4	.544	13.6	.211	2.11					161	-.025	625
260 25	5.3	1.2	⊖	.222	5.5	.539	13.5	.220	2.20					160	-.025	625
265 30	5.2	1.1	.1	.222	5.5	.539	13.5	.220	2.20					160	-.025	625
270 35	5.1	1.0	.1	.224	5.6	.537	13.4	.218	2.18					159	-.024	625
275 40	5.0	.9	.1	.224	5.6	.536	13.4	.217	2.17					158	-.024	650
280 45	5.0	.9	⊖	.222	5.5	.541	13.5	.214	2.14					158	-.024	650
285 50	4.9	.8	.1	.223	5.5	.547	13.7	.199	2.00					157	-.024	650
290 55	4.8	.7	.1	.221	5.5	.553	13.8	.199	2.00					157	-.024	650
295 1700	4.8	.7	⊖	.217	5.4	.552	13.8	.213	2.13					156	-.023	650
TOTAL	*****	****	****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	1915	-.296	*****
300 1705	4.8	.7	⊖	.217	5.4	.550	13.8	.217	2.17					155	-.023	650
305 10	4.7	.6	.1	.217	5.4	.550	13.8	.216	2.16					155	-.023	650
310 15	4.7	.6	⊖	.218	5.4	.549	13.7	.218	2.18					154	-.023	650
315 20	4.6	.5	.1	.222	5.5	.543	13.6	.225	2.25					154	-.023	650
320 25	4.6	.5	⊖	.228	5.7	.537	13.4	.233	2.33					154	-.023	650
325 30	4.6	.5	⊖	.226	5.6	.539	13.5	.231	2.31					154	-.023	650
330 35	4.5	.4	.1	.215	5.3	.552	13.8	.214	2.14					154	-.023	650
335 40	4.5	.4	⊖	.214	5.3	.555	13.9	.213	2.13					153	-.023	650
340 45	4.4	.3	.1	.211	5.2	.560	14.0	.207	2.08					153	-.023	650
345 50	4.4	.3	⊖	.213	5.3	.556	13.9	.214	2.14					152	-.022	650
350 55	4.3	.2	.1	.212	5.3	.559	14.0	.210	2.11					151	-.021	675
355 1800	4.3	.2	⊖	.216	5.4	.554	13.9	.219	2.19					151	-.021	675
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	1840	-.271	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	3755	-.567	*****

WEIGHT: 4.1 GAS DATA SHEET # 12

UNIT: F500 RUN: 1 DATE: 05-15-02 PAGE: 4 of 4

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	WB	DB	% H_2O	CAL WB	STACK	STATIC	SO_2 PPM
360 1805	4.3	.2	0	.214	5.3	.559	14.0	.215	2.15					151	-.021	675
365 10	4.2	.1	.1	.211	5.2	.563	14.1	.214	2.14					151	-.023	625
370 15	4.2	.1	0	.206	5.1	.570	14.3	.201	2.02					149	-.022	675
375 20	4.1	0	.1	.203	5.0	.572	14.3	.201	2.02					149	-.021	675
380 25																
385 30																
TOTAL	*****	****	****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	600	-.087	*****
																.76
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	16138	-2.716	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	212	-.036	*****

PREBURN DATA SHEET #15

UNIT: F500 RUN: 1 DATE: 05-15-02 PAGE: 1 of 1

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
0 1100	7.7	-	478	635	208	366	402	309	1062	1205	78	:065	PREBURN START: # 1.1 UP
5 05	7.2	.5	369	608	219	369	392	314	978	1141	80	:057	COAL BED SCALE RANGE:
10 10	6.8	.4	320	556	209	366	378	313	931	1064	80	:054	4.1 → 3.3
15 15	6.5	.3	305	533	210	358	364	312	905	997	81	:052	PRIMARY AIR: closed
20 20	6.2	.3	305	518	202	346	344	308	859	969	81	:051	SECONDARY AIR: N/A
25 25	5.8	.4	295	512	197	336	326	306	822	1013	80	:052	FAN: LOW
30 30	5.5	.3	302	516	193	328	312	297	797	1044	81	:052	PUMPS ON AT: 1135
35 35	5.2	.3	290	511	180	325	303	294	800	1049	79	:050	CHECK WB/DB: N/A
40 40	5.1	.1	243	428	185	316	290	283	797	829	79	:043	
45 45	5.1	0	232	397	180	309	280	281	795	799	79	:040	took out .7 @ 1148
50 50	4.2	.2	234	371	174	303	275	279	760	747	75	:040	
55 55	4.2	0	218	347	180	299	264	275	735	706	76	:037	
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	
60 1200	4.2	0	211	331	178	294	258	275	720	687	75	:036	
65 05	4.1	.1	243	314	171	287	251	278	659	686	75	:035	260.2 ΔT.
70 10													
75 15													

TEMPERATURE DATA SHEET # 14

UNIT: F500 RUN: 1 DATE: 05-15-02 PAGE 1 of 4

TIME	TOP	LT SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	FURNACE	SAMPLE	SAMP IMP	C-GAS	GAS IMP	SO_2 IMP	260.2
0/1205	314	171	287	251	278	659	686	75	1325	242	66	263	36	33	
5/10	338	163	279	271	266	547	842	76	1336	241	44	267	37	36	
10/15	306	166	269	269	270	506	608	75	1331	239	43	265	36	36	
15/20	286	160	257	263	268	476	596	75	1328	238	45	262	34	35	
20/25	277	157	246	255	264	473	703	74	1325	238	46	261	35	36	
25/30	296	154	235	247	257	459	726	74	1324	237	46	259	36	33	
30/35	318	149	229	240	253	449	760	74	1325	237	47	259	37	36	
35/40	328	145	223	207	244	439	853	74	1328	237	47	259	38	36	
40/45	335	142	218	192	238	444	880	74	1334	237	47	258	39	37	
45/50	344	141	214	182	232	454	922	74	1338	237	46	258	37	37	
50/55	387	143	213	175	224	469	1022	74	1342	237	46	256	36	37	
55/1300	418	142	214	171	221	485	1299	74	1338	237	45	256	36	36	
TOTAL	3947	1833	2884	2723	3015	5860	9897	893	*****	*****	*****	*****	*****	*****	
60/1305	421	141	214	168	218	499	1175	74	1337	238	46	255	36	36	
65/10	424	141	219	167	213	517	1128	74	1336	237	46	255	35	36	
70/15	426	146	223	166	209	532	1153	74	1335	238	46	254	36	36	
75/20	432	143	227	167	207	551	1177	74	1333	238	46	254	36	36	
80/25	433	148	233	168	207	573	1211	75	1331	238	47	254	36	36	
85/30	432	150	235	169	205	585	1235	74	1329	237	47	253	37	36	
90/35	429	150	240	171	204	607	1080	75	1327	237	48	253	37	36	
95/40	429	151	242	173	205	623	1059	76	1327	238	48	251	37	36	
100/45	422	153	246	175	205	644	1036	76	1327	237	48	250	37	36	
105/50	399	150	250	177	207	659	1090	76	1331	237	48	249	37	37	
110/55	393	154	252	179	205	665	1127	76	1339	236	49	248	37	38	
115/1400	417	154	254	180	205	671	1363	76	1337	237	49	247	37	38	
TOTAL	5057	1781	2835	2060	2490	7126	13834	900	*****	*****	*****	*****	*****	*****	
TOTAL	9004	3614	5719	4783	5505	12986	23731	1793	*****	*****	*****	*****	*****	*****	

TEMPERATURE DATA SHEET # 14

UNIT: F500 RUN: 1 DATE: 05-15-02 PAGE 2 of 4

TIME	TOP	LT SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	FURNACE	SAMPLE	SAMP IMP	C-GAS	GAS IMP	SO_2 IMP	260.2
120/1405	445	158	257	182	205	677	1362	77	1337	237	50	248	37	38	
125/10	461	157	258	184	206	685	1338	77	1337	237	50	248	37	37	
130/15	465	157	260	186	206	697	1342	77	1338	237	50	248	37	38	
135/20	430	158	263	189	207	701	1169	77	1343	237	50	248	38	37	
140/25	423	158	265	194	209	703	1161	77	1340	237	50	247	37	37	
145/30	385	158	268	199	211	711	886	77	1338	237	51	247	37	36	
150/35	360	162	269	201	212	703	815	77	1339	237	51	246	38	36	
155/40	345	159	268	203	213	696	774	78	1336	237	51	246	37	35	
160/45	337	159	266	203	214	691	749	78	1335	238	51	246	37	35	
165/50	323	159	266	204	214	684	732	78	1333	238	51	245	36	35	
170/55	309	156	263	206	215	676	709	78	1329	237	52	245	36	35	
175/1500	299	155	261	206	217	668	698	77	1327	237	54	245	36	35	
TOTAL	4582	1896	3164	2357	2529	8292	11735	928	*****	*****	*****	*****	*****	*****	
180/1505	286	156	258	206	219	670	676	78	1324	237	54	244	36	35	
185/10	274	153	254	206	219	668	667	78	1319	237	55	243	36	36	
190/15	270	155	254	206	219	666	658	78	1318	237	54	242	36	36	
195/20	264	154	251	204	218	660	656	77	1318	237	54	243	36	34	
200/25	258	153	250	203	219	656	653	77	1319	237	54	243	35	35	
205/30	252	151	247	202	218	652	645	77	1319	237	54	243	35	36	
210/35	248	151	246	201	218	644	642	77	1319	237	54	242	36	36	
215/40	245	149	244	199	216	638	639	77	1319	237	54	242	36	36	
220/45	242	152	241	198	218	634	639	77	1319	236	54	243	36	37	
225/50	239	150	240	197	217	626	645	77	1318	236	54	242	37	36	
230/55	237	150	238	197	217	621	640	77	1316	236	54	242	37	37	
235/1600	233	145	237	197	214	619	606	77	1315	236	54	242	36	37	
TOTAL	3048	1819	2960	2416	2612	7754	7766	927	*****	*****	*****	*****	*****	*****	
TOTAL	7630	3715	6124	4773	5141	16046	19501	1855	*****	*****	*****	*****	*****	*****	

TEMPERATURE DATA SHEET # 14

UNIT: F500 RUN: 1 DATE: 05-15-02 PAGE 3 of 4

TIME	TOP	LT SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	FURNACE	SAMPLE	SAMP IMP	C-GAS	GAS IMP	SO_2 IMP	260.2
240/1605	230	147	235	195	213	615	601	77	1314	236	55	241	37	37	
245/10	228	145	234	194	213	610	601	77	1313	236	57	241	37	37	
250/15	228	145	233	192	212	603	598	77	1312	235	57	241	36	37	
255/20	225	145	231	191	212	603	594	77	1311	236	58	241	38	37	
260/25	223	142	230	190	211	604	592	77	1311	235	58	241	38	37	
265/30	221	141	229	188	209	605	593	77	1310	236	58	242	38	38	
270/35	222	147	229	187	209	603	588	76	1310	235	58	243	38	37	
275/40	220	143	229	186	210	602	584	77	1313	236	57	243	38	36	
280/45	219	144	229	186	208	601	581	77	1318	237	58	243	36	37	
285/50	218	143	229	184	210	597	581	78	1322	237	58	244	37	36	
290/55	217	145	228	183	210	590	572	78	1325	237	59	243	38	36	
295/1700	217	144	227	183	209	585	567	78	1326	237	59	244	37	35	
TOTAL	2668	1731	2763	2259	2526	7218	7052	926	*****	*****	*****	*****	*****	*****	
300/1705	216	142	227	182	208	581	566	78	1327	237	59	245	37	35	
305/10	215	142	226	181	209	580	563	78	1327	237	59	244	37	35	
310/15	214	143	224	181	208	575	561	78	1328	237	59	244	36	35	
315/20	214	141	224	180	208	573	564	79	1327	237	59	244	36	36	
320/25	212	142	224	180	207	575	560	79	1327	237	59	244	36	36	
325/30	211	142	223	180	209	569	565	79	1327	238	61	244	36	36	
330/35	212	140	222	180	206	560	554	79	1326	237	61	244	36	34	
335/40	211	138	222	180	206	551	553	79	1326	237	61	244	36	35	
340/45	210	140	220	180	205	542	553	79	1325	237	61	244	36	35	
345/50	210	139	218	180	205	539	551	79	1325	237	62	244	36	35	
350/55	210	141	217	180	206	538	548	80	1323	237	61	244	36	34	
355/1800	209	142	217	180	207	542	533	81	1320	237	61	243	35	35	
TOTAL	2544	1692	2664	2164	2484	6725	6671	948	*****	*****	*****	*****	*****	*****	
TOTAL	5212	3423	5427	4423	5010	13943	13723	1874	*****	*****	*****	*****	*****	*****	

TEMPERATURE DATA SHEET #1

UNIT: F500 RUN: 1 DATE: 05-15-02 PAGE 4 of 4

TIME	TOP	LT SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	FURNACE	SAMPLE	SAMP IMP	C-GAS	GAS IMP	SO_2 IMP	260.2
360 / 1805	208	141	217	180	205	543	524	80	1319	237	61	243	35	35	
365 / 10	207	132	214	179	203	544	518	77	1319	237	61	243	36	35	
370 / 15	205	139	215	177	203	538	511	79	1318	237	61	243	36	37	
375 / 20	206	135	215	178	204	527	508	80	1319	237	59	244	36	35	
380 / 25															
385 / 30															
TOTAL	826	547	861	714	815	2152	2061	316	*****	*****	*****	*****	*****	*****	
											260.2				
											187.6				
											-72.6	ΔT			
									:76						
TOTAL	22672	11299	18131	14693	16471	45127	59016	5838	*****	*****	*****	*****	*****	*****	
TOTAL	298	149	239	193	217	594	777	77	*****	*****	*****	*****	*****	*****	

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 05-15-2002 Analyte : CO_2 (15-1)

Unit : F500 Run # : 1

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 % CO_2 Cyl. Press. : 2000 PSI

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

Span Cyl. # : CC12767 Conc. : 12.49 % CO_2 Cyl. Press. : 1420 PSI

Certified by : AIR LIQUIDE Date : 02-15-02

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 : 1055 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	.022	.022	.087
SPAN	50.0	.500	12.49	50.0	.500	12.442	.048	.194

POST RUN Audit : by : D. Wadington Time : 1845 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	.047	.047	.187
SPAN	50.0	.500	12.49	50.1	.501	12.466	.024	.094

± 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 : 05-15-2002 Analyte : O_2 (15-2)

Unit : F500 Run # : 1

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 % O_2 Cyl. Press. : 2000 PSI

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

Span Cyl. # : CC12767 Conc. : 12.50 % O_2 Cyl. Press. : 1420 PSI

Certified by : AIR LIQUIDE Date : 02-15-02

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 : 1055 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	-.065	-.065	-.259
SPAN	12.50	.500	12.50	12.50	.500	12.513	+.013	+.053

POST RUN Audit : by : D. Washington Time : 1845 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	.002	-.014	-.014	-.057
SPAN	12.50	.500	12.50	12.50	.501	12.538	+.038	+.154

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

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

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

ZERO / SPAN CHECK DATA SHEET #15-3

Date : 05-15-2002 Analyte : CO (15-3)

Unit : F500 Run # : 1

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 % CO Cyl. Press. : 2000 PSI

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

Span Cyl. # : CC12767 Conc. : 4.80 % CO Cyl. Press. : 1420 PSI

Certified by : AIR LIQUIDE Date : 02-15-02

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 : 1055 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	.014	+.014	+.141
SPAN	48.0	.480	4.80	48.0	.480	4.793	-.007	-.066

POST RUN Audit : by : D. Washington Time : 1845 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	.024	+.024	+.240
SPAN	48.0	.480	4.80	48.0	.480	4.793	-.007	-.066

± 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 : 05-15-2002 Analyte : SO_2 (15-4)

Unit : F500 Run # : 1

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 ppm SO_2 Cyl. Press. : 2000 PSI

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

Span Cyl. # : CC62184 Conc. : 1290 ppm SO_2 Cyl. Press. : 1350 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. Washington Time : 1055 Temp : 77 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	5.892	+5.892	+.236
SPAN	51.6	.516	1290	51.6	.516	1292.236	+2.236	+.089

POST RUN Audit : by : D. Washington Time : 1840 Temp : 78 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	-.001	3.399	+3.399	+.136
SPAN	51.6	.516	1290	51.5	.515	1289.743	-.257	-.010

± 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 : F500 RUN : 1 DATE : 05-15-02

Thermocouple Check:

T/C # 1	— °F	T/C # 13	54.3 °F
T/C # 2	— °F	T/C # 14	54.0 °F
T/C # 3	54.0 °F	T/C # 15	54.5 °F
T/C # 4	53.3 °F	T/C # 16	57.5 °F
T/C # 5	51.7 °F	T/C # 17	57.6 °F
T/C # 6	52.5 °F	T/C # 18	54.4 °F
T/C # 7	52.0 °F	T/C # 19	53.6 °F
T/C # 8	52.4 °F	T/C # 20	59.4 °F
T/C # 9	52.3 °F	T/C # 21	— °F
T/C # 10	52.6 °F	T/C # 22	— °F
T/C # 11	50.8 °F	T/C # 23	54.8 °F
T/C # 12	55.2 °F	T/C # 24	— °F

Thermocouple Readout:

Pretest zero and span check and calibration

ZERO : .1 °F Adj. to 0.0 °F

SPAN : 1999.3 °F Adj. to 2000.0 °F

post test zero and span — % difference

ZERO 4.0 °F Adj. to +.200 %

SPAN 1999.9 °F Adj. to -.005 %

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 202.6 °F	400	= 399.4 °F
600	= 601.6 °F	800	= 801.8 °F	1000	= 1000.7 °F
1200	= 1198.3 °F	1400	= 1399.2 °F	1600	= 1599.7 °F
1800	= 1800.0 °F	2000	= 2000.0 °F		

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

Scale Check Pre : 15.7 - 5.7

Post : 13.4 - 3.4

Stack Cleaned Prior to Test Run : YES X NO _____

COMPUTER INPUT DATA SHEET #1

Client: JOTUL U.S.A., INC.

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

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

Run No.: 4 Date of Test: 05-20-2002 Burn Rate: 1.233

Model No.: F500 ☐ min ☒ min-1.25 ☐ ~~fan~~

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

Dry Gas Meter Y Factor: 1,000 (0.000) (Data Sheet #2) Post Leak Rate: .001 (.000) (Data Sheet #2) cfm Time: 310 (000) (Data Sheet #2) min.

Dry Gas Meter Volume: 103.128 (00.000) (Data Sheet #2) cf

Stack Flow: 6.910 (00.000) (Data Sheet #2) dscfm Δ H: .169 (.000) (Data Sheet #2) in. H_2O

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

H_2O Captured: 173.2 (00.0) (Data Sheet #3) g

Front Half Catch % Of Total: 31.8 (00.0) (Data Sheet #6) % Total Particulate Catch: .7372 (0.0000) (Data Sheet #6) g

Flue Gas Moisture: 7.5651 (00.000) (Data Sheet #7) %

Particulate Emission: .1142 (0.0000) (Data Sheet #7) gr/dscf

Relative Humidity: 35.0 (00.0) (Data Sheet #8) % RH Ambient Moisture: 1.35 (0.00) (Data Sheet #8) % H_2O

Pretest Fuel Wt.: 50.1 (00.0) (Data Sheet #8) lbs. Coal Bed Wt.: 4.2 (00.0) (Data sheet #8) lbs. Test Fuel Wt.: 17.0 (00.0) (Data sheet #8) lbs.

Heat Output (EPA Default): 14,864.3 (00,000.0) (Data Sheet #8) BTU/hr

Kindling Fuel % Moisture (wet): 11.032 (00.000) (Data Sheet #10) % Pretest Fuel % Moisture (wet): 16.730 (00.000) (Data Sheet #10) %

Test Fuel % Moisture (dry): 21,073 (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove]) % Test Fuel % Moisture (wet): 17.405 %

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

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

Average Ambient Temperature: 75 (00) (Data Sheet #14) °F Stove Temperature Change: -65.2 (+/- 000.0) (Data Sheet #14) °F

TABLE 1 ----- RAW DATA

CLIENT : Jotul U.S.A., Inc. TEST No. : 4

MODEL: F500 DATE: 20-May-02

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	653.000	0.150	84	1.05	5.80	525
5	654.500	0.450	84	0.39	14.60	300
10	657.212	0.150	84	0.68	3.00	525
15	658.764	0.130	85	0.73	3.00	550
20	660.251	0.130	85	0.81	3.20	550
25	661.738	0.120	85	0.90	4.00	575
30	663.161	0.160	85	0.59	7.70	500
35	664.796	0.150	85	0.79	7.40	525
40	666.354	0.200	85	0.25	11.30	450
45	668.171	0.220	85	0.24	12.50	425
50	670.094	0.220	85	0.19	12.50	425
55	672.018	0.220	85	0.19	11.70	425
60	673.942	0.220	85	0.13	11.60	425
65	675.863	0.220	85	0.13	11.70	425
70	677.785	0.220	85	0.12	12.00	425
75	679.707	0.220	85	0.20	11.70	425
80	681.628	0.220	85	0.16	12.10	425
85	683.550	0.220	85	0.13	12.50	425
90	685.471	0.220	86	0.11	13.10	425
95	687.400	0.200	86	0.16	11.80	450
100	689.222	0.200	86	0.17	10.40	450
105	691.044	0.200	86	0.19	9.90	450
110	692.865	0.200	86	0.23	9.80	450
115	694.687	0.200	86	0.29	9.90	450
120	696.509	0.200	86	0.27	10.20	450
125	698.331	0.200	86	0.16	11.00	450
130	700.152	0.200	86	0.19	11.50	450
135	701.974	0.180	86	0.47	10.30	475
140	703.700	0.150	86	0.74	8.00	525
145	705.262	0.130	86	0.87	7.60	550
150	706.753	0.150	86	1.17	6.90	525
155	708.315	0.130	86	1.39	6.60	550
160	709.806	0.150	86	1.44	6.50	525
165	711.368	0.150	86	1.49	6.50	525
170	712.930	0.150	86	1.67	6.40	525
175	714.492	0.160	86	1.74	6.30	500
180	716.132	0.160	85	1.87	6.10	500
185	717.771	0.150	85	1.68	6.20	525
190	719.333	0.150	85	1.69	6.20	525
195	720.895	0.150	85	1.71	6.10	525
200	722.457	0.150	85	1.82	6.10	525
205	724.019	0.150	85	2.08	5.90	525
210	725.581	0.150	85	2.11	5.70	525
215	727.143	0.150	85	2.24	5.50	525

220	728.705	0.150	85	2.56	5.20	525
225	730.266	0.150	85	2.55	5.20	525
230	731.828	0.150	85	2.25	5.50	525
235	733.390	0.150	85	2.49	5.20	525
240	734.952	0.150	85	2.45	5.20	525
245	736.514	0.150	85	1.75	5.50	525
250	738.076	0.130	85	1.58	5.60	550
255	739.567	0.150	85	1.65	5.50	525
260	741.129	0.150	85	1.48	5.30	525
265	742.691	0.150	85	1.51	5.20	525
270	744.252	0.150	85	1.60	5.10	525
275	745.814	0.150	85	1.56	5.10	525
280	747.376	0.130	85	1.64	4.90	550
285	748.867	0.130	85	1.82	4.90	550
290	750.358	0.130	85	1.81	5.30	550
295	751.849	0.120	85	1.89	4.90	575
300	753.276	0.120	85	1.85	4.80	575
305	754.702	0.120	85	1.85	4.80	575
310	756.128	0.120	85	1.85	4.90	575
315						

TABLE 2---RAW DATA

CLIENT : Jotul U.S.A., Inc. TEST No. 4

MODEL: F500 DATE: 20-May-02

****

METER CAL. FACTOR (Y)	------ 1		Wt. WOOD BURNED(LB)	------- 17.0	Lbs
BAROMETRIC PRESS.(Pb)	------ 29.83	in Hg	WET,FUEL MOISTURE %	------- 17.405	%
LEAK RATE POST (Lp)	------ 0.001	cfm	Wt. PART. COLLECTED	------- 0.7372	g
WATER VOL. (V1c)	------ 173.2	Ml	METER VOLUME Vm	------- 103.128	mcf
TEST TIME (MIN)	------ 310	min	HC MOLE FRACTION	------- 0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT :Jotul U.S.A., Inc. TEST No. 4

MODEL: F500 DATE: 20-May-02

****

AVG DELTA H	-------	0.17 in H2O		AVG PRCNT CO	-------	1.14	%
AVG METER TEMP. Tm	-------	85 deg F		AVG PRCNT CO2	-------	7.57	%
AVG PPM SO2	-------	500	PPM	AVG BAL CO2/CO	-------	6.64	%

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul U.S.A., Inc. TEST No. 4

MODEL: F500 DATE: 20-May-02

****

STD SAMPLE VOL. Vm(std) -----	99.63	dscf	STACK GAS FLOW Qsd -------	442.853	dscf/Hr & 7.38 dscf/min
VOL. WATER VAPOR Vw(std) ----	8.153	scf	PARTICULATE CONCTRT. Cs ------	0.0074	g/dscf
PRCNT MSTR Bws -------	7.56	%	PARTC.EMISS. RATE E -------	3.28	g/Hr
BURN RATE BR -------	1.23	Kg/Hr	MOLES OF GAS PER Lb WOOD Nt --	0.42	Lb-mole/Lb
CO EMISSION RATE -------	168.95 g/Hr & 137.02	g/Kgdry fuel	PART.EMISS. RATE ------	2.66	g/Kgdry fuel

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Jotul U.S.A., Inc. TEST No. : 4

MODEL: F500 DATE: 20-May-02

TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR	PROPRTN RATE VAR. AVERAGE
5	762.4	96	100
10	788.3	100	
15	788.2	100	
20	790.3	100	
25	790.3	100	
30	790.7	100	
35	790.1	100	
40	790.5	100	
45	790.3	100	
50	790.0	100	
55	790.4	100	
60	790.4	100	
65	789.1	100	
70	789.5	100	
75	789.5	100	
80	789.1	100	
85	789.5	100	
90	788.4	100	
95	791.0	100	
100	791.0	100	
105	791.0	100	
110	790.6	100	
115	791.0	100	
120	791.0	100	
125	791.0	100	
130	790.6	100	
135	791.0	100	
140	790.9	100	
145	791.1	100	
150	791.0	100	
155	791.1	100	
160	791.0	100	
165	791.1	100	
170	791.1	100	
175	791.1	100	
180	791.8	100	
185	792.0	100	
190	792.5	100	
195	792.5	100	
200	792.5	100	
205	792.5	100	
210	792.5	100	
215	792.5	100	
220	792.5	100	

225	792.0	100
230	792.5	100
235	792.5	100
240	792.5	100
245	792.5	100
250	792.5	100
255	792.5	100
260	792.5	100
265	792.5	100
270	792.0	100
275	792.5	100
280	792.5	100
285	792.5	100
290	792.5	100
295	792.5	100
300	792.9	100
305	792.4	100
310	792.4	100
315		
320		

METER BOX DATA SHEET PAGE # 2

Page: 1 of 3

UNIT: F500 RUN: 4 DATE: 05-20-02

Meter Box: 5H Y Factor: 1.000

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

22 15 " Hg @ .001 cfm _____ " Hg @ _____ cfm

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

ROTO: PRESS: .14			SAMPLING RATIO: 21.5 : 1				BP: 29.80		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1355	653.000	—	6.506	.15	84	525	84	2.0
5	1400	654.500	—	11.385	.45	84	300	84	3.0
10	05	657.212	657.212	6.506	.15	84	525	84	2.0
15	10	658.764	658.764	6.199	.13	85	550	85	2.0
20	15	660.251	660.251	6.199	.13	85	550	85	2.0
25	20	661.738	661.738	5.929	.12	85	575	85	2.0
30	25	663.161	663.161	6.819	.16	85	500	85	2.0
35	30	664.796	664.796	6.494	.15	85	525	85	2.0
40	35	666.354	666.354	7.576	.20	85	450	85	2.0
45	40	668.171	668.171	8.022	.22	85	425	85	2.0
50	45	670.094	670.094	8.022	.22	85	425	85	2.0
55	50	672.018	672.018	8.022	.22	85	425	85	2.0
ROTO PRESS: .14			TOTALS:	87.679	2.30	1017	BP.: 29.83		
60	1455	673.942	673.942	8.030	.22	85	425	85	2.0
65	1500	675.863	675.863	8.030	.22	85	425	85	2.0
70	05	677.785	677.785	8.030	.22	85	425	85	2.0
75	10	679.707	679.707	8.030	.22	85	425	85	2.0
80	15	681.628	681.628	8.030	.22	85	425	85	2.0
85	20	683.550	683.550	8.030	.22	85	425	85	2.0
90	25	685.471	685.471	8.015	.22	86	425	86	2.0
95	30	687.400	687.400	7.570	.20	86	450	86	2.0
100	35	689.222	689.222	7.570	.20	86	450	86	2.0
105	40	691.044	691.044	7.570	.20	86	450	86	2.0
110	45	692.865	692.865	7.570	.20	86	450	86	2.0
115	50	694.687	694.687	7.570	.20	86	450	86	2.0
			TOTALS:	94.045	2.54	1026	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	181.724	4.84	2043	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 2 of 3

UNIT: F500 RUN: 4 DATE: 05-20-02

Meter Box: 5H Y Factor: 1.000

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

15 " Hg @ .001 cfm _____ " Hg @ _____ cfm

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

ROTO: PRESS: .14 SAMPLING RATIO: 21.5 : 1 BP: 29.83

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1555	696.509	696.509	7.570	.20	86	450	86	2.0
125	1600	698.331	698.331	7.570	.20	86	450	86	2.0
130	05	700.152	700.152	7.570	.20	86	450	86	2.0
135	10	701.974	701.974	7.172	.18	86	475	86	2.0
140	15	703.700	703.700	6.489	.15	86	525	86	2.0
145	20	705.262	705.262	6.194	.13	86	550	86	2.0
150	25	706.753	706.753	6.489	.15	86	525	86	2.0
155	30	708.315	708.315	6.194	.13	86	550	86	2.0
160	35	709.806	709.806	6.489	.15	86	525	86	2.0
165	40	711.368	711.368	6.489	.15	86	525	86	2.0
170	45	712.930	712.930	6.489	.15	86	525	86	2.0
175	50	714.492	714.492	6.813	.16	86	500	86	2.0
ROTO PRESS:		.14	TOTALS:	81.528	1.95	1032	BP.:	29.83	
180	1655	716.132	716.132	6.813	.16	85	500	85	2.0
185	1700	717.771	717.771	6.489	.15	85	525	85	2.0
190	05	719.333	719.333	6.489	.15	85	525	85	2.0
195	10	720.895	720.895	6.489	.15	85	525	85	2.0
200	15	722.457	722.457	6.489	.15	85	525	85	2.0
205	20	724.019	724.019	6.489	.15	85	525	85	2.0
210	25	725.581	725.581	6.489	.15	85	525	85	2.0
215	30	727.143	727.143	6.489	.15	85	525	85	2.0
220	35	728.705	728.705	6.489	.15	85	525	85	2.0
225	40	730.266	730.266	6.489	.15	85	525	85	2.0
230	45	731.828	731.828	6.489	.15	85	525	85	2.0
235	50	733.390	733.390	6.489	.15	85	525	85	2.0
			TOTALS:	78.192	1.81	1020	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	159.720	3.76	2052	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 3 of 3

UNIT: F500 RUN: 4 DATE: 05-20-02

Meter Box: 5H Y Factor: 1.000

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

15 " Hg @ .001 cfm _____ " Hg @ _____ cfm

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

ROTO: PRESS: .14 SAMPLING RATIO: 21.5 : 1 BP: 29.83

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
240	1755	734.952	734.952	6.489	.15	85	525	85	2.0
245	1800	736.514	736.514	6.489	.15	85	525	85	2.0
250	05	738.076	738.076	6.194	.13	85	550	85	2.0
255	10	739.567	739.567	6.489	.15	85	525	85	2.0
260	15	741.129	741.129	6.489	.15	85	525	85	2.0
265	20	742.691	742.691	6.489	.15	85	525	85	2.0
270	25	744.252	744.252	6.489	.15	85	525	85	2.0
275	30	745.814	745.814	6.489	.15	85	525	85	2.0
280	35	747.376	747.376	6.194	.13	85	550	85	2.0
285	40	748.867	748.867	6.194	.13	85	550	85	2.0
290	45	750.358	750.358	6.194	.13	85	550	85	2.0
295	50	751.849	751.849	5.924	.12	85	575	85	2.0
ROTO PRESS:		.14	TOTALS:	76.123	1.69	1020	BP.: 29.83		
300	1855	753.276	753.276	5.924	.12	85	575	85	2.0
305	1900	754.702	754.702	5.924	.12	85	575	85	2.0
310	05	756.128	756.128	5.924	.12	85	575	85	2.0
315	10			17.772	.36	255			
320									
325									
330									
335									
340									
345									
350									
355						5370	÷63.		
			TOTALS:	435.339	10.650	85	MAX VACC =		3.0
TOTAL Cu Ft.		103.128	TOTALS:	6.910	.169	545	AVG. BP:	29.83	

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : F500 RUN : 4 DATE : 05-20-02

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	768.0	601.5	486.2	921.5
INITIAL WT	623.8	591.4	483.8	905.0
NET WT GRAMS	144.2	10.1	2.4	16.5

TOTAL CATCH : 173.2 GRAMS H_2O

FRONT HALF

FILTER #	120F	
FINAL WT g	.8345	.
INITIAL WT g	.6843	.
NET WT g	.1502	.

BEAKER #	66	
DESC.	ACETONE	
FINAL WT g	96.5970	.
INITIAL WT g	96.5125	.
NET WT g	.0845	.
VOL. DESC. ml	150	.

BACK HALF

FILTER #	120B	
FINAL WT g	.5016	.
INITIAL WT g	.4425	.
NET WT g	.0591	.

BEAKER #	67	68	69	70	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	106.4365 .	94.2367 .	109.0814 .	107.5621 .	
INITIAL WT g	106.2276 .	94.1606 .	108.9969 .	107.4845 .	
NET WT g	.2089 .	.0761 .	.0845 .	.0776 .	.1621 .
VOL. DESC ml	150	75	200	185	(385) .

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 01/29/02 Time : 1125 By : DKW

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

Back Size: 8.2 cm Lot No. : ZB911

	DATE: 02-07	BY: DKW	DATE: 02-10	BY: DKW	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
111F	.6782	0934	.6780	1939	JOTUL C450	R-2
112F	.6755	0935	.6751	1940	" "	R-3
113F	.6721	0935	.6719	1941	" "	R-4
114F	.6843	0936	.6844	1942	" "	R-5
115F	.6699	0937	.6700	1943	" "	R-6
116F	.6696	0938	.6694	1943	" "	R-7
117F	.6796	0939	.6793	1944	JOTUL F500	R-1
118F	.6715	0940	.6718	1945	" "	R-2
119F	.6743	0941	.6746	1946	" "	R-3
120F	.6844	0942	.6843	1947	" "	R-4
111B	.4462	0943	.4464	1948	JOTUL C450	R-2
112B	.4448	0944	.4451	1949	" "	R-3
113B	.4466	0945	.4464	1949	" "	R-4
114B	.4305	0946	.4307	1950	" "	R-5
115B	.4234	0947	.4236	1951	" "	R-6
116B	.4444	0948	.4445	1952	" "	R-7
117B	.4431	0949	.4430	1953	JOTUL F500	R-1
118B	.4293	0950	.4294	1954	" "	R-2
119B	.4441	0951	.4439	1955	" "	R-3
120B	.4427	0952	.4425	1955	" "	R-4

Checked by: C Warlington Date: 2-10-02 Time: 2000

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
02-07	0910	DKW		74	47
02-10	1905	DKW		74	45

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 04-24-2002 Time : 1820 By : DKW

	DATE: 05-17	BY:	DATE: 05-19	BY:	DATE:	BY:
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
66	96.5130	1606	96.5125	1518		
67	106.2279	1607	106.2276	1519	JOTUL F500	
68	94.1608	1608	94.1606	1520	R-4	
69	108.9974	1609	108.9969	1521		
70	107.4847	1611	107.4845	1523		
71	104.1557	1612	104.1555	1524		
72	103.8325	1613	103.8327	1525	JOTUL F500	
73	104.3597	1614	104.3600	1527	R-5	
74	107.5126	1615	107.5129	1528		
75	96.4716	1616	96.4715	1529		
76	103.8088	1617	103.8088	1530		
77	107.3923	1618	107.3924	1532		
78	94.5006	1620	94.5004	1533		
79	97.6258	1621	97.6257	1534		
80	109.1322	1622	109.1320	1535		

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH	
05-17	1600			75	48	Checked by C. Worthington
05-19	1500			77	48	Date : 5-20-02
						Time : 1430

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : F500 **RUN :** 4 **DATE :** 05-20-02 **Page :** 1 **of** 1

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
66	05-21	1220		96.5968	05-22	1230		96.5970	05-22	1923					
67	05-21	1915		106.4367	05-22	1924		106.4365	05-23	2107					
68	05-21	1915		94.2370	05-22	1925		94.2367	05-23	2108					
69	05-21	1220		109.0815	05-22	1231		109.0814	05-22	1926					
70	05-21	1220		107.5621	05-22	1232		107.5621	05-22	1927					

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
120F	5-20	2000	CP	.8344	05-21	0943		.8345	05-22	1206					
120B	5-20	2000	CP	.5029	05-21	0945		.5018	05-22	1207		.5016	05-22	1928	

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	05-21	0930		78	49
2	05-22	1155		78	48
3	05-22	1920		78	49
4	05-23	2105		77	48
5					

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

Dates: From 11-20-2001
Through 02-16-2002

WOODSTOVE DATA SHEET #4-4
SCALE QA SHEET

Scale: Sartorius
Model: A1205
SN : 37010004

100g weight	10 g weight	1.0 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	Wet Bulb	%.RH
99.9998	10.0002	1.0003	.1000	DKW	11-20	0945	78		48
100.0000	10.0000	1.0001	.0999	DKW	11-21	1000	75		49
99.9998	9.9998	1.0000	.1001	DKW	11-22	1050	75		49
100.0003	9.9999	1.0000	.0999	DKW	11-26	1150	74		47
100.0001	9.9997	1.0000	.1000	DKW	11-27	1155	74		48
100.0001	10.0000	.9997	.0999	DKW	11-28	1220	72		48
99.9999	10.0001	1.0000	.1000	DKW	11-28	1930	73		48
99.9998	10.0000	.9999	.0999	DKW	11-29	1015	75		46
99.9998	10.0000	.9997	.0998	DKW	11-29	1925	73		46
100.0000	10.0001	.9998	.0999	DKW	11-30	1355	74		45
99.9999	9.9999	1.0000	.1000	DKW	12-01	1210	77		45
100.0003	10.0000	.9997	.1000	DKW	01-08	2045	78		47
100.0001	10.0000	.9998	.1000	DKW	01-09	1600	78		48
99.9999	9.9999	.9999	.1000	DKW	01-12	1900	74		46
99.9998	9.9999	.9997	.1000	DKW	01-13	1730	72		43
100.0000	10.0001	1.0000	.1001	DKW	01-14	1355	78		45
99.9998	9.9999	.9999	.1000	DKW	01-26	1745	72		47
99.9998	10.0000	1.0000	.0999	DKW	01-28	1705	74		44
100.0003	10.0000	1.0000	.0998	DKW	01-29	1130	70		47
99.9998	9.9997	1.0000	.1000	DKW	01-29	2300	71		44
100.0002	10.0000	1.0000	.1000	DKW	01-30	2200	75		45
99.9999	9.9999	.9999	.1000	DKW	01-31	2205	74		47
100.0001	9.9999	1.0000	.1000	DKW	02-02	0700	75		45
100.0002	9.9999	1.0001	.1000	DKW	02-04	1045	73		47
100.0000	10.0000	.9998	.0997	DKW	02-06	0905	73		47
100.0001	10.0000	1.0000	.1000	DKW	02-07	0910	74		47
100.0002	10.0001	1.0000	.0999	DKW	02-07	1235	77		48
99.9999	10.0000	.9999	.0998	DKW	02-08	1110	72		49
99.9998	9.9999	1.0000	.0999	DKW	02-09	1045	70		49
99.9997	10.0000	.9999	.0999	DKW	02-10	0920	74		48
99.9997	10.0001	.9999	.0999	DKW	02-10	1905	76		45
99.9999	9.9999	1.0000	.0997	DKW	02-11	1935	73		43
99.9998	9.9997	1.0000	.0999	DKW	02-13	1740	75		41
99.9997	10.0000	.9999	.1000	DKW	02-14	1015	74		38
99.9998	9.9999	1.0000	.1000	DKW	02-14	2010	74		43
100.0000	10.0000	1.0000	.1000	DKW	02-15	1150	74		41
99.9998	9.9999	.9999	.1000	DKW	02-16	1045	78		41

Dates: From 02-16-2002
Through 05-17-2002

WOODSTOVE DATA SHEET #4-4
SCALE QA SHEET

Scale: Sartorius
Model: A1205
SN : 37010004

100g weight	10 g weight	1.0 g weight	100 mg weight	Tech	Date	Time	Wet Bulb	Dry Bulb	% RH
100.0000	9.9999	1.0000	.0999		02-16	1845		77	46
100.0000	9.9999	.9999	.0998		02-17	1555		77	47
100.0001	9.9999	.9999	.0997		02-18	0940		77	47
100.0000	10.0000	.9999	.1000		02-19	1025		78	46
100.0000	9.9999	1.0000	.0999		02-20	0915		75	42
100.0003	10.0000	1.0000	.0999		03-14	1020		78	45
99.9999	9.9998	.9998	.0998		03-15	1725		77	45
99.9999	10.0000	1.0002	.0999		03-16	1820		77	38
100.0001	9.9999	1.0001	.1000		03-16	2130		78	43
99.9999	9.9999	.9998	.0998		03-17	1550		77	43
99.9999	10.0000	1.0001	.0999		03-17	2045		77	39
99.9998	10.0000	1.0000	.1000		03-18	1100		77	39
100.0000	9.9999	.9999	.0999		03-19	1800		76	42
100.0001	10.0000	1.0001	.1000		03-20	1835		77	45
99.9999	10.0001	.9999	.0999		03-21	2235		78	45
99.9998	9.9999	1.0000	.1000		03-24	2205		78	42
99.9998	10.0000	1.0000	.1001		03-25	1000		78	41
99.9997	10.0000	1.0001	.1000		04-04	1300		78	49
99.9998	10.0000	1.0000	.0999		04-05	1210		78	49
99.9997	10.0000	.9999	.0998		04-05	2230		78	49
99.9999	10.0001	1.0000	.0998		04-08	1135		78	47
99.9997	10.0000	1.0000	.0999		04-08	1910		78	48
99.9997	9.9998	.9999	.1000		04-09	2150		77	48
99.9999	10.0000	1.0001	.0999		04-10	2205		78	48
100.0000	10.0001	.9999	.0999		04-11	0940		76	49
99.9997	9.9998	1.0000	.0999		04-11	1705		78	48
99.9999	9.9999	.9999	.0998		04-11	2230		78	48
99.9999	10.0001	.9999	.0999		04-12	0950		78	47
100.0001	9.9998	1.0000	.0999		04-12	1810		78	48
100.0000	9.9999	.9999	.0998		04-12	2205		78	47
100.0000	9.9999	.9999	.0999		04-13	1720		78	48
99.9998	10.0000	1.0000	.0998		04-13	2325		78	46
99.9999	10.0001	1.0001	.1000		04-14	1740		78	44
99.9998	10.0000	1.0001	.0999		04-16	1925		75	44
99.9997	9.9999	1.0000	.1000		04-19	1350		78	41
100.0000	10.0001	.9998	.0999		04-20	1210		75	41
99.9998	9.9998	1.0001	.0997		05-16	1430		76	48
99.9999	9.9999	1.0000	.0999		05-17	1600		75	48

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

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

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9999	10.0000	.9999	.0999	AKW	05-18	1905	77	49
99.9997	9.9998	.9999	.0998	AKW	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

BLANK PROCESSING DATA SHEET # 5

UNIT: F500 RUN: 4 DATE: 05-20-02

BLANKS DONE: 02-20-2002

BEAKER	A	B	C
	200 ml ACETONE	75 ml DICHLOR	200 ml WATER
	FISHER OPTIMA LOT # 011755	FISHER OPTIMA LOT # 994669	MCKESSON WATER PRODUCTS CO. CERTIFIED DISTILLED
FINAL WEIGHT	108.9015	106.3081	106.9664
TARE WEIGHT	108.9007	106.3064	106.9660
NET WEIGHT	.0008 ✓	.0017 ✓	.0004 ✓

TARE BEAKERS INTO DESC: TIME: 1205 DATE: 02-15-2002

DATE: 02-16 BY: [illegible] DATE: 02-17 BY: [illegible] DATE: BY:

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9002	1849	108.9007	1611 ✓		
B	106.3068	1850	106.3064	1612 ✓		
C	106.9661	1851	106.9660	1613 ✓		

FINAL BEAKERS INTO DESC: TIME: 1125 DATE: 02-18-2002

DATE: 02-19 BY: [illegible] DATE: 02-20 BY: [illegible] DATE: BY:

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9016	1027	108.9015	0917 ✓		
B	106.3084	1028	106.3081	0918 ✓		
C	106.9664	1029	106.9664	0919 ✓		

TARE QC

DATE	TIME	BY	WB	DB	%
02-16	1845	[illegible]		77	46
02-17	1555	[illegible]		77	47

FINAL QC

DATE	TIME	BY	WB	DB	%
02-19	1025	[illegible]		78	46
02-20	0915	[illegible]		75	42

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT: F500 RUN: 4 DATE: 05-20-02

BLANK CALCULATIONS

Acetone: .0008 g ÷ 200 ml = .000004 g/ml
Dicholoromethane: .0017 g ÷ 75 ml = .000023 g/ml
Distilled Water: .0004 g ÷ 200 ml = .000002 g/ml

FRONT HALF CATCH

FILTERS: .1502 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .1502 g

BEAKERS: .0845 (Total Catch) g - 150 (ml Acetone) (.000004 g) (Blank Value / ml Acetone) = .0839 g

TOTAL FRONT HALF CATCH: .2341 g

BACK HALF CATCH

FILTERS: .0591 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0591 g

BEAKERS:

Acetone: .2089 (Total Catch) g - 150 (ml Acetone) (.000004 g) (Blank Value / ml Acetone) = .2083 g

Extract: .0761 (Total Catch) g - 75 (ml Dichloromethane) (.0017 .000023 g) (Blank Value / Dichloromethane) = .0744 g

Water: .1621 (Total Catch) g - 385 (ml Water) (.000002 g) (Blank Value / Water) = .1613 g

TOTAL BACK HALF CATCH: .5031 g

TOTAL CATCH: .7372 g

% FRONT HALF: 31.8 %

CALCULATIONS DATA SHEET # 7

UNIT : F500 RUN : 4 DATE : 05-20-02

1) $Vm(std) = \dfrac{(103.128\ Vm)(17.64)(1.000\ mcf)\left(29.83\text{" Hg} + \frac{.169\text{" } H_2O}{13.6}\right)}{(545\ TmA)} = \dfrac{99.6123}{000.0000}$ dscf

2) $Vw(std) = (.04707)(173.2\ ml\ H_2O) = \dfrac{8.1525}{00.0000}$ scf

3) $Asw = \dfrac{(8.1525\ scf)}{(8.1525\ scf + 99.6123\ dscf)} = \dfrac{.0757}{.0000}$ Bws × 100 = $\dfrac{7.5651}{00.0000}$ % H_2O

4) $Cs = \dfrac{(.7372\ g.)}{(99.6123\ dscf)}(15.43) = \dfrac{.1142}{0.0000}$ gr / dscf

5) Estimated g / hr = $\dfrac{(.7372\ g.)}{(99.6123\ dscf)}\left(\dfrac{6.910}{00.0000}\ dscfm\right)(60) = \dfrac{3.0683}{00.0000}$ 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: F500 RUN: 4 DATE: 05-20-02

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: 67 DB: 88 = 31 % RH 1.4 % H_2O

Average: 35.0 % RH 1.35 % H_2O

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

Kindling Weight (lbs): Paper: .1 Wood: 3.1

Preburn Fuel Weight: 16.5+14.5+13.3+2.7 Total: 47.0

Kindling & Preburn Fuel Weight (wood only) (lbs): **Total**: 50.1

Coal Bed Wt Range (lbs): 4.2 - 3.4 **Scale**: 4.2 - 3.4

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

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

Maximum Coal Bed Removal (lbs): ((4.2 (Upper) + 3.4 (Lower)) ÷ 2) .25 = .9 (round down to nearest tenth)

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

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" × 4"	17	3	7.0	41.2
4" × 4"	17	2	10.0	58.8

Test Fuel Weight: 17.0 lbs

Estimated Dry Burn Rate:

$$\frac{17.0 - (17.0 \times .17405)}{2.2046} \times \frac{60}{\frac{310}{\text{TIME}}} = 1.233 \text{ kg / hr}$$

Estimated BTU's/hr: $19{,}140 \times \frac{63}{100} \times \frac{1.233}{\text{DBR}} = 14{,}864.3$ BTU's/hr

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

WOOD STOVE OPERATING DATA PAGE #9

Unit : F500 Run : 4 Date : 05-20-02

FIRE STARTED: 0900

WARM UP AND PREBURN:

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

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

CHARCOAL BED PREPARATION :

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

TEST:

DOOR wide open during loading ~~0~~ min. 45 sec.

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

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

FAN:

ON / OFF during warm-up

ON / OFF first 30 minutes of test

Fan speed set at Low

ON / OFF during preburn

ON / OFF balance of test run

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

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

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

All Grades WCLB rules:

WARM UP INFORMATION:

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

1st warm up / pre-burn fuel charge (16.5 lbs.) added at 0920

2nd warm up / pre-burn fuel charge (14.5 lbs.) added at 1050

3rd warm up / pre-burn fuel charge (13.3 lbs.) added at 1200

4th warm up / pre-burn fuel charge (2.7 lbs.) added at 1250

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

TEST DATA SHEET #10

Unit : F500 Run : 4 Date : 05-20-02

Room Temperature : 72 °F Correction Factor : Ø

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

Time Test Fuel moisture reading taken : 1200

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	11.5	12.2	11.5	12.2	12.0	12.8	12.400
2									
3									
4	2"×4"×8'	P	18.0	19.2	18.5	19.8	18.5	19.8	19.600
5	2"×4"×8'	P	18.0	19.2	18.0	19.2	18.5	19.8	19.400
6	2"×4"×8'	P	18.0	19.2	18.0	19.2	18.0	19.2	19.200
7	2"×4"×8'	P	21.5	23.1	20.0	21.4	20.5	22.0	22.167
8	2"×4"×8'	P							80.367
9									
10	2×4×17	T	17.5	18.7	17.5	18.7	18.0	19.2	18.867
11	"	T	18.0	19.2	18.0	19.2	18.0	19.2	19.200
12	"	T	23.5	25.2	23.5	25.2	23.5	25.2	25.200
13	4×4×17	T	19.5	20.9	19.5	20.9	20.0	21.4	21.067
14	"	T	19.0	20.3	20.0	21.4	20.0	21.4	21.033
15									105.367
16									
17									
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 % :	12.400 %	20.092 %	21.073 %
Wet Moisture % :	11.032 %	16.730 %	17.405 %

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°

WEIGHT: 4.2

UNIT: F500

GAS DATA SHEET # 12

RUN: 4 DATE: 05-20-02 PAGE: 1 of 3

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	WB	DB	% H_2O	CAL WB	STACK	STATIC	SO_2 PPM
0 1355	21.2	17.0	—	.234	5.8	.556	13.9	.104	1.05					233	-.037	525
5 1400	20.6	16.4	.6	.585	14.6	.241	6.0	.038	.39					336	-.058	300
10 05	20.3	16.1	.3	.124	3.0	.687	17.2	.067	.68					240	-.044	525
15 10	20.0	15.8	.3	.123	3.0	.690	17.3	.072	.73					212	-.040	550
20 15	19.8	15.6	.2	.130	3.2	.683	17.1	.080	.81					203	-.038	550
25 20	19.4	15.2	.4	.160	4.0	.661	16.6	.089	.90					274	-.038	575
30 25	19.0	14.8	.4	.309	7.7	.500	12.5	.058	.59					232	-.045	500
35 30	18.4	14.2	.6	.298	7.4	.510	12.8	.078	.79					246	-.048	525
40 35	17.9	13.7	.5	.453	11.3	.382	9.5	.024	.25					294	-.054	450
45 40	17.2	13.0	.7	.503	12.5	.344	8.6	.023	.24					323	-.057	425
50 45	16.4	12.2	.8	.503	12.5	.343	8.6	.018	.19					338	-.058	425
55 50	15.7	11.5	.7	.472	11.7	.369	9.2	.018	.19					339	-.059	425
TOTAL	*****	****	****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	3270	-.576	*****
60 1455	15.1	10.9	.6	.468	11.6	.370	9.2	.012	.13					342	-.059	425
65 1500	14.5	10.3	.6	.469	11.7	.374	9.3	.012	.13					344	-.059	425
70 05	14.0	9.8	.5	.484	12.0	.361	9.0	.011	.12					348	-.059	425
75 10	13.3	9.1	.7	.472	11.7	.368	9.2	.019	.20					344	-.059	425
80 15	12.8	8.6	.5	.485	12.1	.357	8.9	.015	.16					345	-.059	425
85 20	12.3	8.1	.5	.503	12.5	.340	8.5	.012	.13					348	-.059	425
90 25	11.6	7.4	.7	.526	13.1	.330	8.2	.010	.11					355	-.060	425
95 30	10.9	6.7	.7	.474	11.8	.361	9.0	.015	.16					345	-.058	450
100 35	10.6	6.4	.3	.418	10.4	.395	9.9	.016	.17					333	-.056	450
105 40	10.2	6.0	.4	.400	9.9	.407	10.2	.018	.19					323	-.055	450
110 45	9.8	5.6	.4	.396	9.8	.410	10.2	.022	.23					317	-.055	450
115 55	9.4	5.2	.4	.399	9.9	.406	10.1	.028	.29					312	-.055	450
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	4056	-.693	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	7326	-1.269	*****

WEIGHT: 4.2

GAS DATA SHEET # 12

UNIT: F500 RUN: 4 DATE: 05-20-02 PAGE: 2 of 3

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	WB	DB	% H_2O	CAL WB	STACK	STATIC	SO_2 PPM
120 1555	9.0	4.8	.4	.410	10.2	.395	9.9	.026	.27					310	-.055	450
125 1600	8.7	4.5	.3	.441	11.0	.378	9.4	.015	.16					314	-.055	450
130 05	8.3	4.1	.4	.463	11.5	.349	8.7	.018	.19					319	-.055	450
135 10	7.9	3.7	.4	.415	10.3	.394	9.8	.046	.47					309	-.054	475
140 15	7.6	3.4	.3	.320	8.0	.457	11.4	.073	.74					289	-.054	525
145 20	7.5	3.3	.1	.306	7.6	.469	11.7	.086	.87					268	-.048	550
150 25	7.3	3.1	.2	.277	6.9	.484	12.1	.116	1.17					254	-.045	525
155 30	7.2	3.0	.1	.266	6.6	.496	12.4	.138	1.39					245	-.044	550
160 35	7.1	2.9	.1	.263	6.5	.500	12.5	.143	1.44					237	-.043	525
165 40	6.9	2.7	.2	.261	6.5	.501	12.5	.148	1.49					229	-.041	525
170 45	6.8	2.6	.1	.256	6.4	.504	12.6	.167	1.67					225	-.041	525
175 50	6.7	2.5	.1	.252	6.3	.508	12.7	.173	1.74					222	-.040	500
TOTAL	*****	****	****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	3221	-.575	*****
180 1655	6.6	2.4	.1	.246	6.1	.513	12.8	.186	1.87					219	-.040	500
185 1700	6.5	2.3	.1	.249	6.2	.515	12.9	.167	1.68					213	-.039	525
190 05	6.4	2.2	.1	.248	6.2	.514	12.9	.168	1.69					211	-.038	525
195 10	6.3	2.1	.1	.247	6.1	.516	12.9	.170	1.71					208	-.038	525
200 15	6.2	2.0	.1	.245	6.1	.517	12.9	.181	1.82					205	-.037	525
205 20	6.0	1.8	.2	.237	5.9	.524	13.1	.207	2.08					203	-.036	525
210 25	5.9	1.7	.1	.230	5.7	.531	13.3	.210	2.11					201	-.036	525
215 30	5.8	1.6	.1	.223	5.5	.536	13.4	.224	2.24					199	-.036	525
220 35	5.7	1.5	.1	.211	5.2	.543	13.6	.256	2.56					197	-.035	525
225 40	5.6	1.4	.1	.210	5.2	.546	13.7	.255	2.55					194	-.035	525
230 45	5.6	1.4	0	.220	5.5	.542	13.6	.225	2.25					194	-.035	525
235 50	5.4	1.2	.2	.209	5.2	.549	13.7	.249	2.49					192	-.035	525
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	2436	-.440	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	5657	-1.015	*****

WEIGHT: 4.2

GAS DATA SHEET # 12

UNIT: F500 RUN: 4 DATE: 05-20-02 PAGE: 3 of 3

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	WB	DB	% H_2O	CAL WB	STACK	STATIC	SO_2PPM
240 1735	5.4	1.2	0	.208	5.2	.550	13.8	.245	2.45					191	.035	525
245 1800	5.3	1.1	.1	.221	5.5	.554	13.9	.174	1.75					188	.033	525
250 05	5.2	1.0	.1	.225	5.6	.552	13.8	.157	1.58					187	.033	550
255 10	5.0	.8	.2	.222	5.5	.555	13.9	.164	1.65					186	.032	525
260 15	5.0	.8	0	.215	5.3	.567	14.2	.147	1.48					185	.031	525
265 20	4.9	.7	.1	.210	5.2	.572	14.3	.150	1.51					184	.031	525
270 25	4.8	.6	.1	.206	5.1	.572	14.3	.159	1.60					183	.031	525
275 30	4.7	.5	.1	.204	5.1	.575	14.4	.155	1.56					181	.030	525
280 35	4.7	.5	0	.199	4.9	.579	14.5	.163	1.64					180	.030	550
285 40	4.6	.4	.1	.199	4.9	.575	14.4	.181	1.82					179	.029	550
290 45	4.5	.3	.1	.201	5.3	.573	14.3	.180	1.81					179	.029	550
295 50	4.4	.2	.1	.198	4.9	.574	14.4	.188	1.89					178	.029	575
TOTAL	*****	****	****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	2201	-.373	*****
300 1855	4.3	.1	.1	.195	4.8	.578	14.5	.184	1.85					177	.029	575
305 1900	4.3	.1	0	.194	4.8	.578	14.5	.184	1.85					176	.028	575
310 05	4.2	0	.1	.197	4.9	.575	14.4	.184	1.85					175	.028	575
315 10																
320 15														528	.085	
325 20																
330 25																
335 30																
340 35																
345 40																
350 45																
355 50																.63
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	15712	-2.742	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	249	-.044	*****

at. 5.4 add 3 blocks (2.7)

PREBURN DATA SHEET #15

UNIT: F500 RUN: 4 DATE: 05-20-02 PAGE: 1 of 1

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
0 / 1250	8.1	–	441	660	205	364	391	304	1029	1250	80	-.067	PREBURN START: # 1.2 UP
5 / 55	7.7	.4	381	625	207	369	405	308	980	1225	80	-.062	COAL BED SCALE RANGE:
10 / 1300	7.3	.4	346	591	203	367	380	313	938	1154	80	-.059	4.2 → 3.4
15 / 05	6.9	.4	323	564	203	360	386	319	905	1182	81	-.057	PRIMARY AIR: 1/8"
20 / 10	6.6	.3	308	540	197	349	372	316	873	1168	82	-.055	SECONDARY AIR: N/A
25 / 15	6.2	.4	305	525	210	346	361	309	855	1193	83	-.055	FAN: LOW
30 / 20	5.9	.3	307	523	208	341	349	306	841	1242	83	-.054	PUMPS ON AT: 1340
35 / 25	5.5	.4	299	517	203	333	337	301	827	1156	83	-.052	CHECK WB/DB: N/A
40 / 30	5.4	.2	264	461	195	327	326	299	805	834	83	-.046	
45 / 35	5.3	.1	245	419	192	321	316	294	795	773	84	-.042	
50 / 40	4.5	.1	257	387	178	318	308	293	774	725	81	-.041	took out .7 @ 1340
55 / 45	4.5	0	230	366	175	312	301	292	788	689	79	-.040	
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	
60 / 1350	4.4	.1	350	350	174	307	293	290	773	672	78	-.038	
65 / 55	4.2	.2	233	329	173	303	282	291	724	616	77	-.037	275.6 ΔT
70 / 1400													
75 / 05													

TEMPERATURE DATA SHEET # 14

UNIT: F500 RUN: 4 DATE: 05-20-02 PAGE 1 of 3

TIME	TOP	LT SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	FURNACE	SAMPLE	SAMP IMP	C-GAS	GAS IMP	SO_2 IMP	2756
0 / 1355	329	173	303	282	291	724	616	77	1261	229	67	225	36	37	
5 / 1400	363	169	296	286	280	614	905	76	1269	232	44	236	36	36	
10 / 05	336	159	286	282	286	574	601	75	1274	233	42	241	36	34	
15 / 10	304	154	269	274	281	527	535	75	1284	235	44	246	37	35	
20 / 15	290	148	261	267	276	504	540	73	1286	236	47	247	38	36	
25 / 20	274	147	247	256	268	484	616	73	1315	237	45	247	37	36	
30 / 25	296	142	239	250	262	477	795	73	1319	237	44	247	39	37	
35 / 30	317	141	231	227	252	477	1019	72	1329	238	44	247	37	36	
40 / 35	381	148	227	213	244	498	1275	73	1336	238	44	249	36	37	
45 / 40	428	143	226	201	236	522	1300	73	1344	237	44	248	36	36	
50 / 45	457	142	227	197	229	544	1261	72	1338	237	44	251	37	37	
55 / 50	470	143	230	192	226	559	1282	72	1337	237	44	247	37	37	
TOTAL	4245	1809	3042	2927	3131	6504	10745	884	*****	*****	*****	*****	*****	*****	
60 / 1455	477	144	232	194	222	574	1186	72	1335	237	45	246	38	37	
65 / 1500	483	146	235	195	217	593	1188	73	1334	238	45	246	38	37	
70 / 05	491	145	240	196	215	610	1213	73	1333	238	45	247	38	37	
75 / 10	499	154	246	198	211	633	1176	74	1327	237	45	247	36	37	
80 / 15	502	151	249	199	209	648	1192	75	1328	237	46	248	36	36	
85 / 20	509	155	253	201	208	663	1189	74	1329	238	46	249	37	37	
90 / 25	519	158	261	204	206	689	1215	75	1330	237	46	250	35	36	
95 / 30	515	159	266	207	205	705	1149	75	1328	237	46	250	36	37	
100 / 35	503	161	270	212	205	716	1086	75	1328	237	46	248	36	38	
105 / 40	491	164	273	216	204	724	1074	75	1328	237	47	247	36	38	
110 / 45	480	161	274	220	204	732	1074	75	1328	236	47	246	36	38	
115 / 50	474	164	277	223	205	741	1089	76	1327	236	47	246	36	37	
TOTAL	5943	1862	3076	2465	2511	8028	13831	892	*****	*****	*****	*****	*****	*****	
TOTAL	10188	3671	6118	5392	5642	14532	24576	1776	*****	*****	*****	*****	*****	*****	

TEMPERATURE DATA SHEET # 14

UNIT: F500 RUN: 4 DATE: 05-20-02 PAGE 2 of 3

TIME	TOP	LT SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	FURNACE	SAMPLE	SAMP IMP	C-GAS	GAS IMP	SO_2 IMP	2756
120/1555	472	166	280	228	207	751	1097	75	1325	236	47	245	36	37	
125/1600	474	167	281	230	206	757	1119	76	1324	236	47	245	36	37	
130/05	486	165	282	232	209	767	1209	75	1323	236	48	245	36	37	
135/10	483	168	285	240	210	774	1126	76	1325	236	48	246	36	37	
140/15	457	169	286	242	210	773	1004	76	1327	235	48	245	36	37	
145/20	429	166	287	244	214	774	915	76	1328	235	49	244	36	37	
150/25	403	170	288	249	216	776	867	76	1328	234	50	240	36	36	
155/30	385	168	287	250	219	776	826	76	1328	234	50	240	36	36	
160/35	369	165	285	250	222	776	807	75	1327	233	49	241	36	36	
165/40	355	165	285	253	225	772	797	76	1326	234	49	240	36	35	
170/45	343	164	283	252	227	768	789	76	1325	234	49	240	36	35	
175/50	336	167	283	252	228	764	779	75	1324	234	50	242	35	36	
TOTAL	4992	2000	3412	2922	2593	9228	11335	908	*****	*****	*****	*****	*****	*****	
180/1655	324	162	280	251	229	758	744	75	1322	233	51	242	36	36	
185/1700	314	164	281	250	231	748	705	75	1320	234	51	244	37	34	
190/05	309	159	278	247	231	741	696	75	1325	234	49	245	37	35	
195/10	302	158	277	246	233	736	691	74	1329	234	49	244	36	35	
200/15	296	156	275	242	232	731	686	75	1331	234	49	244	36	34	
205/20	291	156	276	242	233	723	674	74	1328	234	50	245	37	36	
210/25	287	152	274	239	232	717	663	74	1325	234	50	244	37	35	
215/30	279	155	271	236	232	714	651	75	1323	234	50	244	38	36	
220/35	276	153	271	236	233	709	652	74	1323	234	50	245	37	37	
225/40	272	152	268	233	232	704	645	74	1323	234	50	245	37	37	
230/45	270	152	267	230	232	699	668	73	1325	234	50	246	38	37	
235/50	268	153	266	229	232	694	647	73	1324	235	50	246	38	37	
TOTAL	3488	1872	3284	2881	2782	8674	8122	891	*****	*****	*****	*****	*****	*****	
TOTAL	8480	3872	6696	5803	5375	17902	19457	1799	*****	*****	*****	*****	*****	*****	

TEMPERATURE DATA SHEET # 14

UNIT: FSDO RUN: 4 DATE: 05-20-02 PAGE 3 of 3

TIME	TOP	LT SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	FURNACE	SAMPLE	SAMP IMP	C-GAS	GAS IMP	SO_2 IMP	275.6
240 1755	265	153	264	228	231	687	643	74	1325	234	50	246	37	37	
245 1800	258	156	262	223	228	678	621	76	1326	235	50	247	37	37	
250 05	258	152	260	222	228	673	628	76	1327	235	51	247	37	35	
255 10	255	150	256	223	229	666	620	77	1328	235	53	247	37	35	
260 15	254	152	255	220	228	662	612	77	1328	236	54	248	37	36	
265 20	251	151	253	219	229	658	584	77	1329	236	54	248	37	36	
270 25	247	152	253	215	226	651	576	78	1330	236	55	248	36	36	
275 30	246	148	251	214	227	641	569	78	1330	236	55	247	36	36	
280 35	244	148	247	211	227	634	561	78	1329	236	54	248	36	36	
285 40	240	149	248	211	228	630	566	79	1329	236	54	249	36	37	
290 45	237	151	248	209	226	629	562	80	1327	236	53	249	36	36	
295 50	237	151	247	211	225	628	562	81	1326	237	52	248	36	35	
TOTAL	2992	1813	3044	2606	2732	7837	7104	931	*****	*****	*****	*****	*****	*****	
300 1855	234	148	246	209	224	620	556	82	1325	237	52	247	36	34	
305 1900	233	148	243	208	223	612	552	81	1325	237	52	247	35	35	
310 05	232	149	243	205	223	609	554	82	1325	236	52	246	35	34	
315 10															
320 15	699	445	732	622	670	1841	1662	245							
325 20															
330 25															
335 30										275.6	•				
340 35										210.4	•				
345 40										-65.2	ΔT				
350 45															
355 50									263						
TOTAL	22359	9801	16590	14423	14419	42112	52799	4751	*****	*****	*****	*****	*****	*****	
TOTAL	355	156	263	229	229	668	838	75	*****	*****	*****	*****	*****	*****	

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 05-20-2002 Analyte : CO_2 (15-1)

Unit : F500 Run # : 4

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 % CO_2 Cyl. Press. : 2000 PSI

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

Span Cyl. # : CC12767 Conc. : 12.49 % CO_2 Cyl. Press. : 1420 PSI

Certified by : AIR LIQUIDE Date : 02-15-02

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. Washington Time : 1335 Temp : 84 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.001	.003	+.003	+.013
SPAN	50.0	.500	12.49	49.6	.496	12.342	-.148	-.593

POST RUN Audit : by : D. Washington Time : 1925 Temp : 82 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	-.022	-.022	-.087
SPAN	50.0	.500	12.49	49.9	.499	12.417	-.073	-.294

± 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 : 05-20-2002 Analyte : O_2 (15-2)

Unit : F500 Run # : 4

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 % O_2 Cyl. Press. : 2000 PSI

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

Span Cyl. # : CC12767 Conc. : 12.50 % O_2 Cyl. Press. : 1420 PSI

Certified by : AIR LIQUIDE Date : 02-15-02

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 : 1335 Temp : 84 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.003	.011	+.011	+.043
SPAN	12.50	.500	12.50	12.4	.496	12.413	-.087	-.349

POST RUN Audit : by : D. Washington Time : 1925 Temp : 82 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.002	+.014	-.014	-.057
SPAN	12.50	.500	12.50	12.5	.499	12.488	-.012	-.047

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

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

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

ZERO / SPAN CHECK DATA SHEET #15-3

Date : 05-20-2002 Analyte : CO (15-3)

Unit : F500 Run # : 4

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 % CO Cyl. Press. : 2000 PSI

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

Span Cyl. # : CC12767 Conc. : 4.80 % CO Cyl. Press. : 1420 PSI

Certified by : AIR LIQUIDE Date : 02-15-02

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 : 1335 Temp : 84 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.014	+.014	+.141
SPAN	48.0	.480	4.80	48.0	.480	4.793	-.007	-.066

POST RUN Audit : by : A. Washington Time : 1925 Temp : 82 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.001	.004	+.004	+.041
SPAN	48.0	.480	4.80	48.1	.481	4.803	+.003	+.034

± 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 : 05-20-2002 Analyte : SO_2 (15-4)

Unit : F500 Run # : 4

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 ppm SO_2 Cyl. Press. : 2000 PSI

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

Span Cyl. # : CC62184 Conc. : 1290 ppm SO_2 Cyl. Press. : 1350 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. Washington Time : 1330 Temp : 83 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.001	3.399	+3.399	+.136
SPAN	51.6	.516	1290	51.1	.511	1279.771	-10.229	-.409

POST RUN Audit : by : D. Washington Time : 1920 Temp : 82 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.001	3.399	+3.399	+.136
SPAN	51.6	.516	1290	51.3	.513	1284.757	-5.243	-.210

± 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 : F500 RUN : 4 DATE : 05-20-02

Thermocouple Check:

T/C # 1	— °F	T/C # 13	67.2 °F
T/C # 2	— °F	T/C # 14	66.0 °F
T/C # 3	67.1 °F	T/C # 15	67.2 °F
T/C # 4	62.3 °F	T/C # 16	60.8 °F
T/C # 5	61.0 °F	T/C # 17	60.1 °F
T/C # 6	61.4 °F	T/C # 18	74.2 °F
T/C # 7	61.3 °F	T/C # 19	63.4 °F
T/C # 8	61.2 °F	T/C # 20	52.0 °F
T/C # 9	61.7 °F	T/C # 21	— °F
T/C # 10	61.8 °F	T/C # 22	— °F
T/C # 11	60.2 °F	T/C # 23	64.4 °F
T/C # 12	70.4 °F	T/C # 24	— °F

Thermocouple Readout:

Pretest zero and span check and calibration

ZERO : 2.1 °F Adj. to 0.0 °F

SPAN : 1998.8 °F Adj. to 2000.0 °F

post test zero and span — % difference

ZERO 2.3 °F Adj. to .115 %

SPAN 2004.1 °F Adj. to .205 %

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 202.4 °F	400	= 399.8 °F
600	= 601.9 °F	800	= 802.0 °F	1000	= 1000.9 °F
1200	= 1198.4 °F	1400	= 1399.4 °F	1600	= 1599.8 °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 : 15.6 - 5.6 .

Post : 14.0 - 4.0 .

Stack Cleaned Prior to Test Run : YES _____ NO X

COMPUTER INPUT DATA SHEET #1

Client: JOTUL U.S.A., INC.

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

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

Run No.: 3 Date of Test: 05-17-2002 Burn Rate: 1.893

Model No.: F500 ☐ min ☒ min-1.25 ~~☐ fan~~

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

Dry Gas Meter Y Factor: 1.000 (0.000) (Data Sheet #2) Post Leak Rate: .007 (.000) (Data Sheet #2) cfm Time: 195 (000) (Data Sheet #2) min.

Dry Gas Meter Volume: 57,534 (00.000) (Data Sheet #2) cf

Stack Flow: 9.481 (00.000) (Data Sheet #2) dscfm Δ H: .137 (.000) (Data Sheet #2) in. H_2O

Maximum Vac.: 2.0 (0.0) (Data Sheet #2) Barometric Pressure: 30.17 (00.00) (Data Sheet #2) in. Hg

H_2O Captured: 108.9 (00.0) (Data Sheet #3) g

Front Half Catch % Of Total: 38.3 (00.0) (Data Sheet #6) % Total Particulate Catch: .1150 (0.0000) (Data Sheet #6) g

Flue Gas Moisture: 8.3161 (00.000) (Data Sheet #7) %

Particulate Emission: .0314 (0.0000) (Data Sheet #7) gr/dscf

Relative Humidity: 37.0 (00.0) (Data Sheet #8) % RH Ambient Moisture: 1.50 (0.00) (Data Sheet #8) % H_2O

Pretest Fuel Wt.: 49.9 (00.0) (Data Sheet #8) lbs. Coal Bed Wt.: 4.0 (00.0) (Data sheet #8) lbs. Test Fuel Wt.: 16.5 (00.0) (Data sheet #8) lbs.

Heat Output (EPA Default): 22,832.1 (00,000.0) (Data Sheet #8) BTU/hr

Kindling Fuel % Moisture (wet): 11.164% (00.000) (Data Sheet #10) Pretest Fuel % Moisture (wet): 16.817 (00.000) (Data Sheet #10) %

Test Fuel % Moisture (dry): 21.620% Test Fuel % Moisture (wet): 17.777 %
(00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove])

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

Stack Static Pressure: -.054 (+/- .000) (Data Sheet #12) in. H_2O

Average Ambient Temperature: 75 (00) (Data Sheet #14) °F Stove Temperature Change: -36.4 (+/- 000.0) (Data Sheet #14) °F

TABLE 1 ----- RAW DATA

CLIENT : Jotul U.S.A., Inc. TEST No. : 3

MODEL: F500 DATE: 17-May-02

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	594.500	0.150	78	0.91	6.50	350
5	596.000	0.210	78	0.42	10.30	300
10	597.766	0.150	79	0.47	10.70	350
15	599.287	0.150	80	0.40	12.30	350
20	600.813	0.150	80	0.32	12.90	350
25	602.338	0.150	80	0.35	14.50	350
30	603.864	0.150	81	0.30	15.00	350
35	605.396	0.150	82	0.23	14.50	350
40	606.933	0.150	83	0.23	14.20	350
45	608.476	0.150	83	0.20	15.00	350
50	610.019	0.150	83	0.48	15.10	350
55	611.562	0.150	83	0.14	14.50	350
60	613.104	0.150	83	0.12	13.10	350
65	614.648	0.150	83	0.19	11.20	350
70	616.192	0.150	83	0.28	10.40	350
75	617.736	0.150	83	0.26	10.10	350
80	619.286	0.150	83	0.28	9.90	350
85	620.824	0.150	83	0.20	10.20	350
90	622.368	0.150	83	0.31	10.70	350
95	623.912	0.150	83	0.44	9.00	350
100	625.455	0.130	83	0.66	7.10	375
105	626.897	0.130	83	0.66	7.00	375
110	628.338	0.130	83	0.74	7.00	375
115	629.779	0.130	83	0.78	6.80	375
120	631.220	0.130	83	0.91	6.80	375
125	632.661	0.130	83	0.89	6.80	375
130	634.102	0.130	83	0.92	6.90	375
135	635.543	0.130	83	0.93	6.80	375
140	636.984	0.130	83	1.00	6.90	375
145	638.425	0.130	83	1.00	6.60	375
150	639.866	0.110	83	1.14	6.40	400
155	641.218	0.110	83	1.16	6.40	400
160	642.569	0.110	83	1.19	6.00	400
165	643.920	0.110	83	1.27	5.70	400
170	645.271	0.110	83	1.29	5.90	400
175	646.622	0.110	83	1.29	5.90	400
180	647.973	0.110	83	1.35	5.90	400
185	649.327	0.110	83	1.43	5.70	400
190	650.680	0.110	83	1.30	5.60	400
195	652.034	0.110	83	1.31	5.40	400
200						

TABLE 2---RAW DATA

CLIENT : Jotul U.S.A., Inc. TEST No. 3

MODEL: F500 DATE: 17-May-02

****

METER CAL. FACTOR (Y)	------ 1		Wt. WOOD BURNED(LB)	------- 16.5	Lbs
BAROMETRIC PRESS.(Pb)	------ 30.17	in Hg	WET,FUEL MOISTURE %	------- 17.777	%
LEAK RATE POST (Lp)	------ 0.007	cfm	Wt. PART. COLLECTED	------- 0.115	g
WATER VOL. (V1c)	------ 108.9	Ml	METER VOLUME Vm	------- 57.534	mcf
TEST TIME (MIN)	------ 195	min	HC MOLE FRACTION	------- 0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT :Jotul U.S.A., Inc. TEST No. 3

MODEL: F500 DATE: 17-May-02

****

AVG DELTA H	-------	0.14 in H2O		AVG PRCNT CO	-------	0.69	%
AVG METER TEMP. Tm	-------	82 deg F		AVG PRCNT CO2	-------	9.19	%
AVG PPM SO2	-------	368	PPM	AVG BAL CO2/CO	-------	13.25	%

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul U.S.A., Inc. TEST No. 3

MODEL: F500 DATE: 17-May-02

****

STD SAMPLE VOL. Vm(std) -----	56.51	dscf	STACK GAS FLOW Qsd -------	608.480	dscf/Hr
				10.14	& dscf/min
VOL. WATER VAPOR Vw(std) ----	5.126	scf	PARTICULATE CONCTRT. Cs ------	0.0020	g/dscf
PRCNT MSTR Bws -------	8.32	%	PARTC.EMISS. RATE E -------	1.24	g/Hr
BURN RATE BR -------	1.89	Kg/Hr	MOLES OF GAS PER Lb WOOD Nt --	0.38	Lb-mole/Lb
CO EMISSION RATE -------	141.36	g/Hr	PART.EMISS. RATE ------	0.65	g/Kgdry fuel
	74.68	& g/Kgdry fuel			

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Jotul U.S.A., Inc. TEST No. : 3

MODEL: F500 DATE: 17-May-02

TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR	PROPRTN RATE VAR. AVERAGE
5	519.8	98	100
10	524.2	99	
15	525.6	99	
20	526.9	100	
25	526.5	99	
30	526.4	99	
35	527.5	100	
40	528.2	100	
45	529.8	100	
50	529.8	100	
55	529.8	100	
60	529.5	100	
65	530.1	100	
70	530.1	100	
75	530.1	100	
80	532.2	101	
85	528.1	100	
90	530.1	100	
95	530.1	100	
100	529.8	100	
105	530.5	100	
110	530.1	100	
115	530.1	100	
120	530.1	100	
125	530.1	100	
130	530.1	100	
135	530.1	100	
140	530.1	100	
145	530.1	100	
150	530.1	100	
155	530.5	100	
160	530.1	100	
165	530.1	100	
170	530.1	100	
175	530.1	100	
180	530.1	100	
185	531.3	100	
190	530.9	100	
195	531.3	100	
200			
205			

METER BOX DATA SHEET PAGE # 2

Page: 1 of 2

UNIT: F500 RUN: 3 DATE: 05-17-02

Meter Box: 5H Y Factor: 1.000

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

.15 " Hg @ .007 cfm _____ " Hg @ _____ cfm

Inject SO^2 @ 100 cc/min. Nozzle: Probe @ 3/8 " od Initial Volume: 1.506

ROTO: PRESS: .14			SAMPLING RATIO: 33 : 1				BP: 30.20		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1145	594.500	—	10.000	.15	78	350	78	2.0
5	50	596.000	—	11.667	.21	78	300	78	2.0
10	55	597.766	597.766	9.982	.15	79	350	79	2.0
15	1200	599.287	599.287	9.963	.15	80	350	80	2.0
20	05	600.813	600.813	9.963	.15	80	350	80	2.0
25	10	602.338	602.338	9.963	.15	80	350	80	2.0
30	15	603.864	603.864	9.945	.15	81	350	81	2.0
35	20	605.396	605.396	9.926	.15	82	350	82	2.0
40	25	606.933	606.933	9.908	.15	83	350	83	2.0
45	30	608.476	608.476	9.908	.15	83	350	83	2.0
50	35	610.019	610.019	9.908	.15	83	350	83	2.0
55	40	611.562	611.562	9.908	.15	83	350	83	2.0
ROTO PRESS: .14			TOTALS:	121.041	1.86	970	BP.: 30.18		
60	1245	613.104	613.104	9.901	.15	83	350	83	2.0
65	50	614.648	614.648	9.901	.15	83	350	83	2.0
70	55	616.192	616.192	9.901	.15	83	350	83	2.0
75	1300	617.736	617.736	9.901	.15	83	350	83	2.0
80	05	619.286	619.286	9.901	.15	83	350	83	2.0
85	10	620.824	620.824	9.901	.15	83	350	83	2.0
90	15	622.368	622.368	9.901	.15	83	350	83	2.0
95	20	623.912	623.912	9.901	.15	83	350	83	2.0
100	25	625.455	625.455	9.241	.13	83	375	83	2.0
105	30	626.897	626.897	9.241	.13	83	375	83	2.0
110	35	628.338	628.338	9.241	.13	83	375	83	2.0
115	40	629.779	629.779	9.241	.13	83	375	83	2.0
			TOTALS:	116.172	1.72	996	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	237.213	3.58	1966	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 2 of 2

UNIT: F500 RUN: 3 DATE: 05-17-02

Meter Box: 5H Y Factor: 1.000

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

15 " Hg @ .007 cfm _____ " Hg @ _____ cfm

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

ROTO: PRESS: .14 SAMPLING RATIO: 33 : 1 BP: 30.18

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1345	631.220	631.220	9.241	.13	83	375	83	2.0
125	50	632.661	632.661	9.241	.13	83	375	83	2.0
130	55	634.102	634.102	9.241	.13	83	375	83	2.0
135	1400	635.543	635.543	9.241	.13	83	375	83	2.0
140	05	636.984	636.984	9.241	.13	83	375	83	2.0
145	10	638.425	638.425	9.241	.13	83	375	83	2.0
150	15	639.866	639.866	8.664	.11	83	400	83	2.0
155	20	641.218	641.218	8.664	.11	83	400	83	2.0
160	25	642.569	642.569	8.664	.11	83	400	83	2.0
165	30	643.920	643.920	8.664	.11	83	400	83	2.0
170	35	645.271	645.271	8.664	.11	83	400	83	2.0
175	40	646.622	646.622	8.664	.11	83	400	83	2.0
ROTO PRESS:		.14	TOTALS:	107.430	1.44	996	BP.: 30.13		
180	1445	647.973	647.973	8.649	.11	83	400	83	2.0
185	50	649.327	649.327	8.649	.11	83	400	83	2.0
190	55	650.680	650.680	8.649	.11	83	400	83	2.0
195	1500	652.034	652.034	8.649	.11	83	400	83	2.0
200	05								
205				34.596	.44	332			
210				142.026	1.88	1328			
215									
220									
225									
230						3294			
235							÷40.		
			TOTALS:	379.239	5.46	82	MAX VACC =		2.0
TOTAL Cu Ft.		57.534	TOTALS:	9.481	.137	542	AVG. BP:	30.17	

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : F500 RUN : 3 DATE : 05-17-02

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	706.7	595.1	485.7	905.7
INITIAL WT	616.7	589.9	483.9	893.8
NET WT GRAMS	90.0	5.2	1.8	11.9

TOTAL CATCH : 108.9 GRAMS H_2O

FRONT HALF

FILTER #	119F	
FINAL WT g	.7075	
INITIAL WT g	.6746	
NET WT g	.0329	

BEAKER #	56
DESC.	ACETONE
FINAL WT g	104.1865
INITIAL WT g	104.1750
NET WT g	.0115
VOL. DESC. ml	75

BACK HALF

FILTER #	119B	
FINAL WT g	.4526	
INITIAL WT g	.4439	
NET WT g	.0087	

BEAKER #	57	58	59	60	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	97.4507	96.9065	105.3698	106.7451	
INITIAL WT g	97.4141	96.8989	105.3593	106.7348	
NET WT g	.0366	.0076	.0105	.0103	.0208
VOL. DESC ml	125	75	150	165	(315)

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 01/29/02 Time : 1125 By : DKW

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

Back Size: 8.2 cm Lot No. : ZB911

	DATE: 02-07	BY: DKW	DATE: 02-10	BY: DKW	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
111F	.6782	0934	.6780	1939	JOTUL C450	R-2
112F	.6755	0935	.6751	1940	" "	R-3
113F	.6721	0935	.6719	1941	" "	R-4
114F	.6843	0936	.6844	1942	" "	R-5
115F	.6699	0937	.6700	1943	" "	R-6
116F	.6696	0938	.6694	1943	" "	R-7
117F	.6796	0939	.6793	1944	JOTUL F500	R-1
118F	.6715	0940	.6718	1945	" "	R-2
119F	.6743	0941	.6746	1946	" "	R-3
120F	.6844	0942	.6843	1947	" "	R-4
111B	.4462	0943	.4464	1948	JOTUL C450	R-2
112B	.4448	0944	.4451	1949	" "	R-3
113B	.4466	0945	.4464	1949	" "	R-4
114B	.4305	0946	.4307	1950	" "	R-5
115B	.4234	0947	.4236	1951	" "	R-6
116B	.4444	0948	.4445	1952	" "	R-7
117B	.4431	0949	.4430	1953	JOTUL F500	R-1
118B	.4293	0950	.4294	1954	" "	R-2
119B	.4441	0951	.4439	1955	" "	R-3
120B	.4427	0952	.4425	1955	" "	R-4

Checked by: C Washington Date: 2-10-02 Time: 2000

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
02-07	0910	DKW		74	47
02-10	1905	DKW		74	45

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 04-08-2002 Time : 1930 By : [signature]

	DATE: 04-11	BY: [signature]	DATE: 04-12	BY: [signature]	DATE:	BY:
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
41	105.4919	0944	105.4917	0953	✓	
42	104.6743	0945	104.6742	0954	✓ JOTUL C450	
43	107.3634	0950	107.3637	0956	✓ R-7	
44	107.7988	0952	107.7985	0957	✓	
45	94.9437	0953	94.9434	0958	✓	
46	106.0543	0954	106.0544	0959	✓	
47	107.0426	0955	107.0421	1000	✓ JOTUL F500	
48	97.7564	0955	97.7560	1001	✓ R-1	
49	108.3629	0956	108.3626	1003	✓	
50	96.5389	0957	96.5390	1004	✓	
51	104.8788	0958	104.8784	1005	✓	
52	107.5030	0959	107.5027	1006	✓ JOTUL F500	
53	105.7406	1000	105.7410	1007	✓ R-2	
54	107.3136	1001	107.3139	1008	✓	
55	93.4939	1001	93.4941	1009	✓	
56	104.1752	1002	104.1750	1010	✓	
57	97.4138	1003	97.4141	1011	✓ JOTUL F500	
58	96.8985	1004	96.8989	1012	✓ R-3	
59	105.3591	1005	105.3593	1013	✓	
60	106.7350	1006	106.7348	1015	✓	

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
04-11	0940	[signature]		76	49
04-12	0950	[signature]		78	47

Checked by : [signature]
Date : 04-12-02
Time : 1040

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : F500 **RUN :** 3 **DATE :** 05-17-02 **Page :** 1 **of** 1

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
56	05-18	1930		104.1880	05-20	0902		104.1863	05-21	0936		104.1865	05-22	1200	
57	05-18	1930		97.4526	05-20	0903		97.4506	05-21	0937		97.4507	05-22	1201	
58	05-18	1930		96.9089	05-20	0904		96.9066	05-21	0938		96.9065	05-22	1203	
59	05-19	1600		105.3700	05-21	0939		105.3698	05-22	1204					
LD	05-19	1600		106.7447	05-21	0941		106.7451	05-22	1205					

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
119F	5-17	1530		.7100	05-18	1921		.7089	05-19	1515		.7080	05-20	0905	
				.7075	05-21	0942									
119B	5-17	1530		.4528	05-18	1923		.4526	05-19	1516					

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	05-18	1905		77	49
2	05-19	1500		77	48
3	05-20	0855		77	47
4	05-21	0930		78	49
5	05-22	1155		78	48

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

Dates: From 11-20-2001
Through 02-16-2002

WOODSTOVE DATA SHEET #4-4
SCALE QA SHEET

Scale: Sartorius
Model: A1205
SN : 37010004

100g weight	10 g weight	1.0 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	Wet Bulb	%.RH
99.9998	10.0002	1.0003	.1000	DKW	11-20	0945	78		48
101.0000	10.0000	1.0001	.0999	DKW	11-21	1000	75		49
99.9998	9.9998	1.0000	.1001	DKW	11-22	1050	75		49
100.0003	9.9999	1.0000	.0999	DKW	11-26	1150	74		47
100.0001	9.9997	1.0000	.1000	DKW	11-27	1155	74		48
100.0001	10.0000	.9997	.0999	DKW	11-28	1220	72		48
99.9999	10.0001	1.0000	.1000	DKW	11-28	1930	73		48
99.9998	10.0000	.9999	.0999	DKW	11-29	1015	75		46
99.9998	10.0000	.9997	.0998	DKW	11-29	1925	73		46
100.0000	10.0001	.9998	.0999	DKW	11-30	1355	74		45
99.9999	9.9999	1.0000	.1000	DKW	12-01	1210	77		45
100.0003	10.0000	.9997	.1000	DKW	01-08	2045	78		47
100.0001	10.0000	.9998	.1000	DKW	01-09	1600	78		48
99.9999	9.9999	.9999	.1000	DKW	01-12	1900	74		46
99.9998	9.9999	.9997	.1000	DKW	01-13	1730	72		43
100.0000	10.0001	1.0000	.1001	DKW	01-14	1355	78		45
99.9998	9.9999	.9999	.1000	DKW	01-26	1745	72		47
99.9998	10.0000	1.0000	.0999	DKW	01-28	1705	74		44
100.0003	10.0000	1.0000	.0998	DKW	01-29	1130	70		47
99.9998	9.9997	1.0000	.1000	DKW	01-29	2300	71		44
100.0002	10.0000	1.0000	.1000	DKW	01-30	2200	75		45
99.9999	9.9999	.9999	.1000	DKW	01-31	2205	74		47
100.0001	9.9999	1.0000	.1000	DKW	02-02	0700	75		45
100.0002	9.9999	1.0001	.1000	DKW	02-04	1045	73		47
100.0000	10.0000	.9998	.0997	DKW	02-06	0905	73		47
100.0001	10.0000	1.0000	.1000	DKW	02-07	0910	74		47
100.0002	10.0001	1.0000	.0999	DKW	02-07	1235	77		48
99.9999	10.0000	.9999	.0998	DKW	02-08	1110	72		49
99.9998	9.9999	1.0000	.0999	DKW	02-09	1045	70		49
99.9997	10.0000	.9999	.0999	DKW	02-10	0920	74		48
99.9997	10.0001	.9999	.0999	DKW	02-10	1905	76		45
99.9999	9.9999	1.0000	.0997	DKW	02-11	1935	73		43
99.9998	9.9997	1.0000	.0999	DKW	02-13	1740	75		41
99.9997	10.0000	.9999	.1000	DKW	02-14	1015	74		38
99.9998	9.9999	1.0000	.1000	DKW	02-14	2010	74		43
100.0000	10.0000	1.0000	.1000	DKW	02-15	1150	74		41
99.9998	9.9999	.9997	.1000	DKW	02-16	1045	78		41

Dates: From 02-16-2002
Through 05-17-2002

WOODSTOVE DATA SHEET #4-4
SCALE QA SHEET

Scale: Sartorius
Model: A1205
SN : 37010004

100g weight	10 g weight	1.0 g weight	100 mg weight	Tech	Date	Time	Wet Bulb	Dry Bulb	% RH
100.0000	9.9999	1.0000	.0999	DFW	02-16	1845		77	46
100.0000	9.9999	.9999	.0998	DFW	02-17	1555		77	47
100.0001	9.9999	.9999	.0997	DFW	02-18	0940		77	47
100.0000	10.0000	.9999	.1000	DFW	02-19	1025		78	46
100.0000	9.9999	1.0000	.0999	DFW	02-20	0915		75	42
100.0003	10.0000	1.0000	.0999	DFW	03-14	1020		78	45
99.9999	9.9998	.9998	.0998	DFW	03-15	1725		77	45
99.9999	10.0000	1.0002	.0999	DFW	03-16	1820		77	38
100.0001	9.9999	1.0001	.1000	DFW	03-16	2130		78	43
99.9999	9.9999	.9998	.0998	DFW	03-17	1550		77	43
99.9999	10.0000	1.0001	.0999	DFW	03-17	2045		77	39
99.9998	10.0000	1.0000	.1000	DFW	03-18	1100		77	39
100.0000	9.9999	.9999	.0999	DFW	03-19	1800		76	42
100.0001	10.0000	1.0001	.1000	DFW	03-20	1835		77	45
99.9999	10.0001	.9999	.0999	DFW	03-21	2235		78	45
99.9998	9.9999	1.0000	.1000	DFW	03-24	2205		78	42
99.9998	10.0000	1.0000	.1001	DFW	03-25	1000		78	41
99.9997	10.0000	1.0001	.1000	DFW	04-04	1300		78	49
99.9998	10.0000	1.0000	.0999	DFW	04-05	1210		78	49
99.9997	10.0000	.9999	.0998	DFW	04-05	2230		78	49
99.9999	10.0001	1.0000	.0998	DFW	04-08	1135		78	47
99.9997	10.0000	1.0000	.0999	DFW	04-08	1910		78	48
99.9997	9.9998	.9999	.1000	DFW	04-09	2150		77	48
99.9999	10.0000	1.0000	.0999	DFW	04-10	2205		78	48
100.0000	10.0001	.9999	.0999	DFW	04-11	0940		76	49
99.9997	9.9998	1.0000	.0999	DFW	04-11	1705		78	48
99.9999	9.9999	.9999	.0998	DFW	04-11	2230		78	48
99.9999	10.0001	.9999	.0999	DFW	04-12	0950		78	47
100.0000	9.9998	1.0000	.0999	DFW	04-12	1810		78	48
100.0000	9.9999	.9999	.0998	DFW	04-12	2205		78	47
100.0000	9.9999	.9999	.0999	DFW	04-13	1720		78	48
99.9998	10.0000	1.0000	.0998	DFW	04-13	2325		78	46
99.9999	10.0001	1.0001	.1000	DFW	04-14	1740		78	44
99.9998	10.0000	1.0001	.0999	DFW	04-16	1925		75	44
99.9997	9.9999	1.0000	.1000	DFW	04-19	1350		78	41
100.0000	10.0001	.9998	.0999	DFW	04-20	1210		75	41
99.9998	9.9998	1.0001	.0997	DFW	05-16	1430		76	48
99.9999	9.9999	1.0000	.0999	DFW	05-17	1600		75	48

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates:	Scale:	Model:	SN:
From 05-18-2002 Through	Sartorius	A 120 S	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	AKW	05-18	1905	77	49
99.9997	9.9998	.9999	.0998	AKW	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

BLANK PROCESSING DATA SHEET # 5

UNIT: F500 RUN: 3 DATE: 05-17-02

BLANKS DONE: 02-20-2002

BEAKER	A	B	C
	200 ml ACETONE	75 ml DICHLOR	200 ml WATER
	FISHER OPTIMA LOT # 011755	FISHER OPTIMA LOT # 994669	MCKESSON WATER PRODUCTS CO. CERTIFIED DISTILLED
FINAL WEIGHT	108.9015	106.3081	106.9664
TARE WEIGHT	108.9007	106.3064	106.9660
NET WEIGHT	.0008 ✓	.0017 ✓	.0004 ✓

TARE BEAKERS INTO DESC: TIME: 1205 DATE: 02-15-2002

DATE: 02-16 BY: DH DATE: 02-17 BY: DH DATE: BY:

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9002	1849	108.9007	1611 ✓		
B	106.3068	1850	106.3064	1612 ✓		
C	106.9661	1851	106.9660	1613 ✓		

FINAL BEAKERS INTO DESC: TIME: 1125 DATE: 02-18-2002

DATE: 02-19 BY: DH DATE: 02-20 BY: DH DATE: BY:

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9016	1027	108.9015	0917 ✓		
B	106.3084	1028	106.3081	0918 ✓		
C	106.9664	1029	106.9664	0919 ✓		

TARE QC

DATE	TIME	BY	WB	DB	%
02-16	1845	DH		77	46
02-17	1555	DH		77	47

FINAL QC

DATE	TIME	BY	WB	DB	%
02-19	1025	DH		78	46
02-20	0915	DH		75	42

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT: F500 RUN: 3 DATE: 05-17-02

BLANK CALCULATIONS

Acetone: .0008 g ÷ 200 ml = .000004 g/ml
Dicholoromethane: .0017 g ÷ 75 ml = .000023 g/ml
Distilled Water: .0004 g ÷ 200 ml = .000002 g/ml

FRONT HALF CATCH

FILTERS: .0329 (Total Catch) g - 1 (# of Filters) * (.0000 g) (Blank Value / Filter) = .0329 g

BEAKERS: .0115 (Total Catch) g - 75 (ml Acetone) (.000004 g) (Blank Value / ml Acetone) = .0112 g

TOTAL FRONT HALF CATCH: .0441 g

BACK HALF CATCH

FILTERS: .0087 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0087 g

BEAKERS:

Acetone: .0366 (Total Catch) g - 125 (ml Acetone) (.000004 g) (Blank Value / ml Acetone) = .0361 g

Extract: .0076 (Total Catch) g - 75 (ml Dichloromethane) (.000023 g) (Blank Value / Dichloromethane) = .0059 g

Water: .0208 (Total Catch) g - 315 (ml Water) (.000002 g) (Blank Value / Water) = .0202 g

TOTAL BACK HALF CATCH: .0709 g

TOTAL CATCH: .1150 g

% FRONT HALF: 38.3 %

CALCULATIONS DATA SHEET # 7

UNIT : F500 RUN : 3 DATE : 05-17-02

1) $Vm(std) = \dfrac{(57.534\ Vm)(17.64)(1.000\ mcf)\left(30.17\text{ " Hg} + \frac{.137\text{ " } H_2O}{13.6}\right)}{(542\ TmA)} = \dfrac{56.5125}{000.0000}$ dscf

2) $Vw(std) = (.04707)(108.9\ ml\ H_2O) = \dfrac{5.1259}{00.0000}$ scf

3) $Asw = \dfrac{(5.1259\ scf)}{(5.1259\ scf + 56.5125\ dscf)} = \dfrac{.0832}{.0000}$ Bws × 100 = $\dfrac{8.3161}{00.0000}$ % H_2O

61.6384

4) $Cs = \dfrac{(.1150\ g.)}{(56.5125\ dscf)}(15.43) = \dfrac{.0314}{0.0000}$ gr / dscf

5) Estimated g / hr = $\dfrac{(.1150\ g.)}{(56.5125\ dscf)}\left(\dfrac{9.481}{00.0000}\ dscfm\right)(60) = \dfrac{1.1576}{00.0000}$ 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 : F500 RUN : 3 DATE : 05-17-02

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

Wet Bulb / Dry Bulb

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

Post : WB : 70 DB : 88 = 40 % RH 1.8 % H_2O

Average : 37.0 % RH 1.50 % H_2O

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

Kindling Weight (lbs) : Paper : .2 Wood : 4.4

Preburn Fuel Weight : 16.5 + 14.6 + 11.5 + 2.9 Total : 45.5

Kindling & Preburn Fuel Weight (wood only) (lbs) : **Total :** 49.9

Coal Bed Wt Range (lbs) : 4.1 - 3.3 **Scale :** 4.1 - 3.3

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

Lower : .20 × fuel weight : Always round UP to nearest tenth **Actual Coal Bed Weight :** 4.0

Maximum Coal Bed Removal (lbs) : ((4.1 (Upper) + 3.3 (Lower)) ÷ 2) .25 = .9 (round down to nearest tenth)

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

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" × 4"	17	3	6.2	37.6
4" × 4"	17	2	10.3	62.4

Test Fuel Weight : 16.5 lbs

Estimated Dry Burn Rate :

$$\frac{16.5 - (16.5 \times .17777)}{2.2046} \times \frac{60}{\frac{195}{\text{TIME}}} = 1.893 \text{ kg / hr}$$

Estimated BTU's/hr : $19{,}140 \times \frac{63}{100} \times \frac{1.893}{\text{DBR}} = 22{,}832.1$ BTU's/hr

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

WOOD STOVE OPERATING DATA PAGE #9

Unit : F500 Run : 3 Date : 05-17-02

FIRE STARTED: 0720

WARM UP AND PREBURN:

PRIMARY AIR : Set wide open for all warm-up / preburn fuel charges. Then set to 3/8" at start of preburn.

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

CHARCOAL BED PREPARATION :

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

TEST:

DOOR wide open during loading 0 min. 40 sec.

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

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

FAN:

ON / OFF during warm-up

ON / OFF first 30 minutes of test

Fan speed set at Low

ON / OFF during preburn

ON / OFF balance of test run

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

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

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

All Grades WCLB rules:

WARM UP INFORMATION:

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

1st warm up / pre-burn fuel charge (16.5 lbs.) added at 0730

2nd warm up / pre-burn fuel charge (14.6 lbs.) added at 0850

3rd warm up / pre-burn fuel charge (11.5 lbs.) added at 0956

4th warm up / pre-burn fuel charge (2.9 lbs.) added at 1030

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

TEST DATA SHEET #10

Unit : F500 Run : 3 Date : 05-17-02

Room Temperature : 70 °F Correction Factor : 4

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

Time Test Fuel moisture reading taken : 0930

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	12.5	13.3	11.5	12.2	11.5	12.2	12.567
2									
3									
4	2"×4"×8'	P	18.0	19.2	19.0	20.3	18.5	19.8	19.767
5	2"×4"×8'	P	19.0	20.3	19.0	20.3	19.0	20.3	20.300
6	2"×4"×8'	P	19.0	20.3	19.0	20.3	18.5	19.8	20.133
7	2"×4"×8'	P	20.0	21.4	19.0	20.3	19.0	20.3	20.667
8	2"×4"×8'	P							80.867
9									
10									
11	2×4×17	T	18.0	19.2	18.0	19.2	18.0	19.2	19.200
12	"	T	20.5	22.0	21.0	22.5	20.5	22.0	22.167
13	"	T	23.5	25.2	23.5	25.2	23.5	25.2	25.200
14	4×4×17	T	18.5	19.8	19.0	20.3	19.0	20.3	20.133
15	"	T	20.0	21.4	20.0	21.4	20.0	21.4	21.400
16									108.100
17									
18									
19									
20	Spacers	T	18.0	19.2	18.0	19.2	18.5	19.8	19.400

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	12.567 %	20.217 %	21.620 %
Wet Moisture % :	11.164 %	16.817 %	17.777 %

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°

WEIGHT: 4.0

UNIT: F500

GAS DATA SHEET # 12

RUN: 3 DATE: 05-17-02 PAGE: 1 of 2

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	WB	DB	% H_2O	CAL WB	STACK	STATIC	SO_2PPM
0 / 1145	20.5	16.5	—	.261	6.5	.546	13.7	.090	.91					299	-.047	350
5 / 50	19.7	15.7	.8	.413	10.3	.410	10.2	.041	.42					371	-.056	300
10 / 55	19.0	15.0	.7	.429	10.7	.379	9.5	.046	.47					395	-.060	350
15 / 1200	18.0	14.0	1.0	.493	12.3	.339	8.5	.039	.40					442	-.065	350
20 / 05	17.1	13.1	.9	.518	12.9	.323	8.1	.031	.32					460	-.066	350
25 / 10	15.9	11.9	1.2	.584	14.5	.273	6.8	.034	.35					485	-.066	350
30 / 15	14.8	10.8	1.1	.603	15.0	.256	6.4	.029	.30					506	-.068	350
35 / 20	13.7	9.7	1.1	.581	14.5	.271	6.8	.022	.23					503	-.067	350
40 / 25	12.8	8.8	.9	.572	14.2	.280	7.0	.022	.23					499	-.067	350
45 / 30	12.1	8.1	.7	.602	15.0	.254	6.3	.019	.20					503	-.067	350
50 / 35	11.3	7.3	.8	.607	15.1	.234	5.8	.047	.48					514	-.069	350
55 / 40	10.4	6.4	.9	.584	14.5	.257	6.4	.013	.14					502	-.068	350
TOTAL	*****	****	****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	5479	-.766	*****
60 / 1245	9.6	5.6	.8	.527	13.1	.304	7.6	.011	.12					479	-.066	350
65 / 50	8.9	4.9	.7	.450	11.2	.364	9.1	.018	.19					452	-.064	350
70 / 55	8.6	4.6	.3	.417	10.4	.383	9.6	.027	.28					429	-.062	350
75 / 1300	8.2	4.2	.4	.406	10.1	.393	9.8	.025	.26					409	-.061	350
80 / 05	7.8	3.8	.4	.400	9.9	.399	10.0	.027	.28					398	-.060	350
85 / 10	7.3	3.3	.5	.412	10.2	.394	9.8	.019	.20					394	-.059	350
90 / 15	6.9	2.9	.4	.429	10.7	.366	9.1	.030	.31					399	-.061	350
95 / 20	6.5	2.5	.4	.360	9.0	.443	11.1	.043	.44					379	-.058	350
100 / 25	6.3	2.3	.2	.284	7.1	.491	12.3	.065	.66					350	-.055	375
105 / 30	6.1	2.1	.2	.281	7.0	.498	12.5	.065	.66					328	-.053	375
110 / 35	5.9	1.9	.2	.282	7.0	.498	12.5	.073	.74					313	-.051	375
115 / 40	5.8	1.8	.1	.272	6.8	.513	12.8	.077	.78					304	-.050	375
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	4634	-.700	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	10113	-1.466	*****

/EIGHT: 4.0

NIT: F500

GAS DATA SHEET # 12

RUN: 3 DATE: 05-17-02 PAGE: 2 of 2

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	WB	DB	% H_2O	CAL WB	STACK	STATIC	SO_2 PPM
120 1345	5.6	1.6	.2	.272	6.8	.510	12.8	.090	.91					293	.048	375
125 50	5.4	1.4	.2	.272	6.8	.511	12.8	.088	.89					286	.047	375
130 55	5.3	1.3	.1	.277	6.9	.508	12.7	.091	.92					283	.046	375
135 1400	5.2	1.2	.1	.273	6.8	.509	12.7	.092	.93					279	.046	375
140 05	5.1	1.1	.1	.276	6.9	.516	12.9	.099	1.00					276	.046	375
145 10	4.9	.9	.2	.264	6.6	.520	13.0	.099	1.00					274	.045	375
150 15	4.7	.7	.2	.256	6.4	.526	13.2	.113	1.14					272	.043	400
155 20	4.6	.6	.1	.258	6.4	.536	13.4	.115	1.16					267	.042	400
160 25	4.6	.6	0	.241	6.0	.542	13.6	.118	1.19					264	.042	400
165 30	4.4	.4	.2	.229	5.7	.557	13.9	.126	1.27					261	.041	400
170 35	4.4	.4	0	.236	5.9	.552	13.8	.128	1.29					258	.041	400
175 40	4.3	.3	.1	.237	5.9	.549	13.7	.128	1.29					257	.040	400
TOTAL	*****	****	****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	3270	.527	*****
180 1445	4.3	.3	0	.237	5.9	.550	13.8	.134	1.35					255	.041	400
185 50	4.1	.1	.2	.229	5.7	.553	13.8	.142	1.43					254	.040	400
190 55	4.1	.1	0	.225	5.6	.564	14.1	.129	1.30					249	.038	400
195 1500	4.0	0	.1	.218	5.4	.570	14.3	.130	1.31					247	.038	400
200 05																
205 10														1005	.157	
210 15																
215 20																
220 25																
225 30																
230 35																
235 40																.40
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	14388	2.150	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	360	.054	*****

at (5.2) - 'd = 1 lock = (2.0)

PREBURN DATA SHEET #1

UNIT: F500 RUN: 3 DATE: 05-17-02 PAGE: 1 of 1

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
0 / 1030	8.1	-	407	582	211	378	372	304	1013	1164	77	-.061	PREBURN START: # 1.1 UP
5 / 35	7.6	.5	428	604	213	374	369	308	978	1199	78	-.064	COAL BED SCALE RANGE:
10 / 40	7.0	.6	405	598	208	370	370	308	951	1175	78	-.063	4.1 → 3.3
15 / 45	6.4	.6	439	586	200	366	360	308	939	1216	78	-.062	PRIMARY AIR: 3/8" TBA
20 / 50	6.1	.3	449	581	191	361	352	310	935	1199	76	-.062	SECONDARY AIR: N/A
25 / 55	5.6	.5	443	582	192	360	344	310	935	1188	77	-.059	FAN: Low
30 / 1100	5.4	.2	380	520	197	358	335	312	942	1038	76	-.056	PUMPS ON AT: 1120
35 / 05	5.2	.2	351	469	194	355	327	313	954	976	76	-.053	CHECK WB/DB: N/A
40 / 10	5.1	.1	341	452	191	354	325	314	953	962	76	-.052	
45 / 15	4.9	.2	324	423	190	348	318	315	947	944	76	-.051	
50 / 20	4.7	.2	317	406	190	347	313	317	913	938	76	-.049	
55 / 25	4.7	0	309	392	189	342	306	318	906	931	75	-.049	
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	
60 / 1130	4.5	.2	301	376	185	338	296	317	889	910	75	-.048	
65 / 35	4.3	.2	297	369	180	335	297	319	867	902	75	-.048	
70 / 40	4.2	.1	292	361	182	331	288	318	852	882	74	-.047	
75 / 45	4.0	.2	299	350	176	323	289	320	800	844	74	.047	291.6 ΔT

TEMPERATURE DATA SHEET # 14

UNIT: F500 RUN: 3 DATE: 05-17-02 PAGE 1 of 2

TIME	TOP	LT SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	FURNACE	SAMPLE	SAMP IMP	C-GAS	GAS IMP	SO_2 IMP	291.6
0 / 1145	350	176	323	289	320	800	844	74	1269	238	66	251	37	38	
5 / 50	395	178	317	305	323	651	1231	74	1288	239	45	251	38	37	
10 / 55	439	169	306	305	323	625	1364	73	1307	239	45	251	37	35	
15 / 1200	495	167	293	298	315	623	1408	72	1334	241	45	254	35	37	
20 / 05	521	164	285	290	307	629	1447	72	1354	242	45	254	36	37	
25 / 10	555	160	282	283	294	648	1478	73	1379	244	45	257	37	36	
30 / 15	587	167	281	280	290	669	1482	74	1363	244	46	257	38	36	
35 / 20	588	165	285	262	284	691	1495	74	1352	244	46	258	39	37	
40 / 25	592	168	288	248	280	710	1430	75	1345	244	46	256	37	35	
45 / 30	601	168	290	243	282	720	1516	75	1340	243	47	255	36	36	
50 / 35	611	173	293	240	280	749	1537	75	1335	243	47	255	36	36	
55 / 40	613	173	298	241	286	775	1494	75	1333	241	48	254	36	35	
TOTAL	6347	2028	3541	3284	3584	8290	16726	886	*****	*****	*****	*****	*****	*****	
60 / 1245	594	171	301	242	294	798	1431	75	1332	241	48	254	33	34	
65 / 50	569	174	308	246	298	813	1331	76	1331	240	48	253	33	35	
70 / 55	543	172	312	255	302	818	1287	75	1331	240	48	253	35	36	
75 / 1300	521	179	315	259	306	827	1237	76	1331	239	49	250	35	36	
80 / 05	505	175	315	266	311	835	1198	75	1330	238	49	246	35	36	
85 / 10	496	179	317	274	311	851	1210	75	1328	237	49	244	34	37	
90 / 15	494	182	319	280	309	868	1306	75	1327	237	49	242	36	36	
95 / 20	481	182	322	283	305	870	1072	76	1327	237	49	243	36	36	
100 / 25	456	181	322	288	305	868	987	75	1327	236	49	244	34	35	
105 / 30	428	182	321	288	304	865	932	75	1327	235	50	244	35	36	
110 / 35	404	182	320	289	303	862	916	75	1325	234	50	243	35	36	
115 / 40	390	179	318	290	304	847	899	75	1324	234	50	243	36	35	
TOTAL	5881	2138	3790	3260	3652	10122	13806	903	*****	*****	*****	*****	*****	*****	
TOTAL	12228	4166	7331	6544	7236	18412	30532	1789	*****	*****	*****	*****	*****	*****	

TEMPERATURE DATA SHEET # 14

UNIT: F500 RUN: 3 DATE: 05-17-02 PAGE 2 of 2

TIME	TOP	LT SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	FURNACE	SAMPLE	SAMP IMP	C-GAS	GAS IMP	SO$_2$ IMP	291.6
120/1345	373	179	313	286	307	823	869	75	1323	233	51	237	36	38	
125/50	362	176	309	286	311	814	868	74	1321	234	50	237	37	37	
130/55	356	178	306	285	314	809	854	74	1324	234	50	237	37	36	
135/1400	348	175	305	278	317	798	880	74	1328	234	51	237	36	35	
140/05	343	173	301	277	320	795	886	74	1330	233	51	237	36	34	
145/10	334	174	300	270	319	790	858	74	1333	233	51	237	36	36	
150/15	334	175	296	264	321	781	834	77	1335	235	51	241	35	35	
155/20	329	178	294	265	323	771	818	77	1337	237	51	244	35	36	
160/25	323	175	293	260	314	762	802	78	1338	237	51	245	35	36	
165/30	318	175	291	259	316	750	801	78	1339	238	52	245	37	36	
170/35	313	173	289	254	315	741	801	77	1335	238	52	246	36	36	
175/40	307	170	285	249	312	730	799	79	1331	238	52	247	35	36	
TOTAL	4040	2101	3582	3233	3794	9364	10070	911	*****	*****	*****	*****	*****	*****	
180/1445	306	170	283	246	311	723	800	79	1329	238	52	247	35	36	
185/50	302	172	280	248	309	713	782	79	1327	238	53	248	35	36	
190/55	295	164	278	242	306	703	748	78	1325	239	53	246	36	37	
195/1500	292	167	276	240	301	693	736	78	1324	237	52	246	37	37	
200/05															
205/10	1195	673	1117	976	1227	2832	3066	314							
210/15															
215/20												291.6	•		
220/25												255.2	•		
225/30												-36.4	• ΔT		
230/35															
235/40									÷40 •						
TOTAL	17463	6940	12030	10753	12257	30608	43668	3014	*****	*****	*****	*****	*****	*****	
TOTAL	437	174	301	269	306	765	1092	75	*****	*****	*****	*****	*****	*****	

• • • • • • • •

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 05-17-2002 Analyte : CO_2 (15-1)

Unit : F500 Run # : 3

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 % CO_2 Cyl. Press. : 2000 PSI

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

Span Cyl. # : CC12767 Conc. : 12.49 % CO_2 Cyl. Press. : 1420 PSI

Certified by : AIR LIQUIDE Date : 02-15-02

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 : 1045 Temp : 78 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.2	.002	.028	+.028	+.112
SPAN	50.0	.500	12.49	50.2	.502	12.491	+.001	+.006

POST RUN Audit : by : D. Wadington Time : 1520 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	.003	+.003	+.013
SPAN	50.0	.500	12.49	50.2	.502	12.491	+.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 #15-2

Date : 05-17-2002 Analyte : O_2 (15-2)

Unit : F500 Run # : 3

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 % O_2 Cyl. Press. : 2000 PSI

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

Span Cyl. # : CC12767 Conc. : 12.50 % O_2 Cyl. Press. : 1420 PSI

Certified by : AIR LIQUIDE Date : 02-15-02

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 : 1045 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	-.040	-.040	-.158
SPAN	12.50	.500	12.50	12.50	.501	12.538	+.038	+.154

POST RUN Audit : by : D. Washington Time : 1520 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	.003	.011	+.011	+.043
SPAN	12.50	.500	12.50	12.50	.500	12.513	+.013	+.053

± 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 : 05-17-2002 Analyte : CO (15-3)

Unit : F500 Run # : 3

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 % CO Cyl. Press. : 2000 PSI

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

Span Cyl. # : CC12767 Conc. : 4.80 % CO Cyl. Press. : 1420 PSI

Certified by : AIR LIQUIDE Date : 02-15-02

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 : 1045 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	,014	+,014	+,141
SPAN	48.0	.480	4.80	48.1	,481	4.803	+,003	+,034

POST RUN Audit : by : D. Washington Time : 1520 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	,004	+,004	+,041
SPAN	48.0	.480	4.80	48.1	,481	4.803	+,003	+,034

± 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 : 05-17-2002 Analyte : SO_2 (15-4)

Unit : F500 Run # : 3

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 ppm SO_2 Cyl. Press. : 2000 PSI

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

Span Cyl. # : CC62184 Conc. : 1290 ppm SO_2 Cyl. Press. : 1350 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 : 1110 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	8.385	+8.385	+.335
SPAN	51.6	.516	1290	51.6	.516	1292.236	+2.236	+.089

POST RUN Audit : by : D. Wadington Time : 1520 Temp : 77 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.001	3.399	+3.399	+.136
SPAN	51.6	.516	1290	51.5	.515	1289.743	-.257	-.010

± 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 : F500 RUN : 3 DATE : 05-17-02

Thermocouple Check:

T/C # 1	— °F	T/C # 13	64.8 °F
T/C # 2	— °F	T/C # 14	62.3 °F
T/C # 3	64.2 °F	T/C # 15	65.4 °F
T/C # 4	61.1 °F	T/C # 16	60.2 °F
T/C # 5	59.0 °F	T/C # 17	59.8 °F
T/C # 6	60.1 °F	T/C # 18	68.3 °F
T/C # 7	60.7 °F	T/C # 19	62.2 °F
T/C # 8	60.1 °F	T/C # 20	41.2 °F
T/C # 9	60.3 °F	T/C # 21	— °F
T/C # 10	61.4 °F	T/C # 22	— °F
T/C # 11	57.6 °F	T/C # 23	62.7 °F
T/C # 12	71.2 °F	T/C # 24	— °F

Thermocouple Readout:

Pretest zero and span check and calibration

ZERO : 2.0 °F Adj. to 0.0 °F

SPAN : 2001.0 °F Adj. to 2000.0 °F

post test zero and span % difference

ZERO 2.1 °F Adj. to .105 %

SPAN 2004.9 °F Adj. to .245 %

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 201.6 °F	400	= 399.0 °F
600	= 601.3 °F	800	= 801.3 °F	1000	= 1000.6 °F
1200	= 1198.2 °F	1400	= 1399.2 °F	1600	= 1599.7 °F
1800	= 1800.1 °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 : 15.7 - 5.7

Post : 13.8 - 3.8

Stack Cleaned Prior to Test Run : YES ____ NO X

COMPUTER INPUT DATA SHEET #1

Client: JOTUL U.S.A., INC.

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

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

Run No.: 2 Date of Test: 05-16-2002 Burn Rate: 2.877

Model No.: F500 ☐ min ☐ min-1.25 ~~☐ fan~~

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

Dry Gas Meter Y Factor: 1.000 (0.000) (Data Sheet #2) • Post Leak Rate: .014 (.000) (Data Sheet #2) cfm Time: 135 (000) (Data Sheet #2) min.

Dry Gas Meter Volume: 35.765 (00.000) (Data Sheet #2) cf

Stack Flow: 11.485 (00.000) (Data Sheet #2) dscfm Δ H: .106 (.000) (Data Sheet #2) in. H_2O

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

H_2O Captured: 71.6 (00.0) (Data Sheet #3) g

Front Half Catch % Of Total: 37.6 (00.0) (Data Sheet #6) % Total Particulate Catch: .1403 (0.0000) (Data Sheet #6) g

Flue Gas Moisture: 8.9338 (00.000) (Data Sheet #7) %

Particulate Emission: .0630 (0.0000) (Data Sheet #7) gr/dscf

Relative Humidity: 25.5 (00.0) (Data Sheet #8) % RH Ambient Moisture: 1.15 (0.00) (Data Sheet #8) % H_2O

Pretest Fuel Wt.: 48.4 (00.0) (Data Sheet #8) lbs. Coal Bed Wt.: 4.1 (00.0) (Data sheet #8) lbs. Test Fuel Wt.: 17.2 (00.0) (Data sheet #8) lbs.

Heat Output (EPA Default): 34,690.8 (00,000.0) (Data Sheet #8) BTU/hr

Kindling Fuel % Moisture (wet): 11.583 (00.000) (Data Sheet #10) % Pretest Fuel % Moisture (wet): 17.460 (00.000) (Data Sheet #10) %

Test Fuel % Moisture (dry): 20.527 (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove]) % Test Fuel % Moisture (wet): 17.031 %

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

Stack Static Pressure: -.061 (+/- .000) (Data Sheet #12) in. H_2O

Average Ambient Temperature: 79 (00) (Data Sheet #14) °F Stove Temperature Change: -41.0 (+/- 000.0) (Data Sheet #14) °F

TABLE 1 ----- RAW DATA

CLIENT : Jotul U.S.A., Inc. TEST No. : 2

MODEL: F500 DATE: 16-May-02

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	558.000	0.150	90	0.62	7.50	250
5	559.500	0.090	90	0.61	14.70	325
10	560.696	0.090	90	0.27	15.50	325
15	561.892	0.090	90	0.34	16.90	325
20	563.088	0.090	90	0.44	17.50	325
25	564.285	0.100	90	0.31	16.20	300
30	565.580	0.090	90	0.44	14.90	325
35	566.776	0.100	90	0.42	15.30	300
40	568.072	0.120	91	0.25	14.20	275
45	569.491	0.120	92	0.13	12.70	275
50	570.915	0.120	92	0.37	8.10	275
55	572.338	0.090	92	1.00	6.90	325
60	573.543	0.090	93	1.24	6.60	325
65	574.754	0.090	93	1.17	6.90	325
70	575.965	0.120	93	0.80	7.60	275
75	577.396	0.120	93	0.46	7.90	275
80	578.827	0.120	93	0.23	8.90	275
85	580.257	0.120	93	0.24	9.10	275
90	581.688	0.150	93	0.56	7.80	250
95	583.262	0.100	93	0.64	7.60	300
100	584.573	0.100	93	1.00	6.80	300
105	585.885	0.100	93	1.10	6.50	300
110	587.197	0.100	93	1.22	6.40	300
115	588.508	0.100	93	0.84	6.70	300
120	589.820	0.100	93	0.96	6.40	300
125	591.132	0.100	94	1.06	6.10	300
130	592.448	0.100	94	1.13	6.10	300
135	593.765	0.100	94	1.16	6.00	300
140						

TABLE 2---RAW DATA

CLIENT : Jotul U.S.A., Inc. TEST No. 2

MODEL: F500 DATE: 16-May-02

****

METER CAL. FACTOR (Y)	------ 1		Wt. WOOD BURNED(LB)	------- 17.2	Lbs
BAROMETRIC PRESS.(Pb)	------ 30.05	in Hg	WET,FUEL MOISTURE %	------- 17.031	%
LEAK RATE POST (Lp)	------ 0.014	cfm	Wt. PART. COLLECTED	------- 0.1403	g
WATER VOL. (V1c)	------ 71.6	Ml	METER VOLUME Vm	------- 35.765	mcf
TEST TIME (MIN)	------ 135	min	HC MOLE FRACTION	------- 0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT :Jotul U.S.A., Inc. TEST No. 2

MODEL: F500 DATE: 16-May-02

****

AVG DELTA H	-------	0.11 in H2O		AVG PRCNT CO	-------	0.68	%
AVG METER TEMP. Tm	-------	92 deg F		AVG PRCNT CO2	-------	9.78	%
AVG PPM SO2	-------	297	PPM	AVG BAL CO2/CO	-------	14.40	%

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul U.S.A., Inc. TEST No. 2

MODEL: F500 DATE: 16-May-02

****

STD SAMPLE VOL. Vm(std) -----	34.37	dscf	STACK GAS FLOW Qsd -------	879.919	dscf/Hr &
				14.67	dscf/min
VOL. WATER VAPOR Vw(std) ----	3.370	scf	PARTICULATE CONCTRT. Cs ------	0.0041	g/dscf
PRCNT MSTR Bws -------	8.93	%	PARTC.EMISS. RATE E -------	3.59	g/Hr
BURN RATE BR -------	2.88	Kg/Hr	MOLES OF GAS PER Lb WOOD Nt --	0.36	Lb-mole/Lb
CO EMISSION RATE -------	200.06	g/Hr &	PART.EMISS. RATE ------	1.25	g/Kgdry fuel
	69.54	g/Kgdry fuel			

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Jotul U.S.A., Inc. TEST No. : 2

MODEL: F500 DATE: 16-May-02

TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR	PROPRTN RATE VAR. AVERAGE
5	361.8	96	100
10	374.9	100	
15	374.9	100	
20	374.9	100	
25	375.2	100	
30	374.7	100	
35	374.9	100	
40	374.7	100	
45	375.4	100	
50	376.4	100	
55	376.1	100	
60	376.0	100	
65	377.6	100	
70	377.6	100	
75	377.5	100	
80	377.5	100	
85	377.3	100	
90	377.5	100	
95	377.5	100	
100	377.3	100	
105	377.6	100	
110	377.6	100	
115	377.3	100	
120	377.6	100	
125	377.3	100	
130	378.1	101	
135	378.3	101	
140			
145			

METER BOX DATA SHEET PAGE # 2

Page: 1 of 2

UNIT: F500 RUN: 2 DATE: 05-16-02

Meter Box: 5H Y Factor: 1.000

Leak checks: 15 " Hg @ .009 cfm _____ " Hg @ _____ cfm

15 " Hg @ .014 cfm _____ " Hg @ _____ cfm

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

ROTO: PRESS: .14 SAMPLING RATIO: 45 : 1 BP: 30.08

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1120	558.000	—	13.640	.15	90	250	90	2.0
5	25	559,500	—	10.493	.09	90	325	90	2.0
10	30	560.696	560.696	10.493	.09	90	325	90	2.0
15	35	561.892	561.892	10.493	.09	90	325	90	2.0
20	40	563.088	563.088	10.493	.09	90	325	90	2.0
25	45	564.285	564.285	11.367	.10	90	300	90	2.0
30	50	565.580	565.580	10.493	.09	90	325	90	2.0
35	55	566.776	566.776	11.367	.10	90	300	90	2.0
40	1200	568.072	568.072	12.378	.12	91	275	91	2.0
45	05	569.491	569.491	12.355	.12	92	275	92	2.0
50	10	570.915	570.915	12.355	.12	92	275	92	2.0
55	15	572.338	572.338	10.455	.09	92	325	92	2.0
ROTO PRESS:		.14	TOTALS:	136.382	1.25	1087	BP.: 30.04		
60	1220	573.543	573.543	10.422	.09	93	325	93	2.0
65	25	574.754	574.754	10.422	.09	93	325	93	2.0
70	30	575.965	575.965	12.317	.12	93	275	93	2.0
75	35	577.396	577.396	12.317	.12	93	275	93	2.0
80	40	578.827	578.827	12.317	.12	93	275	93	2.0
85	45	580.257	580.257	12.317	.12	93	275	93	2.0
90	50	581.688	581.688	13.548	.15	93	250	93	2.0
95	55	583.262	583.262	11.290	.10	93	300	93	2.0
100	1300	584.573	584.573	11.290	.10	93	300	93	2.0
105	05	585.885	585.885	11.290	.10	93	300	93	2.0
110	10	587.197	587.197	11.290	.10	93	300	93	2.0
115	15	588.508	588.508	11.290	.10	93	300	93	2.0
			TOTALS:	140.110	1.310	1116	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	276,492	2.56	2203	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 2 of 2

UNIT: F500 RUN: 2 DATE: 05-16-02

Meter Box: 5H Y Factor: 1.000

Leak checks: 15 " Hg @ .009 cfm _____ " Hg @ _____ cfm

15 " Hg @ .014 cfm _____ " Hg @ _____ cfm

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

ROTO: PRESS: .14 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
120	1320	589,820	589,820	11,290	.10	93	300	93	2.0
125	25	591,132	591,132	11,270	.10	94	300	94	2.0
130	30	592,448	592,448	11,270	.10	94	300	94	2.0
135	35	593,763	593,765	11,270	.10	94	300	94	2.0
140									
145				45,100	.40	375			
150									
155									
160									
165									
170									
175									
ROTO PRESS:			TOTALS:				BP.:		
180									
185									
190									
195									
200									
205									
210									
215									
220									
225						2578			
230							728		
235				321,592	2.96	92			
			TOTALS:				MAX VACC =		20
TOTAL Cu Ft.		35,765	TOTALS:	11,485	.106	552	AVG. BP:		30.05

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : F500 RUN : 2 DATE : 05-16-02

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	672.9	603.6	485.8	894.5
INITIAL WT	613.7	601.0	484.3	886.2
NET WT GRAMS	59.2	2.6	1.5	8.3

TOTAL CATCH : 71.6 GRAMS H_2O

FRONT HALF

FILTER #	118F	
FINAL WT g	.7042	
INITIAL WT g	.6718	
NET WT g	.0324	

BEAKER #	51
DESC.	ACETONE
FINAL WT g	104.8993
INITIAL WT g	104.8784
NET WT g	.0209
VOL. DESC. ml	125

BACK HALF

FILTER #	118B	
FINAL WT g	.4387	
INITIAL WT g	.4294	
NET WT g	.0093	

BEAKER #	52	53	54	55	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	107.5540	105.7488	107.3230	93.5070	
INITIAL WT g	107.5027	105.7410	107.3139	93.4941	
NET WT g	.0513	.0078	.0091	.0129	.0220
VOL. DESC ml	150	75	125	145	(290)

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 01/29/02 Time : 1125 By : DKW

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

Back Size: 8.2 cm Lot No. : ZB911

	DATE: 02-07	BY: DKW	DATE: 02-10	BY: DKW	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
111F	.6782	0934	.6780	1939	JOTUL C450	R-2
112F	.6755	0935	.6751	1940	" "	R-3
113F	.6721	0935	.6719	1941	" "	R-4
114F	.6843	0936	.6844	1942	" "	R-5
115F	.6699	0937	.6700	1943	" "	R-6
116F	.6696	0938	.6694	1943	" "	R-7
117F	.6796	0939	.6793	1944	JOTUL F500	R-1
118F	.6715	0940	.6718	1945	" "	R-2
119F	.6743	0941	.6746	1946	" "	R-3
120F	.6844	0942	.6843	1947	" "	R-4
111B	.4462	0943	.4464	1948	JOTUL C450	R-2
112B	.4448	0944	.4451	1949	" "	R-3
113B	.4466	0945	.4464	1949	" "	R-4
114B	.4305	0946	.4307	1950	" "	R-5
115B	.4234	0947	.4236	1951	" "	R-6
116B	.4444	0948	.4445	1952	" "	R-7
117B	.4431	0949	.4430	1953	JOTUL F500	R-1
118B	.4293	0950	.4294	1954	" "	R-2
119B	.4441	0951	.4439	1955	" "	R-3
120B	.4427	0952	.4425	1955	" "	R-4

Checked by: C Warlington Date: 2-10-02 Time: 2000

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
02-07	0910	DKW		74	47
02-10	1905	DKW		76	45

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 04-08-2002 Time : 1930 By :

	DATE: 04-11	BY:	DATE: 04-12	BY:	DATE:	BY:
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
41	105.4919	0944	105.4917	0953	✓	
42	104.6743	0945	104.6742	0954	✓ JOTUL C450	
43	107.3634	0950	107.3637	0956	✓ R-7	
44	107.7988	0952	107.7985	0957	✓	
45	94.9437	0953	94.9434	0958	✓	
46	106.0543	0954	106.0544	0959	✓	
47	107.0426	0955	107.0421	1000	✓ JOTUL F500	
48	97.7564	0955	97.7560	1001	✓ R-1	
49	108.3629	0956	108.3626	1003	✓	
50	96.5389	0957	96.5390	1004	✓	
51	104.8788	0958	104.8784	1005	✓	
52	107.5030	0959	107.5027	1006	✓ JOTUL F500	
53	105.7406	1000	105.7410	1007	✓ R-2	
54	107.3136	1001	107.3139	1008	✓	
55	93.4939	1001	93.4941	1009	✓	
56	104.1752	1002	104.1750	1010	✓	
57	97.4138	1003	97.4141	1011	✓ JOTUL F500	
58	96.8985	1004	96.8989	1012	✓ R-3	
59	105.3591	1005	105.3593	1013	✓	
60	106.7350	1006	106.7348	1015	✓	

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
04-11	0940			76	49
04-12	0950			78	47

Checked by :
Date : 04-12-02
Time : 1040

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : F500 RUN : 2 DATE : 05-16-02 Page : 1 of 1

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
51	05-17	1125		104.8996	05-18	1915		104.8993	05-19	1510					
52	05-18	1930		107.5556	05-20	0901		107.5537	05-21	0935		107.5540	05-22	1159	
53	05-17	1125		105.7485	05-18	1916		105.7488	05-19	1511					
54	05-17	1125		107.3226	05-18	1917		107.3230	05-19	1512					
55	05-17	1125		93.5067	05-18	1918		93.5070	05-19	1513					

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
118F	5-16	1400		.7043	05-17	1604		.7042	05-18	1919					
118B	5-16	1400		.4385	05-17	1605		.4387	05-18	1920					

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	05-17	1600		75	48
2	05-18	1905		77	49
3	05-19	1500		77	48
4	05-20	0855		77	47
5	05-21	0930		78	49

Weighing Session	Date	Time	By	DB	%RH
6	05-22	1155		78	48
7					
8					
9					
10					

Dates: From 11-20-2001
Through 02-16-2002

WOODSTOVE DATA SHEET #4-4
SCALE QA SHEET

Scale: Sartorius
Model: A1205
SN : 37010004

100g weight	10 g weight	1.0 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	Wet Bulb	%.RH
99.9998	10.0002	1.0003	.1000	DKW	11-20	0945	78		48
100.0000	10.0000	1.0001	.0999	DKW	11-21	1000	75		49
99.9998	9.9998	1.0000	.1001	DKW	11-22	1050	75		49
100.0003	9.9999	1.0000	.0999	DKW	11-26	1150	74		47
100.0001	9.9997	1.0000	.1000	DKW	11-27	1155	74		48
100.0001	10.0000	.9997	.0999	DKW	11-28	1220	72		48
99.9999	10.0001	1.0000	.1000	DKW	11-28	1930	73		48
99.9998	10.0000	.9999	.0999	DKW	11-29	1015	75		46
99.9998	10.0000	.9997	.0998	DKW	11-29	1925	73		46
100.0000	10.0001	.9998	.0999	DKW	11-30	1355	74		45
99.9999	9.9999	1.0000	.1000	DKW	12-01	1210	77		45
100.0003	10.0000	.9997	.1000	DKW	01-08	2045	78		47
100.0001	10.0000	.9998	.1000	DKW	01-09	1600	78		48
99.9999	9.9999	.9999	.1000	DKW	01-12	1900	74		46
99.9998	9.9999	.9997	.1000	DKW	01-13	1730	72		43
100.0000	10.0001	1.0000	.1001	DKW	01-14	1355	78		45
99.9998	9.9999	.9999	.1000	DKW	01-26	1745	72		47
99.9998	10.0000	1.0000	.0999	DKW	01-28	1705	74		44
100.0003	10.0000	1.0000	.0998	DKW	01-29	1130	70		47
99.9998	9.9997	1.0000	.1000	DKW	01-29	2300	71		44
100.0002	10.0000	1.0000	.1000	DKW	01-30	2200	75		45
99.9999	9.9999	.9999	.1000	DKW	01-31	2205	74		47
100.0001	9.9999	1.0000	.1000	DKW	02-02	0700	75		45
100.0002	9.9999	1.0001	.1000	DKW	02-04	1045	73		47
100.0000	10.0000	.9998	.0997	DKW	02-06	0905	73		47
100.0001	10.0000	1.0000	.1000	DKW	02-07	0910	74		47
100.0002	10.0001	1.0000	.0999	DKW	02-07	1235	77		48
99.9999	10.0000	.9999	.0998	DKW	02-08	1110	72		49
99.9998	9.9999	1.0000	.0999	DKW	02-09	1045	70		49
99.9997	10.0000	.9999	.0999	DKW	02-10	0920	74		48
99.9997	10.0001	.9999	.0999	DKW	02-10	1905	76		45
99.9999	9.9999	1.0000	.0997	DKW	02-11	1935	73		43
99.9998	9.9997	1.0000	.0999	DKW	02-13	1740	75		41
99.9997	10.0000	.9999	.1000	DKW	02-14	1015	74		38
99.9998	9.9999	1.0000	.1000	DKW	02-14	2010	74		43
100.0000	10.0000	1.0000	.1000	DKW	02-15	1150	74		41
99.9998	9.9999	.9999	.1000	DKW	02-16	1045	78		41

Dates: From 02-16-2002
Through 05-17-2002

WOODSTOVE DATA SHEET #4-4
SCALE QA SHEET

Scale: Sartorius
Model: A1205
SN : 37010004

100g weight	10 g weight	1.0 g weight	100 mg weight	Tech	Date	Time	Wet Bulb	Dry Bulb	% RH
100.0000	9.9999	1.0000	.0999	DFW	02-16	1845		77	46
100.0000	9.9999	.9999	.0998	DFW	02-17	1555		77	47
100.0001	9.9999	.9999	.0997	DFW	02-18	0940		77	47
100.0000	10.0000	.9999	.1000	DFW	02-19	1025		78	46
100.0000	9.9999	1.0000	.0999	DFW	02-20	0915		75	42
100.0003	10.0000	1.0000	.0999	DFW	03-14	1020		78	45
99.9999	9.9998	.9998	.0998	DFW	03-15	1725		77	45
99.9999	10.0000	1.0002	.0999	DFW	03-16	1820		77	38
100.0001	9.9999	1.0001	.1000	DFW	03-16	2130		78	43
99.9999	9.9999	.9998	.0998	DFW	03-17	1550		77	43
99.9999	10.0000	1.0001	.0999	DFW	03-17	2045		77	39
99.9998	10.0000	1.0000	.1000	DFW	03-18	1100		77	39
100.0000	9.9999	.9999	.0999	DFW	03-19	1800		76	42
100.0001	10.0000	1.0001	.1000	DFW	03-20	1835		77	45
99.9999	10.0001	.9999	.0999	DFW	03-21	2235		78	45
99.9998	9.9999	1.0000	.1000	DFW	03-24	2205		78	42
99.9998	10.0000	1.0000	.1001	DFW	03-25	1000		78	41
99.9997	10.0000	1.0001	.1000	DFW	04-04	1300		78	49
99.9998	10.0000	1.0000	.0999	DFW	04-05	1210		78	49
99.9997	10.0000	.9999	.0998	DFW	04-05	2230		78	49
99.9999	10.0001	1.0000	.0998	DFW	04-08	1135		78	47
99.9997	10.0000	1.0000	.0999	DFW	04-08	1910		78	48
99.9997	9.9998	.9999	.1000	DFW	04-09	2150		77	48
99.9999	10.0000	1.0000	.0999	DFW	04-10	2205		78	48
100.0000	10.0001	.9999	.0999	DFW	04-11	0940		76	49
99.9997	9.9998	1.0000	.0999	DFW	04-11	1705		78	48
99.9999	9.9999	.9999	.0998	DFW	04-11	2230		78	48
99.9999	10.0001	.9999	.0999	DFW	04-12	0950		78	47
100.0001	9.9998	1.0000	.0999	DFW	04-12	1810		78	48
100.0000	9.9999	.9999	.0998	DFW	04-12	2205		78	47
100.0000	9.9999	.9999	.0999	DFW	04-13	1720		78	48
99.9998	10.0000	1.0000	.0998	DFW	04-13	2325		78	46
99.9999	10.0001	1.0001	.1000	DFW	04-14	1740		78	44
99.9998	10.0000	1.0001	.0999	DFW	04-16	1925		75	44
99.9997	9.9999	1.0000	.1000	DFW	04-19	1350		78	41
100.0000	10.0001	.9998	.0999	DFW	04-20	1210		75	41
99.9998	9.9998	1.0001	.0997	DF	05-16	1430		76	48
99.9999	9.9999	1.0000	.0999	DFW	05-17	1600		75	48

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

Dates:	Scale:	Model:	SN:
From 05-18-2002 Through	Sartorius	A 120 S	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	[illegible]	05-18	1905	77	49
99.9997	9.9998	.9999	.0998	[illegible]	05-19	1500	77	48
99.9999	10.0000	.9998	.0999	[illegible]	05-20	0855	77	47
99.9998	9.9998	1.0000	.0999	DKW	05-21	0930	78	49
99.9998	9.9999	1.0000	.1000	[illegible]	05-22	1155	78	48
99.9999	9.9999	1.0000	.1001	DKW	05-22	1920	78	49
99.9999	10.0001	1.0001	.0998	DKW	05-23	2105	77	48
99.9998	9.9998	.9998	.0999	DKW	05-28	1225	78	49
99.9998	9.9997	1.0001	.0999	DKW	05-28	1625	78	47

BLANK PROCESSING DATA SHEET # 5

UNIT: F500 RUN: 2 DATE: 05-16-02

BLANKS DONE: 02-20-2002

BEAKER	A	B	C
	200 ml ACETONE	75 ml DICHLOR	200 ml WATER
	FISHER OPTIMA LOT # 011755	FISHER OPTIMA LOT # 994669	MCKESSON WATER PRODUCTS CO. CERTIFIED DISTILLED
FINAL WEIGHT	108.9015	106.3081	106.9664
TARE WEIGHT	108.9007	106.3064	106.9660
NET WEIGHT	.0008 ✓	.0017 ✓	.0004 ✓

TARE BEAKERS INTO DESC: TIME: 1205 DATE: 02-15-2002

DATE: 02-16 BY: [initials] DATE: 02-17 BY: [initials] DATE: BY:

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9002	1849	108.9007	1611 ✓		
B	106.3068	1850	106.3064	1612 ✓		
C	106.9661	1851	106.9660	1613 ✓		

FINAL BEAKERS INTO DESC: TIME: 1125 DATE: 02-18-2002

DATE: 02-19 BY: [initials] DATE: 02-20 BY: [initials] DATE: BY:

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9016	1027	108.9015	0917 ✓		
B	106.3084	1028	106.3081	0918 ✓		
C	106.9664	1029	106.9664	0919 ✓		

TARE QC

DATE	TIME	BY	WB	DB	%
02-16	1845	[initials]		77	46
0217	1555	[initials]		77	47

FINAL QC

DATE	TIME	BY	WB	DB	%
02-19	1025	[initials]		78	46
02-20	0915	[initials]		75	42

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT: F500 RUN: 2 DATE: 05-16-02

BLANK CALCULATIONS

Acetone: .0008 g ÷ 200 ml = .000004 g/ml
Dicholoromethane: .0017 g ÷ 75 ml = .000023 g/ml
Distilled Water: .0004 g ÷ 200 ml = .000002 g/ml

FRONT HALF CATCH

FILTERS: .0324 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0324 g

BEAKERS: .0209 (Total Catch) g - 125 (ml Acetone) (.000004 g) (Blank Value / ml Acetone) = .0204 g

TOTAL FRONT HALF CATCH: .0528 g

BACK HALF CATCH

FILTERS: .0093 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .0093 g

BEAKERS:

Acetone: .0513 (Total Catch) g - 150 (ml Acetone) (.000004 g) (Blank Value / ml Acetone) = .0507 g

Extract: .0078 (Total Catch) g - 75 (ml Dichloromethane) (.000023 g) (Blank Value / Dichloromethane) = .0061 g

Water: .0220 (Total Catch) g - 290 (ml Water) (.000002 g) (Blank Value / Water) = .0214 g

TOTAL BACK HALF CATCH: .0875 g

TOTAL CATCH: .1403 g

% FRONT HALF: 37.6 %

CALCULATIONS DATA SHEET # 7

UNIT : F500 RUN : 2 DATE : 05-16-02

1) $Vm(std) = \dfrac{(35.765\ Vm)(17.64)(1.000\ mcf)\left(30.05" Hg + \frac{.106\ " H_2O}{13.6}\right)}{(552\ TmA)} = \dfrac{34.3538}{000.0000}$ dscf

2) $Vw(std) = (.04707)(71.6\ ml\ H_2O) = \dfrac{3.3702}{00.0000}$ scf

3) $Asw = \dfrac{(3.3702\ scf)}{(3.3702\ scf + 34.3538\ dscf)} = \dfrac{.0893}{.0000}$ Bws × 100 = $\dfrac{8.9338}{00.0000}$ % H_2O

4) $Cs = \dfrac{(.1403\ g.)}{(34.3538\ dscf)}(15.43) = \dfrac{.0630}{0.0000}$ gr / dscf

5) Estimated g / hr = $\dfrac{(.1403\ g.)}{(34.3538\ dscf)}\left(\dfrac{11.485}{00.0000}\ dscfm\right)(60) = \dfrac{2.8143}{00.0000}$ 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 : F500 RUN : 2 DATE : 05-16-02

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

Wet Bulb / Dry Bulb

Pre : WB : 62 DB : 85 = 26 % RH 1.0 % H_2O

Post : WB : 64 DB : 88 = 25 % RH 1.3 % H_2O

Average : 25.5 % RH 1.15 % H_2O

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

Kindling Weight (lbs) : Paper : .2 Wood : 5.2

Preburn Fuel Weight : 14.3 + 14.0 + 14.9 Total : 43.2

Kindling & Preburn Fuel Weight (wood only) (lbs) : **Total** : 48.4

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

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

Lower : .20 × fuel weight : Always round UP to nearest tenth **Actual Coal Bed Weight** : 4.1

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

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

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" × 4"	17	3	7.0	40.7
4" × 4"	17	2	10.2	59.3

Test Fuel Weight : 17.2 lbs

Estimated Dry Burn Rate :

$$\frac{17.2 - (17.2 \times .17031)}{2.2046} \times \frac{60}{\frac{135}{\text{TIME}}} = 2.877 \text{ kg / hr}$$

Estimated BTU's/hr : $19{,}140 \times \frac{63}{100} \times \frac{2.877}{\text{DBR}} = 34{,}690.8$ BTU's/hr

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

WOOD STOVE OPERATING DATA PAGE #9

Unit : F500 Run : 2 Date : 05-16-02

FIRE STARTED: 0730

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 25 sec.

TEST:

DOOR wide open during loading 0 min. 40 sec.

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

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 12 or 16 inches.

1st warm up / pre-burn fuel charge (14.3 lbs.) added at 0740

2nd warm up / pre-burn fuel charge (14.0 lbs.) added at 0845

3rd warm up / pre-burn fuel charge (14.9 lbs.) added at 0955

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 : F500 Run : 2 Date : 05-16-02

Room Temperature : 72 °F Correction Factor : Ø

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

Time Test Fuel moisture reading taken : 1000

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	12.5	13.3	13.0	13.8	11.5	12.2	13.100
2									
3									
4	2"×4"×8'	P	18.5	19.8	19.0	20.3	19.0	20.3	20,133
5	2"×4"×8'	P	19.0	20.3	19.0	20.3	19.0	20.3	20,300
6	2"×4"×8'	P	23.5	25.2	23.5	25.2	23.5	25.2	25.200
7	2"×4"×8'	P	19.5	20.9	19.0	20.3	18.5	19.8	20,333
8	2"×4"×8'	P	18.5	19.8	18.5	19.8	18.5	19.8	19,800
9									105.766
10									
11	2×4×17	T	17.5	18.7	18.0	19.2	17.5	18.7	18.867
12	"	T	18.0	19.2	18.0	19.2	19.0	20.3	19.567
13	"	T	23.5	25.2	23.0	24.7	23.5	25.2	25,033
14	4×4×17	T	18.0	19.2	18.5	19.8	18.0	19.2	19.400
15	"	T	18.0	19.2	19.0	20.3	18.5	19.8	19.767
16									102.634
17									
18									
19									
20	Spacers	T	19.5	20.9	20.0	21.4	20.0	21.4	21.233

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	13.100 %	21.153 %	20.527 %
Wet Moisture % :	11.583 %	17.460 %	17.031 %

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°

WEIGHT: 1.1

UNIT: F500

GAS DATA SHEET # 12

RUN: 2 DATE: 05-16-02 PAGE: 1 of 2

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	WB	DB	% H_2O	CAL WB	STACK	STATIC	SO_2PPM
0 / 1120	21.3	17.2	—	.303	7.5	.497	12.4	.061	.62					346	-.054	250
5 / 25	19.2	15.1	2.1	.589	14.7	.265	6.6	.060	.61					708	-.075	325
10 / 30	17.5	13.4	1.7	.622	15.5	.229	5.7	.026	.27					640	-.074	325
15 / 35	16.2	12.1	1.3	.677	16.9	.180	4.5	.033	.34					659	-.076	325
20 / 40	14.9	10.8	1.3	.704	17.5	.149	3.7	.043	.44					676	-.076	325
25 / 45	13.3	9.2	1.6	.651	16.2	.203	5.0	.030	.31					643	-.075	300
30 / 50	12.1	8.0	1.2	.599	14.9	.233	5.8	.043	.44					621	-.073	325
35 / 55	11.1	7.0	1.0	.614	15.3	.222	5.5	.041	.42					601	-.073	300
40 / 1200	10.0	5.9	1.1	.570	14.2	.264	6.6	.024	.25					574	-.071	275
45 / 05	9.2	5.1	.8	.510	12.7	.318	7.9	.012	.13					532	-.068	275
50 / 10	8.7	4.6	.5	.325	8.1	486	12.2	.036	.37					466	-.065	275
55 / 15	8.3	4.2	.4	.279	6.9	.522	13.1	.099	1.00					415	-.061	325
TOTAL	*****	****	****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	6881	-.841	*****
60 / 1220	7.8	3.7	.5	.267	6.6	.529	13.2	.123	1.24					384	-.058	325
65 / 25	7.5	3.4	.3	.277	6.9	.519	13.0	.116	1.17					371	-.057	325
70 / 30	7.2	3.1	.3	.307	7.6	.492	12.3	.079	.80					375	-.056	275
75 / 35	6.8	2.7	.4	.318	7.9	479	12.0	.045	.46					387	-.058	275
80 / 40	6.3	2.2	.5	.356	8.9	.442	11.1	.022	.23					402	-.059	275
85 / 45	5.9	1.8	.4	.365	9.1	.426	10.7	.023	.24					405	-.059	275
90 / 50	5.6	1.5	.3	.314	7.8	.473	11.8	.055	.56					378	-.057	250
95 / 55	5.5	1.4	.1	.307	7.6	.482	12.1	.063	.64					367	-.056	300
100 / 1300	5.3	1.2	.2	.272	6.8	.522	13.1	.099	1.00					348	-.054	300
105 / 05	5.1	1.0	.2	.263	6.5	.532	13.3	.109	1.10					337	-.052	300
110 / 10	5.0	.9	.1	.259	6.4	.532	13.3	.121	1.22					329	-.051	300
115 / 15	4.8	.7	.2	.268	6.7	.529	13.2	.083	0.84					327	-.051	300
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	4410	-.668	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	11291	-1.509	*****

WEIGHT: 4.1

GAS DATA SHEET # 12

UNIT: F500 RUN: 2 DATE: 05-16-02 PAGE: 2 of 2

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	WB	DB	% H_2O	CAL WB	STACK	STATIC	SO_2PPM
120 1320	4.6	.5	.2	.259	6.4	.540	13.5	.095	.96					320	-.050	300
125 25	4.4	.3	.2	.247	6.1	.551	13.8	.105	1.06					313	-.050	300
130 30	4.3	.2	.1	.246	6.1	.554	13.9	.112	1.13					308	-.049	300
135 35	4.1	.1	.2	.240	6.0	.560	14.0	.115	1.16					305	-.048	300
140 40																
145 45																
150 50																
155 55																
160 1400																
165 05																
170 10																
175 15																
TOTAL	*****	****	****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	1246	-.197	*****
180 1420																
185																
190																
195																
200																
205																
210																
215																
220																
225																
230																
235																-.28
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	12537	-1.706	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	448	-.061	*****

PR__JR_ _AT_ _HE_ . #1

UNIT: F500 RUN: 2 DATE: 05-16-02 PAGE: 1 of 1

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
0 0955	18.2	-	324	434	209	352	287	336	837	725	82	-.051	PREBURN START: # 13.9 UP
5 1000	17.3	.9	450	471	206	350	281	335	795	1301	83	-.067	COAL BED SCALE RANGE:
10 05	15.6	1.7	596	618	204	335	271	328	755	1433	84	-.075	4.3 → 3.5
15 10	13.7	1.9	653	708	212	323	255	308	742	1462	82	-.078	PRIMARY AIR: wide open
20 15	12.1	1.6	678	733	206	312	249	302	751	1516	84	-.079	SECONDARY AIR: N/A
25 20	10.4	1.7	665	756	206	312	246	297	767	1497	86	-.077	FAN: High
30 25	8.6	1.8	636	761	217	317	256	284	819	1519	86	-.075	PUMPS ON AT: 1050
35 30	7.5	1.1	600	733	212	320	262	278	861	1417	80	-.075	CHECK WB/DB: N/A
40 35	6.6	.9	551	713	213	322	272	281	904	1308	81	-.071	
45 40	6.1	.5	487	662	211	334	282	280	954	1214	81	-.067	
50 45	5.6	.5	445	600	216	346	295	286	991	1120	81	-.064	
55 50	5.3	.3	432	569	216	354	296	289	1017	1089	80	-.062	
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	
60 1055	5.0	.3	402	533	219	360	300	294	1027	1059	80	-.061	
65 1100	4.8	.2	375	492	219	364	300	297	997	1056	80	-.058	
70 05	4.6	.2	365	473	222	362	299	298	974	1034	79	-.056	
75 10	4.5	.1	351	451	215	358	296	301	947	1013	79	-.056	
80 15	4.3	.2	340	425	214	350	290	301	927	991	78	-.055	
85 20	4.1	.2	346	406	216	348	286	301	881	949	78	-.054	311.4 ΔT.

TEMPERATURE DATA SHEET # 14

UNIT: F500 RUN: 2 DATE: 05-16-02 PAGE 1 of 2

TIME	TOP	LT SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	FURNACE	SAMPLE	SAMP IMP	C-GAS	GAS IMP	SO_2 IMP	311.4
0/1120	406	216	348	286	301	881	949	78	1330	243	66	263	37	37	
5/25	608	202	338	353	318	769	1270	75	1353	245	50	272	35	36	
10/30	641	204	328	358	325	720	1310	76	1363	247	53	269	36	37	
15/35	668	188	317	356	323	705	1300	77	1371	247	55	268	38	38	
20/40	706	187	311	352	316	709	1330	77	1379	248	55	268	37	38	
25/45	693	193	309	350	306	732	1310	79	1369	246	56	267	35	37	
30/50	683	190	309	359	302	757	1318	79	1364	243	57	264	36	35	
35/55	670	191	311	297	293	792	1335	79	1360	242	53	266	37	36	
40/1200	656	197	316	284	287	841	1309	80	1356	242	53	270	37	35	
45/05	628	198	323	283	281	902	1242	80	1354	242	.52	271	36	34	
50/10	582	203	331	284	282	895	1107	79	1353	241	52	270	34	35	
55/15	531	204	335	285	281	876	1002	80	1351	241	52	272	34	34	
TOTAL	7472	2373	3876	3847	3615	9579	14782	939	*****	*****	*****	*****	*****	*****	
60/1220	491	197	331	281	280	868	949	79	1348	240	53	268	35	36	
65/25	463	192	330	275	280	867	927	79	1344	239	53	266	35	36	
70/30	446	197	325	269	276	875	937	80	1340	239	54	263	36	35	
75/35	446	194	325	265	275	879	984	79	1336	238	57	261	36	37	
80/40	456	193	325	259	271	~~888~~	1051	80	1332	238	58	260	36	38	
85/45	461	197	325	257	272	896	1083	79	1325	238	58	260	37	37	
90/50	441	196	327	255	271	899	1017	79	1322	238	57	259	37	38	
95/55	424	197	329	253	267	915	979	79	1315	237	56	258	36	38	
100/1300	406	195	331	251	265	905	949	79	1309	237	56	256	36	37	
105/05	392	193	328	250	266	901	921	79	1304	236	57	255	38	37	
110/10	380	193	328	248	265	894	907	79	1308	236	57	254	37	39	
115/15	370	195	325	246	265	900	906	80	1310	235	57	253	35	36	
TOTAL	5176	2339	3929	3109	3253	10687	11610	951	*****	*****	*****	*****	*****	*****	
TOTAL	12648	4712	7805	6956	6868	20266	26392	1890	*****	*****	*****	*****	*****	*****	

TEMPERATURE DATA SHEET # 14

UNIT: F500 RUN: 2 DATE: 05-16-02 PAGE 2 of 2

TIME	TOP	LT SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	FURNACE	SAMPLE	SAMP IMP	C-GAS	GAS IMP	SO_2 IMP	311.4
120 / 1320	362	193	323	242	269	889	883	79	1312	235	56	252	36	36	
125 / 25	352	188	324	238	271	880	863	79	1315	236	56	251	35	35	
130 / 30	344	193	320	234	273	868	847	79	1313	235	57	250	35	36	
135 / 35	337	193	317	230	275	856	836	79	1311	236	56	248	36	36	
140 / 40															
145 / 45															
150 / 50															
155 / 55															
160 / 1400															
165 / 05															
170 / 10															
175 / 15															
TOTAL	1395	767	1284	944	1088	3493	3429	316	*****	*****	*****	*****	*****	*****	
180 / 1420															
185															
190															
195															
200											311.4	.			
205											270.4	.			
210											-41.0	ΔT			
215															
220															
225															
230															
235									-18.						
TOTAL	14043	5479	9089	7900	7956	23759	29821	2206	*****	*****	*****	*****	*****	*****	
TOTAL	502	196	325	282	284	849	1065	79	*****	*****	*****	*****	*****	*****	

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 05-16-2002 Analyte : CO_2 (15-1)

Unit : F500 Run # : 2

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 % CO_2 Cyl. Press. : 2000 PSI

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

Span Cyl. # : CC12767 Conc. : 12.49 % CO_2 Cyl. Press. : 1420 PSI

Certified by : AIR LIQUIDE Date : 02-15-02

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. Washington Time : 1045 Temp : 81 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.2	.002	.028	+.028	+.112
SPAN	50.0	.500	12.49	50.2	.502	12.491	+.001	+.006

POST RUN Audit : by : D. Washington Time : 1350 Temp : 79 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.001	.003	+.003	+.013
SPAN	50.0	.500	12.49	50.1	.501	12.466	-.024	-.094

± 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 : 05-16-2002 Analyte : O_2 (15-2)

Unit : F500 Run # : 2

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 % O_2 Cyl. Press. : 2000 PSI

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

Span Cyl. # : CC12767 Conc. : 12.50 % O_2 Cyl. Press. : 1420 PSI

Certified by : AIR LIQUIDE Date : 02-15-02

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. Wadington Time : 1045 Temp : 81 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.003	.011	+.011	+.043
SPAN	12.50	.500	12.50	12.49	.499	12.488	-.012	-.047

POST RUN Audit : by : D. Wadington Time : 1350 Temp : 79 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.002	-.014	-.014	-.057
SPAN	12.50	.500	12.50	12.49	.499	12.488	-.012	-.047

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

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

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

ZERO / SPAN CHECK DATA SHEET #15-3

Date : 05-16-2002 Analyte : CO (15-3)

Unit : F500 Run # : 2

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 % CO Cyl. Press. : 2000 PSI

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

Span Cyl. # : CC12767 Conc. : 4.80 % CO Cyl. Press. : 1420 PSI

Certified by : AIR LIQUIDE Date : 02-15-02

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 : 1045 Temp : 81 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	.014	+,014	+141
SPAN	48.0	.480	4.80	48.1	.481	4.803	+,003	+,034

POST RUN Audit : by : D. Wadington Time : 1350 Temp : 79 ° F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	-,001	.004	+.004	+.041
SPAN	48.0	.480	4.80	48,1	,481	4.803	+,003	+,034

± 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 : 05-16-2002 Analyte : SO_2 (15-4)

Unit : F500 Run # : 2

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 ppm SO_2 Cyl. Press. : 2000 PSI

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

Span Cyl. # : CC62184 Conc. : 1290 ppm SO_2 Cyl. Press. : 1350 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. Washington Time : 1025 Temp : 86 °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	10.878	+10.878	+.435
SPAN	51.6	.516	1290	51.5	.515	1289.743	-0.257	-.010

POST RUN Audit : by : D. Washington Time : 1345 Temp : 79 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.0	.000	5.892	+5.892	+.236
SPAN	51.6	.516	1290	51.6	.516	1292.236	+2.236	+.089

± 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 : F500 RUN : 2 DATE : 05-16-02

Thermocouple Check:

T/C # 1	— °F	T/C # 13	64.5 °F
T/C # 2	— °F	T/C # 14	61.7 °F
T/C # 3	64.4 °F	T/C # 15	67.0 °F
T/C # 4	57.9 °F	T/C # 16	12.3 °F
T/C # 5	56.0 °F	T/C # 17	11.3 °F
T/C # 6	57.2 °F	T/C # 18	67.9 °F
T/C # 7	56.6 °F	T/C # 19	59.5 °F
T/C # 8	57.2 °F	T/C # 20	5.6 °F
T/C # 9	57.6 °F	T/C # 21	— °F
T/C # 10	57.8 °F	T/C # 22	— °F
T/C # 11	54.8 °F	T/C # 23	58.2 °F
T/C # 12	73.6 °F	T/C # 24	— °F

Thermocouple Readout:

Pretest zero and span check and calibration

ZERO : 1.7 °F Adj. to 0.0 °F

SPAN : 1996.0 °F Adj. to 2000.0 °F

post test zero and span % difference

ZERO 2.6 °F Adj. to .130 % of F.

SPAN 2005.0 °F Adj. to .250 % of F.

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 202.6 °F	400	= 399.9 °F
600	= 602.0 °F	800	= 802.0 °F	1000	= 1001.0 °F
1200	= 1198.6 °F	1400	= 1399.4 °F	1600	= 1599.8 °F
1800	= 1800.0 °F	2000	= 2000.0 °F		

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

Scale Check Pre : 18.1 - 8.1 .

Post : 13.9 - 3.9 .

Stack Cleaned Prior to Test Run : YES ____ NO X

COMPUTER INPUT DATA SHEET #1

Client: JOTUL U.S.A., INC.

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

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

Run No.: 5 Date of Test: 05-21-2002 Burn Rate: 1.210

Model No.: F500 ☐ min ☒ min-1.25 ☒ fan

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

Dry Gas Meter Y Factor: 1.000 (0.000) (Data Sheet #2)

Post Leak Rate: .017 cfm (.000) (Data Sheet #2)

Time: 310 min. (000) (Data Sheet #2)

Dry Gas Meter Volume: 99.891 cf (00.000) (Data Sheet #2)

Stack Flow: 7.034 dscfm (00.000) (Data Sheet #2)

Δ H: .154 in. H_2O (.000) (Data Sheet #2)

Maximum Vac.: 3.0 (0.0) (Data Sheet #2)

Barometric Pressure: 30.04 in. Hg (00.00) (Data Sheet #2)

H_2O Captured: 169.7 g (00.0) (Data Sheet #3)

Front Half Catch % Of Total: 28.7 % (00.0) (Data Sheet #6)

Total Particulate Catch: .9613 g (0.0000) (Data Sheet #6)

Flue Gas Moisture: 7.6095 % (00.000) (Data Sheet #7)

Particulate Emission: .1529 gr/dscf (0.0000) (Data Sheet #7)

Relative Humidity: 43.5 % RH (00.0) (Data Sheet #8)

Ambient Moisture: 1.25 % H_2O (0.00) (Data Sheet #8)

Pretest Fuel Wt.: 51.3 lbs. (00.0) (Data Sheet #8)

Coal Bed Wt.: 4.0 lbs. (00.0) (Data sheet #8)

Test Fuel Wt.: 16.6 lbs. (00.0) (Data sheet #8)

Heat Output (EPA Default): 14,588.4 BTU/hr (00,000.0) (Data Sheet #8)

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

Pretest Fuel % Moisture (wet): 16.823 % (00.000) (Data Sheet #10)

Test Fuel % Moisture (dry): 20.460 % (00.000) (Data Sheet #10 [wood stove] or #11 [pellet stove])

Test Fuel % Moisture (wet): 16.985 %

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

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

Average Ambient Temperature: 76 °F (00) (Data Sheet #14)

Stove Temperature Change: -45.8 °F (+/- 000.0) (Data Sheet #14)

TABLE 1 ----- RAW DATA

CLIENT : Jotul U.S.A., Inc. TEST No. : 5

MODEL: F500 DATE: 21-May-02

TIME (MIN.)	METER READING (C F)	DELTA H (IN. H2O)	METER TEMP. (DEG. F)	PERCENT CO (%)	PERCENT CO2 (%)	SO2 COCENTR. PPM
0	757.000	0.150	77	1.16	5.30	500
5	758.500	0.360	78	0.46	8.10	325
10	760.842	0.110	79	0.96	3.80	575
15	762.173	0.120	79	1.03	4.40	550
20	763.563	0.120	79	1.06	5.50	550
25	764.954	0.120	79	1.21	7.60	550
30	766.345	0.100	79	1.57	6.50	625
35	767.569	0.190	79	0.58	9.00	450
40	769.268	0.190	79	0.35	9.60	450
45	770.967	0.230	82	0.29	12.30	400
50	772.900	0.230	82	0.22	12.60	400
55	774.833	0.230	84	0.18	13.10	400
60	776.779	0.230	84	0.22	15.20	400
65	778.728	0.230	85	0.31	15.20	400
70	780.683	0.200	86	0.10	13.90	425
75	782.530	0.230	86	0.10	12.90	400
80	784.493	0.200	87	0.17	12.30	425
85	786.347	0.200	88	0.09	13.30	425
90	788.208	0.180	88	0.29	11.20	450
95	789.966	0.160	88	0.62	10.60	475
100	791.631	0.160	87	0.77	9.70	475
105	793.290	0.140	87	0.66	10.50	500
110	794.867	0.140	86	0.52	11.30	500
115	796.438	0.160	86	0.38	12.00	475
120	798.091	0.180	86	0.41	10.40	450
125	799.836	0.160	87	1.11	8.10	475
130	801.495	0.140	87	1.21	7.90	500
135	803.072	0.130	87	1.29	7.30	525
140	804.573	0.130	88	1.21	7.30	525
145	806.080	0.130	88	1.42	7.10	525
150	807.587	0.140	88	1.25	6.80	500
155	809.169	0.130	88	1.15	6.90	525
160	810.676	0.140	88	1.30	6.70	500
165	812.259	0.140	88	1.55	6.50	500
170	813.841	0.140	88	1.55	6.40	500
175	815.423	0.140	88	1.62	6.40	500
180	817.005	0.140	88	1.70	6.30	500
185	818.589	0.140	88	1.65	6.20	500
190	820.172	0.140	88	1.59	6.20	500
195	821.755	0.140	88	1.36	6.60	500
200	823.339	0.140	88	1.12	6.60	500
205	824.922	0.140	88	1.34	6.30	500
210	826.505	0.140	88	1.56	5.80	500
215	828.089	0.140	88	1.52	5.80	500

220	829.672	0.140	88	2.29	4.80	500
225	831.255	0.130	88	2.26	4.80	525
230	832.763	0.130	88	2.02	4.90	525
235	834.271	0.130	88	1.97	5.10	525
240	835.779	0.130	88	2.28	4.70	525
245	837.287	0.130	88	2.30	4.70	525
250	838.795	0.130	88	2.29	4.70	525
255	840.303	0.130	88	2.24	4.70	525
260	841.811	0.130	88	2.24	4.70	525
265	843.319	0.130	88	2.24	4.70	525
270	844.827	0.130	88	2.01	4.60	525
275	846.335	0.130	88	1.64	5.00	525
280	847.843	0.130	88	1.79	4.80	525
285	849.351	0.130	88	1.90	4.70	525
290	850.859	0.130	88	1.99	4.60	525
295	852.367	0.130	88	2.25	4.50	525
300	853.875	0.130	88	2.20	4.40	525
305	855.383	0.130	88	2.20	4.30	525
310	856.891	0.130	88	2.11	4.30	525
315						

TABLE 2---RAW DATA

CLIENT : Jotul U.S.A., Inc. TEST No. 5

MODEL: F500 DATE: 21-May-02

METER CAL. FACTOR (Y) -------	1		Wt. WOOD BURNED(LB) -------	16.6	Lbs
BAROMETRIC PRESS.(Pb) -------	30.04	in Hg	WET,FUEL MOISTURE % -------	16.985	%
LEAK RATE POST (Lp) -------	0.017	cfm	Wt. PART. COLLECTED -------	0.9613	g
WATER VOL. (V1c) -------	169.7	Ml	METER VOLUME Vm -------	99.891	mcf
TEST TIME (MIN) -------	310	min	HC MOLE FRACTION -------	0.0132	

TABLE 3 -----FIELD DATA AVERAGES

CLIENT :Jotul U.S.A., Inc. TEST No. 5

MODEL: F500 DATE: 21-May-02

****

AVG DELTA H	-------	0.15 in H2O	AVG PRCNT CO	-------	1.28	%
AVG METER TEMP. Tm	-------	86 deg F	AVG PRCNT CO2	-------	7.50	%
AVG PPM SO2	-------	494 PPM	AVG BAL CO2/CO	-------	5.87	%

TABLE 4 ----- CALCULATIONS

CLIENT : Jotul U.S.A., Inc. TEST No. 5

MODEL: F500 DATE: 21-May-02

STD SAMPLE VOL. Vm(std) d) ------	97.03	dscf	STACK GAS FLOW Qsd -------	431.682	dscf/Hr
				7.19	& dscf/min
VOL. WATER VAPOR Vw(s td) -----	7.988	scf	PARTICULATE CONCTRT. C s ------	0.0099	g/dscf
PRCNT MSTR Bws -------	7.61	%	PARTC.EMISS. RATE E -------	4.28	g/Hr
BURN RATE BR -------	1.21	Kg/Hr	MOLES OF GAS PER Lb WOOD Nt ----	0.42	Lb-mole/Lb
CO EMISSION RATE -------	184.56	g/Hr	PART.EMISS. RATE ------	3.54	g/Kgdry fuel
	152.53	& g/Kgdry fuel			

TABLE 5 ----- PROPORTIONAL RATE VARIATION

CLIENT : Jotul U.S.A., Inc. TEST No. : 5

MODEL: F500 DATE: 21-May-02

TIME INTEVAL Ti	PPM * Vm	PROPRTN. RATE VAR. PR	PROPRTN RATE VAR. AVERAGE
5	740.1	97	100
10	750.1	98	
15	753.0	99	
20	752.2	99	
25	752.8	99	
30	752.8	99	
35	752.7	99	
40	752.4	99	
45	750.3	98	
50	756.8	99	
55	755.4	99	
60	759.1	100	
65	759.6	100	
70	760.5	100	
75	762.6	100	
80	762.2	100	
85	763.4	100	
90	765.6	100	
95	765.7	100	
100	766.2	100	
105	764.1	100	
110	765.3	100	
115	763.0	100	
120	762.8	100	
125	762.2	100	
130	764.1	100	
135	764.6	100	
140	763.4	100	
145	765.7	100	
150	765.7	100	
155	765.6	100	
160	765.7	100	
165	766.1	100	
170	765.6	100	
175	765.6	100	
180	765.6	100	
185	766.5	100	
190	766.1	100	
195	766.1	100	
200	766.5	100	
205	766.1	100	
210	766.1	100	
215	766.5	100	
220	766.1	100	

METER BOX DATA SHEET PAGE # 2

Page: 1 of 3

UNIT: F500 RUN: 5 DATE: 05-21-02

Meter Box: 5H Y Factor: 1.000

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: .14 SAMPLING RATIO: 23 : 1 BP: 30.07

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
0	1250	757,000	———	6.983	.15	77	500	77	2.0
5	55	758.500	———	10.723	.36	78	325	78	3.0
10	1300	760.842	760.842	6.050	.11	79	575	79	2.0
15	05	762.173	762.173	6.325	.12	79	550	79	2.0
20	10	763.563	763.563	6.325	.12	79	550	79	2.0
25	15	764.954	764.954	6.325	.12	79	550	79	2.0
30	20	766.345	766.345	5.566	.10	79	625	79	2.0
35	25	767.569	767.569	7.730	.19	79	450	79	2.0
40	30	769.268	769.268	7.730	.19	79	450	79	2.0
45	35	770.967	770.967	8.648	.23	82	400	82	2.0
50	40	772.900	772.900	8.648	.23	82	400	82	2.0
55	45	774.833	774.833	8.616	.23	84	400	84	2.0
ROTO PRESS:		.14	TOTALS:	89.669	2.15	956	BP.:	30.05	
60	1350	776.779	776.779	8.611	.23	84	400	84	2.0
65	55	778.728	778.728	8.595	.23	85	400	85	2.0
70	1400	780.683	780.683	8.074	.20	86	425	86	2.0
75	05	782.530	782.530	8.579	.23	86	400	86	2.0
80	10	784.493	784.493	8.060	.20	87	425	87	2.0
85	15	786.347	786.347	8.045	.20	88	425	88	2.0
90	20	788.208	788.208	7.598	.18	88	450	88	2.0
95	25	789.966	789.966	7.198	.16	88	475	88	2.0
100	30	791.631	791.631	7.211	.16	87	475	87	2.0
105	35	793.290	793.290	6.851	.14	87	500	87	2.0
110	40	794.867	794.867	6.863	.14	86	500	86	2.0
115	45	796.438	796.438	7.224	.16	86	475	86	
			TOTALS:	92.909	2.23	1038	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	182.578	4.38	1994	AVG. BP:		

225	766.1	100
230	766.2	100
235	766.2	100
240	766.2	100
245	766.2	100
250	766.2	100
255	766.2	100
260	766.2	100
265	766.2	100
270	766.2	100
275	766.2	100
280	766.2	100
285	766.2	100
290	766.2	100
295	766.2	100
300	766.2	100
305	766.2	100
310	766.2	100
315		
320		

METER BOX DATA SHEET PAGE # 2

Page: 2 of 3

UNIT : F500 RUN : 5 DATE : 05-21-02

Meter Box: 5H Y Factor: 1.000

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: .14			SAMPLING RATIO: 23			: 1	BP: 30.05		
MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
120	1450	798.091	798.091	7.626	.18	86	450	86	2.0
125	55	799.836	799.836	7.211	.16	87	475	87	2.0
130	1500	801.495	801.495	6.851	.14	87	500	87	2.0
135	05	803.072	803.072	6.524	.13	87	525	87	2.0
140	10	804.573	804.573	6.513	.13	88	525	88	2.0
145	15	806.080	806.080	6.513	.13	88	525	88	2.0
150	20	807.587	807.587	6.838	.14	88	500	88	2.0
155	25	809.169	809.169	6.513	.13	88	525	88	2.0
160	30	810.676	810.676	6.838	.14	88	500	88	2.0
165	35	812.259	812.259	6.838	.14	88	500	88	2.0
170	40	813.841	813.841	6.838	.14	88	500	88	2.0
175	45	815.423	815.423	6.838	.14	88	500	88	2.0
ROTO PRESS: .14			TOTALS:	81.941	1.70	1051	BP.: 30.03		
180	1550	817.005	817.005	6.834	.14	88	500	88	2.0
185	55	818.589	818.589	6.834	.14	88	500	88	2.0
190	1600	820.172	820.172	6.834	.14	88	500	88	2.0
195	05	821.755	821.755	6.834	.14	88	500	88	2.0
200	10	823.339	823.339	6.834	.14	88	500	88	2.0
205	15	824.922	824.922	6.834	.14	88	500	88	2.0
210	20	826.505	826.505	6.834	.14	88	500	88	2.0
215	25	828.089	828.089	6.834	.14	88	500	88	2.0
220	30	829.672	829.672	6.834	.14	88	500	88	2.0
225	35	831.255	831.255	6.508	.13	88	525	88	2.0
230	40	832.763	832.763	6.508	.13	88	525	88	2.0
235	45	834.271	834.271	6.508	.13	88	525	88	2.0
			TOTALS:	81.030	1.65	1056	MAX VACC =		
TOTAL Cu Ft.			TOTALS:	162.971	3.35	2107	AVG. BP:		

METER BOX DATA SHEET PAGE # 2

Page: 3 of 3

UNIT: F500 RUN: 5 DATE: 05-21-02

Meter Box: 5H Y Factor: 1.000

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: .14 SAMPLING RATIO: 23 . : 1 BP: 30.03

MIN	TIME	METER READING	SAMPLE MDCF	STACK DSCFM	DELTA H	METER TEMP	SO2 PPM	ROTO TEMP	PUMP VACC
240	1650	835.779	835.779	6.508	.13	88	525	88	2.0
245	55	837.287	837.287	6.508	.13	88	525	88	2.0
250	1700	838.795	838.795	6.508	.13	88	525	88	2.0
255	05	840.303	840.303	6.508	.13	88	525	88	2.0
260	10	841.811	841.811	6.508	.13	88	525	88	2.0
265	15	843.319	843.319	6.508	.13	88	525	88	2.0
270	20	844.827	844.827	6.508	.13	88	525	88	2.0
275	25	846.335	846.335	6.508	.13	88	525	88	2.0
280	30	847.843	847.843	6.508	.13	88	525	88	2.0
285	35	849.351	849.351	6.508	.13	88	525	88	2.0
290	40	850.859	850.859	6.508	.13	88	525	88	2.0
295	45	852.367	852.367	6.508	.13	88	525	88	2.0
ROTO PRESS:		.14	TOTALS:	78,096	1.56	1056	BP.: 30.03		
300	1750	853.875	853.875	6.508	.13	88	525	88	2.0
305	55	855.383	855.383	6.508	.13	88	525	88	2.0
310	1800	856.891	856.891	6.508	.13	88	525	88	2.0
315	05								
320	10			19.524	.39	264			
325	15			97.620	1.95	1320			
330	20								
335	25								
340	30								
345	35								
350	40								
355	45					5421	163		
			TOTALS:	443.169	9.68	86	MAX VACC =		3.0
TOTAL Cu Ft.		99.891	TOTALS:	7.034	.154	546	AVG. BP: 30.04		

PARTICULATE CATCH / MOISTURE DATA SHEET # 3

UNIT : F500 RUN : 5 DATE : 05 - 21 - 02

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	760.0	597.7	486.3	936.1
INITIAL WT	617.8	587.7	483.6	921.3
NET WT GRAMS	142.2	10.0	2.7	14.8

TOTAL CATCH : 169.7 GRAMS H_2O

FRONT HALF

FILTER #	121F	
FINAL WT g	.9090	•
INITIAL WT g	.6962	•
NET WT g	.2128	•

BEAKER #	71
DESC.	ACETONE
FINAL WT g	104.2205
INITIAL WT g	104.1555
NET WT g	.0650
VOL. DESC. ml	90

BACK HALF

FILTER #	121B	
FINAL WT g	.5153	•
INITIAL WT g	.4110	•
NET WT g	.1043	•

BEAKER #	72	73	74	75	
DESC.	ACETONE	METHCHLOR	H_2O	H_2O	
FINAL WT g	104.1402 •	104.4410 •	107.6038 •	96.5748 •	
INITIAL WT g	103.8327 •	104.3600 •	107.5129 •	96.4715 •	
NET WT g	.3075 •	.0810 •	.0909 •	.1033 •	.1942
VOL. DESC ml	150	75	200	175	(375)

FILTER TARE WEIGHTS DATA SHEET #4-1

Into Dessicator : Date : 04-24-2002 Time : 1850 By : DKW

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

Back Size: 8.2 cm Lot No. : ZB911

	DATE: 05-17	BY:	DATE: 05-19	BY:	DATE:	BY:
FILTER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
121F	.6963	1623	.6962	1537	JOEL F500	R-5
122F	.7031	1624	.7032	1538		
123F	.6989	1625	.6991	1539		
124F	.7095	1626	.7093	1540		
125F	.7076	1627	.7077	1541		
126F	.7022	1628	.7026	1542		
127F	.7056	1629	.7056	1543		
128F	.6936	1630	.6937	1544		
129F	.6894	1632	.6896	1545		
130F	.6957	1633	.6955	1546		

121B	.4110	1634	.4110	1547	JOEL F500	R-5
122B	.4403	1635	.4403	1548		
123B	.4468	1636	.4467	1549		
124B	.4444	1637	.4443	1550		
125B	.4482	1638	.4483	1551		
126B	.4427	1639	.4430	1552		
127B	.4433	1640	.4435	1553		
128B	.4292	1641	.4293	1554		
129B	.4259	1642	.4258	1555		
130B	.4274	1643	.4274	1556		

Checked by: Date: 5-20-02 Time: 1445

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH
05-17	1600			75	48
05-19	1500			77	48

BEAKER TARE WEIGHTS DATA SHEET #4-2

Into Dessicator: Date : 04-24-2002 Time : 1820 By : DKW

	DATE: 05-17	BY:	DATE: 05-19	BY:	DATE:	BY:
BEAKER #	FIRST WEIGHT	TIME	SECOND WEIGHT	TIME	THIRD WEIGHT	TIME
66	96.5130	1606	96.5125	1518		
67	106.2279	1607	106.2276	1519	JOTUL F500	
68	94.1608	1608	94.1606	1520	R-4	
69	108.9974	1609	108.9969	1521		
70	107.4847	1611	107.4845	1523		
71	104.1557	1612	104.1555	1524		
72	103.8325	1613	103.8327	1525	JOTUL F500	
73	104.3597	1614	104.3600	1527	R-5	
74	107.5126	1615	107.5129	1528		
75	96.4716	1616	96.4715	1529		
76	103.8088	1617	103.8088	1530		
77	107.3923	1618	107.3924	1532		
78	94.5006	1620	94.5004	1533		
79	97.6258	1621	97.6257	1534		
80	109.1322	1622	109.1320	1535		

BALANCE ROOM ENVIRONMENTAL CONDITIONS

DATE	TIME	BY	WB	DB	% RH	
05-17	1600			75	48	Checked by C. Worthington
05-19	1500			77	48	Date : 5-20-02
						Time : 1430

WOODSTOVE DATA SHEET # 4-3 : CONSTANT WEIGHTS

UNIT : F500 RUN : 5 DATE : 05-21-02 Page : 1 of 1

Beaker #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
71	05-22	1240		104.2203	05-23	2109		104.2205	05-28	1229					
72	05-22	1240		104.1400	05-23	2110		104.1402	05-28	1230					
73	05-22	1845		104.4534	05-23	2111		104.4412	05-28	1231		104.4410	05-28	1629	
74	05-22	1240		107.6049	05-23	2112		107.6039	05-28	1232		107.6038	05-28	1630	
75	05-22	1240		96.5752	05-23	2113		96.5748	05-28	1233					

Filter #	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By	Weight	Date	Time	By
121F	5-21	1830		.9104	05-22	1209		.9091	05-22	1929		.9090	05-23	2114	
121B	5-21	1830		.5157	05-22	1210		.5153	05-23	1931					

SCALE ROOM ENVIRONMENTAL CONDITIONS

Weighing Session	Date	Time	By	DB	%RH
1	05-22	1155		78	48
2	05-22	1920		78	49
3	05-23	2105		77	48
4	05-28	1225		78	49
5	05-28	1625		78	47

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

Dates: From 02-16-2002
Through 05-17-2002

WOODSTOVE DATA SHEET #4-4
SCALE QA SHEET

Scale: Sartorius
Model: A1205
SN : 37010004

100g weight	10 g weight	1.0 g weight	100 mg weight	Tech	Date	Time	Wet Bulb	Dry Bulb	% RH
100.0000	9.9999	1.0000	.0999	DFW	02-16	1845		77	46
100.0000	9.9999	.9999	.0998	DFW	02-17	1555		77	47
100.0001	9.9999	.9999	.0997	DFW	02-18	0940		77	47
100.0000	10.0000	.9999	.1000	DFW	02-19	1025		78	46
100.0000	9.9999	1.0000	.0999	DFW	02-20	0915		75	42
100.0003	10.0000	1.0000	.0999	DFW	03-14	1020		78	45
99.9999	9.9998	.9998	.0998	DFW	03-15	1725		77	45
99.9999	10.0000	1.0002	.0999	DFW	03-16	1820		77	38
100.0001	9.9999	1.0001	.1000	DFW	03-16	2130		78	43
99.9999	9.9999	.9998	.0998	DFW	03-17	1550		77	43
99.9999	10.0000	1.0001	.0999	DFW	03-17	2045		77	39
99.9998	10.0000	1.0000	.1000	DFW	03-18	1100		77	39
100.0000	9.9999	.9999	.0999	DFW	03-19	1800		76	42
100.0001	10.0000	1.0001	.1000	DFW	03-20	1835		77	45
99.9999	10.0001	.9999	.0999	DFW	03-21	2235		78	45
99.9998	9.9999	1.0000	.1000	DFW	03-24	2205		78	42
99.9998	10.0000	1.0000	.1001	DFW	03-25	1000		78	41
99.9997	10.0000	1.0001	.1000	DFW	04-04	1300		78	49
99.9998	10.0000	1.0000	.0999	DFW	04-05	1210		78	49
99.9997	10.0000	.9999	.0998	DFW	04-05	2230		78	49
99.9999	10.0001	1.0000	.0998	DFW	04-08	1135		78	47
99.9997	10.0000	1.0000	.0999	DFW	04-08	1910		78	48
99.9997	9.9998	.9999	.1000	DFW	04-09	2150		77	48
99.9999	10.0000	1.0001	.0999	DFW	04-10	2205		78	48
100.0000	10.0001	.9999	.0999	DFW	04-11	0940		76	49
99.9997	9.9998	1.0000	.0999	DFW	04-11	1705		78	48
99.9999	9.9999	.9999	.0998	DFW	04-11	2230		78	48
99.9999	10.0001	.9999	.0999	DFW	04-12	0950		78	47
100.0000	9.9998	1.0000	.0999	DFW	04-12	1810		78	48
100.0000	9.9999	.9999	.0998	DFW	04-12	2205		78	47
100.0000	9.9999	.9999	.0999	DFW	04-13	1720		78	48
99.9998	10.0000	1.0000	.0998	DFW	04-13	2325		78	46
99.9999	10.0001	1.0001	.1000	DFW	04-14	1740		78	44
99.9998	10.0000	1.0001	.0999	DFW	04-16	1925		75	44
99.9997	9.9999	1.0000	.1000	DFW	04-19	1350		78	41
100.0000	10.0001	.9998	.0999	DFW	04-20	1210		75	41
99.9998	9.9998	1.0001	.0997	DF	05-16	1430		76	48
99.9999	9.9999	1.0000	.0999	DFW	05-17	1600		75	48

WOODSTOVE DATA SHEET #4-4

SCALE QA SHEET

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

100 g weight	10 g weight	1 g weight	100 mg weight	Tech	Date	Time	Dry Bulb	% RH
99.9999	10.0000	.9999	.0999	AFm	05-18	1905	77	49
99.9997	9.9998	.9999	.0998	AFm	05-19	1500	77	48
99.9999	10.0000	.9998	.0999	AFm	05-20	0855	77	47
99.9998	9.9998	1.0000	.0999	AFm	05-21	0930	78	49
99.9998	9.9999	1.0000	.1000	AFm	05-22	1155	78	48
99.9999	9.9999	1.0000	.1001	AFm	05-22	1920	78	49
99.9999	10.0001	1.0001	.0998	AFm	05-23	2105	77	48
99.9998	9.9998	.9998	.0999	AFm	05-28	1225	78	49
99.9998	9.9997	1.0001	.0999	AFm	05-28	1625	78	47

BLANK PROCESSING DATA SHEET # 5

UNIT: F500 RUN: 5 DATE: 05-21-2002

BLANKS DONE: 02-20-2002

BEAKER	A	B	C
	200 ml ACETONE	75 ml DICHLOR	200 ml WATER
	FISHER OPTIMA LOT # 011755	FISHER OPTIMA LOT # 994669	McKESSON WATER PRODUCTS CO. CERTIFIED DISTILLED
FINAL WEIGHT	108.9015	106.3081	106.9664
TARE WEIGHT	108.9007	106.3064	106.9660
NET WEIGHT	.0008 ✓	.0017 ✓	.0004 ✓

TARE BEAKERS INTO DESC: TIME: 1205 DATE: 02-15-2002

DATE: 02-16 BY: [illegible] DATE: 02-17 BY: [illegible] DATE: BY:

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9002	1849	108.9007	1611 ✓		
B	106.3068	1850	106.3064	1612 ✓		
C	106.9661	1851	106.9660	1613 ✓		

FINAL BEAKERS INTO DESC: TIME: 1125 DATE: 02-18-2002

DATE: 02-19 BY: [illegible] DATE: 02-20 BY: [illegible] DATE: BY:

BEAKER	1 ST WT	TIME	2 ND WT	TIME	3 RD WT	TIME
A	108.9016	1027	108.9015	0917 ✓		
B	106.3084	1028	106.3081	0918 ✓		
C	106.9664	1029	106.9664	0919 ✓		

TARE QC

DATE	TIME	BY	WB	DB	%
02-16	1845	[illegible]		77	46
02-17	1555	[illegible]		77	47

FINAL QC

DATE	TIME	BY	WB	DB	%
02-19	1025	[illegible]		78	46
02-20	0915	[illegible]		75	42

NET PARTICULATE CATCH CALCULATION DATA SHEET #6

UNIT : F500 RUN : 5 DATE : 05-21-02

BLANK CALCULATIONS

Acetone : .0008 g ÷ 200 ml = .000004 g/ml
Dicholoromethane : .0017 g ÷ 75 ml = .000023 g/ml
Distilled Water : .0004 g ÷ 200 ml = .000002 g/ml

FRONT HALF CATCH

FILTERS : .2128 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .2128 g

BEAKERS : .0650 (Total Catch) g - 90 (ml Acetone) (.000004 g) (Blank Value / ml Acetone) = .0646 g

TOTAL FRONT HALF CATCH : .2774 g

BACK HALF CATCH

FILTERS : .1043 (Total Catch) g - 1 (# of Filters) (.0000 g) (Blank Value / Filter) = .1043 g

BEAKERS :

Acetone : .3075 (Total Catch) g - 150 (ml Acetone) (.000004 g) (Blank Value / ml Acetone) = .3069 g

Extract : .0810 (Total Catch) g - 75 (ml Dichloromethane) (.0017 .000023 g) (Blank Value / Dichloromethane) = .0793 g

Water : .1942 (Total Catch) g - 375 (ml Water) (.000002 g) (Blank Value / Water) = .1934 g

TOTAL BACK HALF CATCH : .6839 g

TOTAL CATCH : .9613 g

% FRONT HALF : 28.7 %

CALCULATIONS DATA SHEET # 7

UNIT : F500 RUN : 5 DATE : 05-21-02

1) $Vm(std) = \dfrac{(99.891\ Vm)(17.64)(1.000\ mcf)\left(30.04" Hg + \frac{.154" H_2O}{13.6}\right)}{(546\ TmA)} = \dfrac{96.9831}{000.0000}$ dscf

2) $Vw(std) = (.04707)(169.7\ ml\ H_2O) = \dfrac{7.9878}{00.0000}$ scf

3) $Asw = \dfrac{(7.9878\ scf)}{(7.9878\ scf + 96.9831\ dscf)} = \dfrac{.0761}{.0000}$ Bws × 100 = $\dfrac{7.6095}{00.0000}$ % H_2O

4) $Cs = \dfrac{(.9613\ g.)}{(96.9831\ dscf)}(15.43) = \dfrac{.1529}{0.0000}$ gr / dscf

5) Estimated g / hr = $\dfrac{(.9613\ g.)}{(96.9831\ dscf)}\left(\dfrac{7.034}{00.0000}\ dscfm\right)(60) = \dfrac{4.1833}{00.0000}$ 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 : F500 RUN : 5 DATE : 05-21-02

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

Wet Bulb / Dry Bulb

Pre : WB : 60 DB : 71 = 52 % RH 1.4 % H_2O

Post : WB : 60 DB : 77 = 35 % RH 1.1 % H_2O

Average : 43.5 % RH 1.25 % H_2O

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

Kindling Weight (lbs) : Paper : .2 Wood : 2.8

Preburn Fuel Weight : 17.5 + 14.2 + 13.5 + 3.3 Total : 48.5

Kindling & Preburn Fuel Weight (wood only) (lbs) : **Total :** 51.3

Coal Bed Wt Range (lbs) : 4.1 - 3.4 **Scale :** 4.1 - 3.4

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 :** 4.0

Maximum Coal Bed Removal (lbs) : ((4.1 (Upper) + 3.4 (Lower)) ÷ 2) .25 = .9 (round down to nearest tenth)

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

Dimensions	Length in inches	No. Pcs	Weight in lbs	% of Load
2" x 4"	17	3	6.3	38.0
4" x 4"	17	2	10.3	62.0

Test Fuel Weight : 16.6 lbs

Estimated Dry Burn Rate :

$$\frac{16.6 - (16.6 \times .16985)}{2.2046} \times \frac{60}{\frac{310}{\text{TIME}}} = 1.210 \text{ kg / hr}$$

Estimated BTU's/hr : $19{,}140 \times \frac{63}{100} \times \frac{1.210}{\text{DBR}} = 14{,}588.4$ BTU's/hr

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

WOOD STOVE OPERATING DATA PAGE #9

Unit : F500 Run : 5 Date : 05-21-02

FIRE STARTED: 0820

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 25 sec.

TEST:

DOOR wide open during loading 0 min. 40 sec.

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

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

FAN:

ON / OFF during warm-up

ON / OFF first ALL minutes of test

Fan speed set at OFF

ON / OFF during preburn

ON / OFF balance of test run

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

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

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

All Grades WCLB rules:

WARM UP INFORMATION:

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

1st warm up / pre-burn fuel charge (17.5 lbs.) added at 0735

2nd warm up / pre-burn fuel charge (14.2 lbs.) added at 0900

3rd warm up / pre-burn fuel charge (13.5 lbs.) added at 1015

4th warm up / pre-burn fuel charge (3.3 lbs.) added at 1140

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

TEST DATA SHEET #10

Unit : F500 Run : 5 Date : 05-21-02

Room Temperature : 70 °F Correction Factor : Ø

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

Time Test Fuel moisture reading taken : 1045

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	11.5	12.2	11.0	11.7	11.0	11.7	11.867
2									
3									
4	2"×4"×8'	P	18.0	19.2	18.0	19.2	18.0	19.2	19.200
5	2"×4"×8'	P	19.5	20.9	18.0	19.2	18.0	19.2	19.767
6	2"×4"×8'	P	20.0	21.4	19.5	20.9	20.5	22.0	21.433
7	2"×4"×8'	P	19.5	20.9	19.0	20.3	19.0	20.3	20.500
8	2"×4"×8'	P							80.900
9									
10									
11									
12	2×4×17	T	17.5	18.7	17.5	18.7	18.0	19.2	18.867
13	"	T	18.0	19.2	18.0	19.2	18.0	19.2	19.200
14	"	T	23.5	25.2	23.0	24.7	23.5	25.2	25.033
15	4×4×17	T	18.5	19.8	18.0	19.2	18.0	19.2	19.400
16	"	T	18.5	19.8	18.5	19.8	18.5	19.8	19.800
17									102.300
18									
19									
20	Spacers	T	17.5	18.7	18.0	19.2	18.5	19.8	19.233

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

	KINDLING	PRETEST FUEL	TEST FUEL
Dry Moisture % :	11.867 %	20.225 %	20.460 %
Wet Moisture % :	10.608 %	16.823 %	16.985 %

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°

WEIGHT: 4.0

UNIT: F500

GAS DATA SHEET # 12

RUN: 5 DATE: 05-21-02 PAGE: 1 of 3

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	WB	DB	% H_2O	CAL WB	STACK	STATIC	SO_2 PPM
0 / 1250	20.6	16.6	—	.213	5.3	.578	14.5	.115	1.16					231	-.040	500
5 / 55	20.0	16.0	.6	.324	8.1	.468	11.7	.045	.46					342	-.056	325
10 / 1300	19.6	15.6	.4	.152	3.8	.651	16.3	.095	.96					241	-.045	575
15 / 05	19.2	15.2	.4	.177	4.4	.632	15.8	.102	1.03					223	-.043	550
20 / 10	18.8	14.8	.4	.221	5.5	.593	14.9	.105	1.06					218	-.042	550
25 / 15	18.2	14.2	.6	.305	7.6	.491	12.3	.120	1.21					250	-.049	550
30 / 20	17.7	13.7	.5	.261	6.5	537	13.4	.156	1.57					246	-.047	625
35 / 25	17.1	13.1	.6	.360	9.0	.443	11.1	.057	.58					287	-.054	450
40 / 30	16.1	12.1	1.0	.386	9.6	.440	11.0	.034	.35					307	-.056	450
45 / 35	15.7	11.7	.4	.496	12.3	.346	8.6	.028	.29					332	-.058	400
50 / 40	15.0	11.0	.7	.506	12.6	.335	8.4	.021	.22					346	-.058	400
55 / 45	14.4	10.4	.6	.527	13.1	.319	8.0	.017	.18					358	-.059	400
TOTAL	*****	****	****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	3381	-.607	*****
60 / 1350	13.6	9.6	.8	.609	15.2	.240	6.0	.021	.22					385	-.059	400
65 / 55	12.7	8.7	.9	.612	15.2	.249	6.1	.030	.31					401	-.061	400
70 / 1400	12.1	8.1	.6	.557	13.9	.291	7.3	.009	.10					391	-.060	425
75 / 05	11.5	7.5	.6	.519	12.9	.322	8.0	.009	.10					387	-.060	400
80 / 10	10.9	6.9	.6	.494	12.3	.347	8.7	.016	.17					367	-.059	425
85 / 15	10.4	6.4	.5	.533	13.3	.315	7.9	.008	.09					367	-.058	425
90 / 20	9.9	5.9	.5	.449	11.2	.371	9.3	.028	.29					356	-.068	450
95 / 25	9.5	5.5	.4	.427	10.6	.384	9.6	.061	.62					343	-.067	475
100 / 30	9.2	5.2	.3	.390	9.7	.401	10.0	.076	.77					327	-.061	475
105 / 35	8.8	4.8	.4	.423	10.5	.376	9.4	.065	.66					329	-.059	500
110 / 40	8.4	4.4	.4	.453	11.3	.358	8.9	.051	.52					326	-.056	500
115 / 45	8.0	4.0	.4	.484	12.0	.341	8.5	.037	.38					327	-.054	475
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	4306	-.722	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	7687	-1.329	*****

WEIGHT: 1.0

UNIT: F500

GAS DATA SHEET # 12

RUN: 5 DATE: 05-21-02 PAGE: 2 of 3

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	WB	DB	% H_2O	CAL WB	STACK	STATIC	SO_2PPM
120 1450	7.5	3.5	.5	.418	10.4	.386	9.6	.040	.41					320	-.050	450
125 55	7.3	3.3	.2	.325	8.1	.446	11.2	.110	1.11					302	-.055	475
130 1500	7.1	3.1	.2	.316	7.9	.446	11.2	.120	1.21					284	-.050	500
135 05	6.9	2.9	.2	.295	7.3	.476	11.9	.128	1.29					256	.046	525
140 10	6.8	2.8	.1	.295	7.3	.479	12.0	.120	1.21					257	-.044	525
145 15	6.6	2.6	.2	.286	7.1	.484	12.1	.141	1.42					249	-.043	525
150 20	6.5	2.5	.1	.274	6.8	.499	12.5	.124	1.25					242	-.041	500
155 25	6.4	2.4	.1	.276	6.9	.497	12.4	.114	1.15					237	-.041	525
160 30	6.3	2.3	.1	.270	6.7	.502	12.6	.129	1.30					232	-.040	500
165 35	6.2	2.2	.1	.260	6.5	.510	12.8	.154	1.55					228	-.040	500
170 40	6.1	2.1	.1	.259	6.4	.512	12.8	.154	1.55					225	-.040	500
175 45	6.0	2.0	.1	.259	6.4	.510	12.8	.161	1.62					220	-.039	500
TOTAL	*****	****	****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	3052	-.529	*****
180 1550	5.9	1.9	.1	.255	6.3	.513	12.8	.169	1.70					218	-.039	500
185 55	5.8	1.8	.1	.249	6.2	.525	13.1	.164	1.65					214	-.039	500
190 1600	5.7	1.7	.1	.249	6.2	.526	13.2	.158	1.59					212	-.038	500
195 05	5.6	1.6	.1	.265	6.6	.515	12.9	.135	1.36					211	-.038	500
200 10	5.5	1.5	.1	.266	6.6	.519	13.0	.111	1.12					212	-.038	500
205 15	5.4	1.4	.1	253	6.3	.527	13.2	.133	1.34					212	-.038	500
210 20	5.3	1.3	.1	.232	5.8	.547	13.7	.155	1.56					206	-.037	500
215 25	5.2	1.2	.1	.233	5.8	.547	13.7	.151	1.52					204	-.037	500
220 30	5.1	1.1	.1	.193	4.8	.571	14.3	.229	2.29					199	-.036	500
225 35	5.1	1.1	0	.192	4.8	.570	14.3	.226	2.26					196	-.034	525
230 40	5.0	1.0	.1	.199	4.9	.570	14.3	.201	2.02					194	-.033	525
235 45	4.9	.9	.1	.204	5.1	.567	14.2	.196	1.97					193	-.033	525
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	2471	-.440	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	5523	-.969	*****

WEIGHT: 4.0

UNIT: F500

GAS DATA SHEET # 12

RUN: 5 DATE: 05-21-02 PAGE: 3 of 3

TIME	SCALE	FUEL	DROP	V.	CO_2	V.	O_2	V.	CO	WB	DB	% H_2O	CAL WB	STACK	STATIC	SO_2 PPM
240 1650	4.9	.9	⊖	.191	4.7	.574	14.4	.228	2.28					191	-.032	525
245 55	4.8	.8	.1	.190	4.7	.574	14.4	.230	2.30					189	-.032	525
250 1700	4.7	.7	.1	.189	4.7	.573	14.3	.229	2.29					187	-.031	525
255 05	4.7	.7	⊖	.188	4.7	.578	14.5	.224	2.24					187	-.031	525
260 10	4.6	.6	.1	.188	4.7	.578	14.5	.224	2.24					186	-.031	525
265 15	4.5	.5	.1	.188	4.7	.578	14.5	.224	2.24					185	-.031	525
270 20	4.5	.5	⊖	.186	4.6	.583	14.6	.200	2.01					183	-.031	525
275 25	4.4	.4	.1	.201	5.0	.582	14.6	.163	1.64					183	-.030	525
280 30	4.3	.3	.1	.192	4.8	.585	14.7	.178	1.79					182	-.030	525
285 35	4.3	.3	⊖	.191	4.7	.582	14.6	.189	1.90					181	-.030	525
290 40	4.2	.2	.1	.187	4.6	.583	14.6	.198	1.99					181	-.030	525
295 45	4.2	.2	⊖	.180	4.5	.584	14.6	.225	2.25					180	-.030	525
TOTAL	*****	****	****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	2215	-.369	*****
300 1750	4.1	.1	.1	.177	4.4	.587	14.7	.220	2.20					179	-.030	525
305 55	4.1	.1	⊖	.175	4.3	.588	14.7	.220	2.20					178	-.030	525
310 1800	4.0	⊖	.1	.172	4.3	.592	14.8	.211	2.11					177	-.030	525
315 05																
320 10														534	-.090	
325 15																
330 20																
335 25																
340 30																
345 35																
350 40																
355 45																-.163
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	15959	-2.757	*****
TOTAL	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	253	-.044	*****

PRELIMINARY TEST SHEET #1

UNIT: F500 RUN: 5 DATE: 05-21-02 PAGE: 1 of 1

TIME	SCALE	DROP	STACK	TOP	LF SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	STATIC	COMMENTS
0 1140	7.8	—	351	427	194	355	406	289	922	881	73	-.058	PREBURN START: # 4 UP
5 45	7.6	.2	273	400	191	350	400	295	833	706	72	-.050	COAL BED SCALE RANGE:
10 50	7.3	.3	255	376	191	339	393	300	792	674	72	-.048	4.1 → 3.4
15 55	7.1	.2	273	354	181	328	382	300	757	645	71	-.047	PRIMARY AIR: 1/8"
20 1200	6.7	.4	288	339	265	317	369	296	737	890	71	-.045	SECONDARY AIR: N/A
25 05	6.4	.3	315	364	258	309	358	292	723	1112	71	-.049	FAN: OFF
30 10	6.1	.3	326	382	256	302	351	290	718	1090	70	-.050	PUMPS ON AT: 1220
35 15	5.7	.4	344	403	249	294	340	283	721	1102	69	-.051	CHECK WB/DB: N/A
40 20	5.2	.5	363	430	249	289	332	278	726	1193	69	-.056	
45 25	5.0	.2	319	418	246	288	326	274	720	845	69	-.050	
50 30	4.3	.1	254	368	244	286	322	268	688	723	70	-.045	took out .6 @ 1230
55 35	4.2	.1	231	343	239	279	317	268	703	700	72	-.042	
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	
60 1240	4.2	0	223	331	235	278	314	265	697	685	71	-.041	
65 45	4.2	0	215	316	232	274	307	262	689	670	71	-.040	
70 50	4.0	.2	231	302	230	271	302	260	649	596	70	-.040	273.0 ΔT
75 55													

TEMPERATURE DATA SHEET # 14

UNIT: F500 RUN: 5 DATE: 05-21-02 PAGE 1 of 3

TIME	TOP	LT SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	FURNACE	SAMPLE	SAMP IMP	C-GAS	GAS IMP	SO_2 IMP	2730
0 / 1250	302	230	271	302	260	649	596	70	1286	238	65	239	36	35	
5 / 55	371	223	263	293	265	557	832	69	1290	240	44	243	36	37	
10 / 1300	326	218	256	285	274	524	596	68	1291	239	45	245	34	36	
15 / 05	303	211	246	274	274	506	567	67	1290	239	45	245	36	37	
20 / 10	289	204	238	263	269	493	663	67	1292	238	46	246	36	37	
25 / 15	313	201	232	257	264	483	779	67	1298	239	46	247	36	37	
30 / 20	325	196	227	248	260	479	1048	67	1308	238	46	245	35	37	
35 / 25	378	193	223	239	250	498	1254	67	1313	239	46	246	35	36	
40 / 30	415	194	225	234	247	514	1261	70	1315	241	45	247	35	34	
45 / 35	457	200	224	231	242	530	1279	72	1318	243	46	260	34	35	
50 / 40	506	200	234	229	234	569	1340	74	1328	242	46	250	36	35	
55 / 45	524	203	236	230	232	561	1346	74	1327	243	46	248	36	36	
TOTAL	4509	2473	2875	3085	3071	6363	11561	832	*****	*****	*****	*****	*****	*****	
60 / 1350	545	204	235	231	231	553	1348	75	1327	245	47	246	36	37	
65 / 55	565	218	245	233	226	614	1334	76	1328	242	47	244	37	36	
70 / 1400	564	215	248	236	226	635	1280	77	1331	246	47	244	36	35	
75 / 05	555	216	258	242	223	659	1248	78	1336	246	47	247	35	34	
80 / 10	507	227	264	247	221	668	1243	78	1338	242	48	247	34	35	
85 / 15	554	232	269	252	227	690	1256	78	1338	242	48	248	35	36	
90 / 20	542	236	272	257	222	696	1199	78	1341	243	49	250	36	36	
95 / 25	435	241	273	259	224	708	1174	77	1343	243	49	251	36	35	
100 / 30	507	257	274	266	227	712	1154	75	1344	243	50	253	35	34	
105 / 35	508	251	278	271	228	725	1199	76	1345	242	49	252	36	36	
110 / 40	509	248	281	274	229	738	1240	75	1346	241	50	252	37	36	
115 / 45	511	245	284	279	230	751	1280	75	1348	240	50	253	36	38	
TOTAL	6302	2790	3181	3047	2714	8149	14955	918	*****	*****	*****	*****	*****	*****	
TOTAL	10811	5263	6056	6132	5785	14512	26516	1750	*****	*****	*****	*****	*****	*****	

TEMPERATURE DATA SHEET # 14

UNIT: F500 RUN: 5 DATE: 05-21-02 PAGE 1 of 3

TIME	TOP	LT SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	FURNACE	SAMPLE	SAMP IMP	C-GAS	GAS IMP	SO_2 IMP	273.0
0 / 1250	302	230	271	302	260	649	596	70	1286	238	65	239	36	35	
5 / 55	371	223	263	293	265	557	832	69	1290	240	44	243	36	37	
10 / 1300	326	218	256	285	274	524	596	68	1291	239	45	245	34	36	
15 / 05	303	211	246	274	274	506	567	67	1290	239	45	245	36	37	
20 / 10	289	204	238	263	269	493	663	67	1292	238	46	246	36	37	
25 / 15	313	201	232	257	264	483	779	67	1298	239	46	247	36	37	
30 / 20	325	196	227	248	260	479	1048	67	1308	238	46	245	35	37	
35 / 25	378	193	223	239	250	498	1254	67	1313	239	46	246	35	36	
40 / 30	415	194	225	234	247	514	1261	70	1315	241	45	247	35	34	
45 / 35	457	200	224	231	242	530	1279	72	1318	243	46	260	34	35	
50 / 40	506	200	234	229	234	569	1340	74	1328	242	46	250	36	35	
55 / 45	524	203	236	230	232	561	1346	74	1327	243	46	248	36	36	
TOTAL	4509	2473	2875	3085	3071	6363	11561	832	*****	*****	*****	*****	*****	*****	
60 / 1350	545	204	235	231	231	553	1348	75	1327	245	47	246	36	37	
65 / 55	565	218	245	233	226	614	1334	76	1328	242	47	244	37	36	
70 / 1400	564	215	248	236	226	635	1280	77	1331	246	47	244	36	35	
75 / 05	555	216	258	242	223	659	1248	78	1336	246	47	247	35	34	
80 / 10	507	227	264	247	221	668	1243	78	1338	242	48	247	34	35	
85 / 15	554	232	269	252	227	690	1256	78	1338	242	48	248	35	36	
90 / 20	542	236	272	257	222	696	1199	78	1341	243	49	250	36	36	
95 / 25	435	241	273	259	224	708	1174	77	1343	243	49	251	36	35	
100 / 30	507	257	274	266	227	712	1154	75	1344	243	50	253	35	34	
105 / 35	508	251	278	271	228	725	1199	76	1345	242	49	252	36	36	
110 / 40	509	248	281	274	229	738	1240	75	1346	241	50	252	37	36	
115 / 45	511	245	284	279	230	751	1280	75	1348	240	50	253	36	38	
TOTAL	6302	2790	3181	3047	2714	8149	14955	918	*****	*****	*****	*****	*****	*****	
TOTAL	10811	5263	6056	6132	5785	14512	26516	1750	*****	*****	*****	*****	*****	*****	

TEMPERATURE DATA SHEET # 14

UNIT: F500 RUN: 5 DATE: 05-21-02 PAGE 1 of 3

TIME	TOP	LT SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	FURNACE	SAMPLE	SAMP IMP	C-GAS	GAS IMP	SO_2 IMP	273.0
0 / 1250	302	230	271	302	260	649	596	70	1286	238	65	239	36	35	
5 / 55	371	223	263	293	265	557	832	69	1290	240	44	243	36	37	
10 / 1300	326	218	256	285	274	524	596	68	1291	239	45	245	34	36	
15 / 05	303	211	246	274	274	506	567	67	1290	239	45	245	36	37	
20 / 10	289	204	238	263	269	493	663	67	1292	238	46	246	36	37	
25 / 15	313	201	232	257	264	483	779	67	1298	239	46	247	36	37	
30 / 20	325	196	227	248	260	479	1048	67	1308	238	46	245	35	37	
35 / 25	378	193	223	239	250	498	1254	67	1313	239	46	246	35	36	
40 / 30	415	194	225	234	247	514	1261	70	1315	241	45	247	35	34	
45 / 35	457	200	224	231	242	530	1279	72	1318	243	46	260	34	35	
50 / 40	506	200	234	229	234	569	1340	74	1328	242	46	250	36	35	
55 / 45	524	203	236	230	232	561	1346	74	1327	243	46	248	36	36	
TOTAL	4509	2473	2875	3085	3071	6363	11561	832	*****	*****	*****	*****	*****	*****	
60 / 1350	545	204	235	231	231	553	1348	75	1327	245	47	246	36	37	
65 / 55	565	218	245	233	226	614	1334	76	1328	242	47	244	37	36	
70 / 1400	564	215	248	236	226	635	1280	77	1331	246	47	244	36	35	
75 / 05	555	216	258	242	223	659	1248	78	1336	246	47	247	35	34	
80 / 10	507	227	264	247	221	668	1243	78	1338	242	48	247	34	35	
85 / 15	554	232	269	252	227	690	1256	78	1338	242	48	248	35	36	
90 / 20	542	236	272	257	222	696	1199	78	1341	243	49	250	36	36	
95 / 25	435	241	273	259	224	708	1174	77	1343	243	49	251	36	35	
100 / 30	507	257	274	266	227	712	1154	75	1344	243	50	253	35	34	
105 / 35	508	251	278	271	228	725	1199	76	1345	242	49	252	36	36	
110 / 40	509	248	281	274	229	738	1240	75	1346	241	50	252	37	36	
115 / 45	511	245	284	279	230	751	1280	75	1348	240	50	253	36	38	
TOTAL	6302	2790	3181	3047	2714	8149	14955	918	*****	*****	*****	*****	*****	*****	
TOTAL	10811	5263	6056	6132	5785	14512	26516	1750	*****	*****	*****	*****	*****	*****	

TEMPERATURE DATA SHEET # 14

UNIT: F500 RUN: 5 DATE: 05-21-02 PAGE 1 of 3

TIME	TOP	LT SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	FURNACE	SAMPLE	SAMP IMP	C-GAS	GAS IMP	SO_2 IMP	273.0
0 / 1250	302	230	271	302	260	649	596	70	1286	238	65	239	36	35	
5 / 55	371	223	263	293	265	557	832	69	1290	240	44	243	36	37	
10 / 1300	326	218	256	285	274	524	596	68	1291	239	45	245	34	36	
15 / 05	303	211	246	274	274	506	567	67	1290	239	45	245	36	37	
20 / 10	289	204	238	263	269	493	663	67	1292	238	46	246	36	37	
25 / 15	313	201	232	257	264	483	779	67	1298	239	46	247	36	37	
30 / 20	325	196	227	248	260	479	1048	67	1308	238	46	245	35	37	
35 / 25	378	193	223	239	250	498	1254	67	1313	239	46	246	35	36	
40 / 30	415	194	225	234	247	514	1261	70	1315	241	45	247	35	34	
45 / 35	457	200	224	231	242	530	1279	72	1318	243	46	250	34	35	
50 / 40	506	200	234	229	234	569	1340	74	1328	242	46	250	36	35	
55 / 45	524	203	236	230	232	561	1346	74	1327	243	46	248	36	36	
TOTAL	4509	2473	2875	3085	3071	6363	11561	832	*****	*****	*****	*****	*****	*****	
60 / 1350	545	204	235	231	231	553	1348	75	1327	245	47	246	36	37	
65 / 55	565	218	245	233	226	614	1334	76	1328	242	47	244	37	36	
70 / 1400	564	215	248	236	226	635	1280	77	1331	246	47	244	36	35	
75 / 05	555	216	258	242	223	659	1248	78	1336	246	47	247	35	34	
80 / 10	507	227	264	247	221	668	1243	78	1338	242	48	247	34	35	
85 / 15	554	232	269	252	227	690	1256	78	1338	242	48	248	35	36	
90 / 20	542	236	272	257	222	696	1199	78	1341	243	49	250	36	36	
95 / 25	435	241	273	259	224	708	1174	77	1343	243	49	251	36	35	
100 / 30	507	257	274	266	227	712	1154	75	1344	243	50	253	35	34	
105 / 35	508	251	278	271	228	725	1199	76	1345	242	49	252	36	36	
110 / 40	509	248	281	274	229	738	1240	75	1346	241	50	252	37	36	
115 / 45	511	245	284	279	230	751	1280	75	1348	240	50	253	36	38	
TOTAL	6302	2790	3181	3047	2714	8149	14955	918	*****	*****	*****	*****	*****	*****	
TOTAL	10811	5263	6056	6132	5785	14512	26516	1750	*****	*****	*****	*****	*****	*****	

TEMPERATURE DATA SHEET # 14

UNIT: F500 RUN: 5 DATE: 05-21-02 PAGE 2 of 3

TIME	TOP	LT SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	FURNACE	SAMPLE	SAMP IMP	C-GAS	GAS IMP	SO_2 IMP	273.0
120 1450	493	252	285	286	232	755	1059	75	1348	239	50	253	34	35	
125 55	469	254	287	289	232	762	1004	76	1350	238	51	253	35	36	
130 1500	447	256	290	292	232	770	944	76	1352	238	50	253	35	36	
135 05	425	253	290	297	232	776	913	78	1355	239	51	256	36	38	
140 10	406	253	293	300	233	777	895	79	1355	239	51	254	36	37	
145 15	389	253	292	303	236	777	860	79	1355	239	51	252	36	37	
150 20	372	252	293	304	239	773	808	79	1350	239	52	252	36	37	
155 25	359	252	292	305	241	769	798	79	1343	238	52	251	36	37	
160 30	348	250	290	305	242	763	776	80	1336	238	52	251	35	36	
165 35	338	246	289	303	245	757	760	78	1330	237	52	249	35	36	
170 40	331	245	288	302	245	754	746	78	1327	237	53	247	35	36	
175 45	321	244	284	300	247	746	731	78	1321	236	53	245	35	36	
TOTAL	4698	3010	3473	3586	2856	9179	10294	935	*****	*****	*****	*****	*****	*****	
180 1550	317	242	283	299	248	742	719	78	1321	235	53	245	35	36	
185 55	309	240	280	296	249	725	690	78	1319	235	52	244	35	36	
190 1600	304	239	277	295	251	716	705	78	1317	234	53	243	36	36	
195 05	301	236	274	292	252	705	721	77	1316	234	53	243	35	36	
200 10	300	235	273	289	252	701	748	77	1313	233	53	243	35	36	
205 15	296	233	270	288	251	693	741	77	1311	233	53	242	37	36	
210 20	292	230	269	288	251	685	685	77	1310	232	53	242	37	36	
215 25	288	229	268	286	252	680	691	77	1308	232	53	241	36	37	
220 30	281	227	265	284	252	665	615	76	1307	231	54	242	36	35	
225 35	276	228	264	283	252	651	600	78	1307	233	54	246	35	36	
230 40	271	226	261	282	251	640	595	78	1312	234	54	247	35	35	
235 45	266	225	258	279	248	633	591	78	1316	234	55	249	35	35	
TOTAL	3501	2790	3242	3461	3009	8236	8101	929	*****	*****	*****	*****	*****	*****	
TOTAL	8199	5800	6715	7047	5865	17415	18395	1864	*****	*****	*****	*****	*****	*****	

TEM. ..RAT..E D.... SH..T # ..

UNIT: F500 RUN: 5 DATE: 05-21-02 PAGE 3 of 3

TIME	TOP	LT SIDE	BACK	RT SIDE	BOTTOM	FIREBOX	SEC/CAT	AMBIENT	FURNACE	SAMPLE	SAMP IMP	C-GAS	GAS IMP	SO_2 IMP	273.0
240 1650	262	223	255	277	247	625	576	78	1318	234	55	248	37	36	
245 55	258	221	250	274	244	618	569	79	1320	235	55	247	38	37	
250 1700	255	218	250	272	243	612	566	78	1321	235	55	247	37	37	
255 05	253	216	248	271	243	609	569	78	1322	235	56	247	36	37	
260 10	250	214	246	269	241	607	569	78	1323	235	56	247	37	36	
265 15	247	213	243	266	240	604	565	78	1323	235	56	247	37	35	
270 20	244	209	242	264	238	601	567	78	1323	235	56	248	36	36	
275 25	244	208	240	262	237	598	563	78	1323	235	56	248	37	35	
280 30	241	206	238	258	237	603	552	78	1322	235	56	248	36	35	
285 35	239	206	238	256	237	607	557	78	1321	235	57	248	37	34	
290 40	238	202	238	253	234	607	559	77	1322	235	57	248	35	34	
295 45	236	201	235	251	233	606	544	77	1322	235	57	248	36	34	
TOTAL	2967	2537	2923	3173	2874	7297	6756	935	*****	*****	*****	*****	*****	*****	
300 1750	234	199	235	247	233	603	541	77	1322	235	57	248	35	35	
305 55	232	197	235	245	232	600	537	77	1321	235	57	248	36	35	
310 1800	231	195	233	245	232	594	534	77	1321	235	57	248	36	34	
315 05															
320 10	697	591	703	737	697	1797	1612	231							
325 15											273.0	•			
330 20											227.2	•			
335 25											-45.8	ΔT			
340 30															
345 35															
350 40															
355 45									÷63.						
TOTAL	22674	14191	16397	17089	15221	41021	53279	4780	*****	*****	*****	*****	*****	*****	
TOTAL	360	225	260	271	242	651	846	76	*****	*****	*****	*****	*****	*****	

ZERO / SPAN CHECK DATA SHEET #15-1

Date : 05-21-2002 Analyte : CO_2 (15-1)

Unit : F500 Run # : 5

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 % CO_2 Cyl. Press. : 2000 PSI

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

Span Cyl. # : CC12767 Conc. : 12.49 % CO_2 Cyl. Press. : 1420 PSI

Certified by : AIR LIQUIDE Date : 02-15-02

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 : 1115 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	.003	+.003	+.013
SPAN	50.0	.500	12.49	50.2	.502	12.491	+.001	+.006

POST RUN Audit : by : D. Wadington Time : 1820 Temp : 74 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	%	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.001	.003	+.003	+.013
SPAN	50.0	.500	12.49	50.0	.500	12.442	-.048	-.194

± 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 : 05-21-2002 Analyte : O_2 (15-2)

Unit : F500 Run # : 5

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 % O_2 Cyl. Press. : 2000 PSI

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

Span Cyl. # : CC12767 Conc. : 12.50 % O_2 Cyl. Press. : 1420 PSI

Certified by : AIR LIQUIDE Date : 02-15-02

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. Washington Time : 1115 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	.003	.011	+.011	+.043
SPAN	12.50	.500	12.50	12.49	.499	12.488	-.012	-.047

POST RUN Audit : by : A. Washington Time : 1820 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	.004	.036	+.036	+.144
SPAN	12.50	.500	12.50	12.49	.499	12.488	-.012	-.047

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

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

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

ZERO / SPAN CHECK DATA SHEET #15-3

Date : 05-21-2002 Analyte : CO (15-3)

Unit : F5DO Run # : 5

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 % CO Cyl. Press. : 2000 PSI

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

Span Cyl. # : CC12767 Conc. : 4.80 % CO Cyl. Press. : 1420 PSI

Certified by : AIR LIQUIDE Date : 02-15-02

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 : 1115 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	,014	+,014	+.141
SPAN	48.0	.480	4.80	48.0	,480	4.793	-,007	-,066

POST RUN Audit : by : A. Washington Time : 1820 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	,004	+,004	+,041
SPAN	48.0	.480	4.80	48.1	,481	4.803	+,003	+,034

± 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 : 05-21-2002 Analyte : SO_2 (15-4)

Unit : F500 Run # : 5

Zero Cyl. # : 042TAC 2-A Conc. : 0.00 ppm SO_2 Cyl. Press. : 2000 PSI

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

Span Cyl. # : CC62184 Conc. : 1290 ppm SO_2 Cyl. Press. : 1350 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. Washington Time : 1105 Temp : 82 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.1	.001	8.385	+8.385	+.335
SPAN	51.6	.516	1290	51.7	.517	1294.729	+4.729	+.189

POST RUN Audit : by : D. Washington Time : 1815 Temp : 75 °F

AUDIT RESULTS

Point #	Expected Response			Actual Response			± Conc. Difference	Δ %
	Meter	DVM	PPM	Meter	DVM	%		
ZERO	00.0	.000	00.0	00.2	.002	10.878	+10.878	+.435
SPAN	51.6	.516	1290	51.5	.515	1289.743	-.257	-.010

± 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 : F500 RUN : 5 DATE : 05-21-02

Thermocouple Check:

T/C # 1	— °F	T/C # 13	72.0 °F
T/C # 2	— °F	T/C # 14	68.8 °F
T/C # 3	71.0 °F	T/C # 15	72.4 °F
T/C # 4	67.6 °F	T/C # 16	61.6 °F
T/C # 5	65.2 °F	T/C # 17	60.4 °F
T/C # 6	66.7 °F	T/C # 18	74.6 °F
T/C # 7	67.8 °F	T/C # 19	67.9 °F
T/C # 8	66.8 °F	T/C # 20	45.6 °F
T/C # 9	67.3 °F	T/C # 21	— °F
T/C # 10	68.3 °F	T/C # 22	— °F
T/C # 11	63.0 °F	T/C # 23	67.0 °F
T/C # 12	79.4 °F	T/C # 24	— °F

Thermocouple Readout:

Pretest zero and span check and calibration

ZERO : .4 °F Adj. to 0.0 °F

SPAN : 1998.0 °F Adj. to 2000.0 °F

post test zero and span — % difference

ZERO 1.2 °F Adj. to .060 %

SPAN 2004.2 °F Adj. to .210 %

Thermocouple Readout Pretest Linearity Check:

0	= 0.0 °F	200	= 202.4 °F	400	= 399.6 °F
600	= 601.9 °F	800	= 801.9 °F	1000	= 1000.9 °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 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 : 17.2 - 7.2 .

Post : 13.8 - 3.8 .

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 Prairie Circle E
Sumner, WA 98390
Technician: P. McClellan
Authorization Signature: _____

Date of Inspection: 5-2-02
Next Inspection Due: 11-2-02

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
1000.2	0	
	500.0	
	999.9	

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)

T15-20				
T15-28				

Any changes to document or scale not authorized by

QUALITY CONTROL SERVICES Inc.

2340 S.E. 11Th. Avenue Portland, Oregon 97214
(503) 236-2712 / FAX:(503) 235-2535

Customer and Contact
L ikee Testing Labs
3235 Prairie Circle E
Sumner, WA. 98390
ip Wadington

Report Number: EESPC37010004020506

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#
/eight Set	R.L./Troemner	1MG-25KG	A45	Grams	12/13/2001	12/2002	2261-1201

C ments / Info Concerning This Calibration:

P nanent Information Concerning This Instrument:

Technician: D.Deleasa

Signature: Dony Deleasa

C IBRATIONS ARE PERFORMED UNDER AMBIENT CONDITIONS USING MANUFACTURER'S OR CUSTOMERS SPECIFICATIONS FOR THE P S/FAIL RESULTS. RESULTS MAY BE INFLUENCED BY THE AGE OF THE INSTRUMENT AND ENVIRONMENTAL CONDITIONS. CALIBRATION ATA SHOULD BE REVIEWED TO INSURE THAT THE INSTRUMENT IS PERFORMING TO ITS INTENDED ACCURACY. CALIBRATIONS CONFORM O ISO/IEC GUIDE 25-1990(17025) AND ANSI / NCSL Z540-1-1994 SPECIFICATIONS.

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

omments / Info Concerning This Calibration:

ermanent Information Concerning This Instrument:
-00 CUSTOMER REQUESTED SPECIFIC 6 POINT CHECK.100,50,20,10,5,1

Technician:D.Deleasa
Signature: D. Deleasa

ALIBRATIONS 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) ISO/IEC GUIDE 25-1990(17025) AND ANSI / NCSL Z540-1-1994 SPECIFICATIONS.

Thermocouple Calibration Record Semi-Annual

Thermocouples Check against
Reference Thermometer serial number 9123454
Ice Water Bath 32.0
Boiling Water 211.9
Room Temperature 68.2
Barometric Pressure 30.02
DATE: 5-13-02

TC	Location	Ice Bath Temp	Boiling Water Temp
1	Wet Bulb	32.2	211.9
2	Dry Bulb	32.2	211.8
3	Stack	32.0	211.8
4	Stove Top	32.2	211.7
5	Left Side	32.1	211.9
6	Back	32.2	211.8
7	Right Side	32.0	212.0
8	Bottom	32.0	211.8
9	Firebox	32.1	211.9
10	Secondary/Cat	32.1	212.0
11	Ambient	32.2	211.7
12	Tube Furnace	32.0	212.0
13	Sample Box	32.1	211.8
14	Impinger Out	32.2	211.8
15	C. Gas Box	32.2	212.0
16	C. Gas Out	32.0	211.6
17	SO2 Out	32.0	211.9
18	Upper Ambient	32.1	212.0
19			
20			
21			
22			
23	Calibrator	32.0	211.9
24	Oven	32.0	211.5

Thermocouple Readout Semi-Annual Calibration Data Sheet

Date: 5-13-02
Ambient Temperature: 68.6
Technician: Chris W.

Thermocouple Number: T/C Readout
Barometric Pressure: 30.02
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	299.8	.067
400	Omega	400.0	400.3	-.075
500	Omega	500.0	500.1	-.020
600	Omega	600.0	599.8	.033
700	Omega	700.0	700.8	-.114
800	Omega	800.0	799.8	-.025
900	Omega	900.0	900.0	∅
1000	Omega	1000.0	1000.1	-.010
1200	Omega	1200.0	1198.7	.108
1400	Omega	1400.0	1399.6	.029
1600	Omega	1600.0	1599.2	.050
1800	Omega	1800.0	1799.8	.011
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: 5-13-02

SO^2 INJECTION ROTAMETER

FISHER SN 9123454

NIST Traceable

Actual	°C = °F	°F
0.0	32.0	32.0
18.8	65.9	65.9
39.4	102.9	103.0
58.6	136.7	136.4

DRY GAS METER THERMOCOUPLES

Actual	°C = °F	5H in	5H out	KK
Ø	32.0	32.0	32.0	32.0
18.8	66.0	66.1	66.1	66.2
39.4	102.9	102.7	103.0	102.8
58.2	136.7	136.6	136.6	136.8

SLING PSYCHROMETER

Actual	°C = °F	Wet Bulb	Dry Bulb
Ø	32.0	32.0	32.0
18.8	66.0	66.0	66.2
28.6	83.5	83.3	83.5
39.2	102.6	102.4	102.4

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

UNIT: F500 DATE: 6-23-02

TEST DATA

RUN #	1	2	3	4	5	6	7	8	9	10
AVG. Δ H	.142	.106	.137	.169	.154	≀	≀	≀	≀	≀
MAX VAC	2.0	2.0	2.0	3.0	3.0	≀	≀	≀	≀	≀

Avg. Test Series Δ H: .142 in H_2O Test Series Max Vac: 3.0 in Hg

Audit Dry Gas Meter: K2 Correction (Y) Factor: 1.006 (mcf)

Test Dry Gas Meter: H Correction (Y) Factor: 1.000 (mcf)

AUDIT DATA

		Audit # 1	Audit #2	Audit #3
BP		30.02	30.02	30.02
VAC		3.0	3.0	3.0
AUDIT METER :				
VOL.	Final	200.000	204.983	209.975
(Vw)	Initial	195.000	200.000	204.983
	Vol.	5.000	4.983	4.992
TEMP (°F)	Initial	88	90	92
(Tw)	Mid	89	91	93
	Final	90	92	94
(°F / °A)	**Avg.**	89 (549)	91 (551)	93 (553)
Δ H	Initial	.142	.142	.142
	Mid	.142	.142	.142
	Final	.142	.142	.142
	Avg.	.142	.142	.142
DRY GAS METER :				
VOL.	Final	877.500	882.500	887.500
(Vd)	Initial	877.500	877.500	882.500
	Vol.	5.000	5.000	5.000
TEMP (°F)	Initial	83	86	90
(Tm)	Mid	85	88	92
	Final	86	90	94
(°F / °A)	**Avg.**	85 (545)	88 (548)	92 (552)

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

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

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

RUN 1

$$Y = \frac{(5.000)(1.006)(30.02)(545)}{(5.000)\left(30.02 + \frac{.142}{13.6}\right)(549)} = \frac{82295.33}{82433.56} = .998$$

$$\Delta\% = \frac{(.998 - .994)}{.994} X\,100 = .426\ \%$$

RUN 2

$$Y = \frac{(4.983)(1.006)(30.02)(548)}{(5.000)\left(30.02 + \frac{.142}{13.6}\right)(551)} = \frac{82466.98}{82733.87} = .997$$

$$\Delta\% = \frac{(.997 - .994)}{.994} X\,100 = .319\ \%$$

RUN 3

$$Y = \frac{(4.992)(1.006)(30.02)(552)}{(5.000)\left(30.02 + \frac{.142}{13.6}\right)(553)} = \frac{83218.97}{83034.17} = 1.002$$

$$\Delta\% = \frac{(1.002 - .994)}{.994} X\,100 = 2.766\ \%$$

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

INTERPOLATED Y FACTOR

.1 (A) inch H_2O ΔH = .992 (C) — Calculated calibration Y factor from calibrations

.2 (B) inch H_2O ΔH = .996 (D) — Calculated calibration Y factor from calibrations

.2 (B) - .1 (A) = .1 X 100 = 10 (E)

.996 (D) - .992 (C) = .004 ÷ 10 (E) = .0004 (F)

.142 Avg ΔH - .1 (A) = .042 X 100 = 4.2 (G)

$\left[\frac{.0004}{(F)} X \frac{4.2}{(G)}\right] + \frac{.992}{(C)} = .994$ Interpolated Y factor

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

DRY GAS METER CALIBRATION

DATE: 5-13-02 DRY GAS METER: H BOX: 5

BAROMETRIC PRESSURE, Pb 30.23 in. Hg.

Orifice Manometer Setting, ΔH, in. H_2O		.1	.2	.3	.5	.75	1.0
Gas Volume Wet Test Meter Vw ft^3	Final	153.054	158.121	163.195	168.268	174.357	179.438
	Initial	148.000	153.054	158.121	163.195	168.268	174.357
	Vw ft^3	5.054	5.067	5.074	5.073	6.089	5.081
Gas Volume Dry Test Meter Vd ft^3	Final	417.000	422.000	427.000	432.000	438.000	443.000
	Initial	412.000	417.000	422.000	427.000	432.000	438.000
	Vw ft^3	5.000	5.000	5.000	5.000	6.000	5.000
Wet Test Meter Temperature .tw	Initial	80	78	78	78	78	78
	Middle	79	78	78	78	78	77
	Final	78	78	78	78	78	77
	Average	79 (539)	78 (538)	(538)	(538)	(538)	(537)
Dry Test Meter Temperature tm	Initial	66	66	66	67	69	71
	Middle	66	66	67	68	70	71
	Final	66	66	67	69	71	71
	Average	66 (526)	66 (526)	(527)	(528)	(539)	(531)
$Y = \frac{(Kz_y)(Vw)(Pb)(tm)}{Vd\left[Pb + \frac{\Delta H}{13.6}\right](tw)}$		80845.73 / 81481.67	81053.69 / 81358.26	81319.97 / 81378.04	81458.22 / 81417.60	98142.69 / 97760.46	82050.24 / 81364.98
		.992	.996	.999	1.000	1.004	1.008

Average Y= 1.000

METER BOX CALIBRATION

Avg MCF 1.0055
1.006

Date : 07/11/01
Calibrated By : J.C.
Dry Gas Meterbox ID : K2

Barometric Pressure, Pb = 28.1 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.		5.000	5.000	5.000	5.000	5.000	5.000
Gas Volume Dry Gas Meter							
M Final		1058.033	1063.070	1068.101	1073.139	1078.188	1083.200
M Initial		1053.000	1058.033	1063.070	1068.101	1073.139	1078.139
Vd, cu. ft.		5.033	5.037	5.031	5.038	5.049	5.061
Wet Test Meter							
tw Deg F		84	84	84	84	84	84
tw Deg A		544	544	544	544	544	544
Dry Gas Meter Outlet, tmo	1)	86	86	87	88	90	91
	2)	86	87	87	89	90	92
	3)	86	87	88	89	90	92
Dry Gas Meter Inlet tmi	1)	91	91	92	92	94	95
	2)	91	92	92	93	94	96
	3)	91	92	92	93	95	96
Mean tm, Deg F		89	89	90	91	92	94
Mean tm, Deg A		549	549	550	551	552	554
Results :	**Y =**	1.002	1.002	1.004	1.004	1.005	1.005
Averages :	**Y =**	1.004					

METER BOX CALIBRATION

Date : 01/11/01
Calibrated By : J.C.
Dry Gas Meterbox ID : K2

Barometric Pressure, Pb = 28.1 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.		5.000	5.000	5.000	5.000	5.000	5.000
Gas Volume Dry Gas Meter							
	M Final	1088.255	1093.310	1098.375	1103.444	1108.513	1113.590
	M Initial	1083.200	1088.255	1093.310	1098.375	1103.444	1108.513
	Vd, cu. ft.	5.055	5.055	5.065	5.069	5.069	5.077
Wet Test Meter							
	tw Deg F	84	84	84	84	84	84
	tw Deg A	544	544	544	544	544	544
Dry Gas Meter Outlet, tmo	**1)**	88	89	89	91	92	93
	2)	88	89	90	91	92	93
	3)	89	89	90	91	93	94
Dry Gas Meter Inlet tmi	**1)**	94	95	96	97	99	99
	2)	94	95	96	98	99	100
	3)	95	95	97	98	99	100
Mean tm, Deg F		91	92	93	94	96	97
Mean tm, Deg A		551	552	553	554	556	557
Results :	**Y =**	1.001	1.003	1.003	1.005	1.007	1.007
Averages :	**Y =**	**1.004**					

METER BOX CALIBRATION

Date : 07/11/01
Calibrated By : J.C.
Dry Gas Meterbox ID : K2

Barometric Pressure, Pb = 28.1 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.		5.000	5.000	5.000	5.000	5.000	5.000
Gas Volume Dry Gas Meter							
M Final		118.654	123.730	128.811	133.900	138.989	144.090
M Initial		113.590	118.654	123.730	128.811	133.900	138.989
Vd, cu. ft.		5.064	5.076	5.081	5.089	5.089	5.101
Wet Test Meter							
tw Deg F		84	84	85	85	85	85
tw Deg A		544	544	545	545	545	545
Dry Gas Meter Outlet, tmo	1)	92	93	94	95	95	96
	2)	92	94	94	95	95	96
	3)	93	94	94	95	95	96
Dry Gas Meter Inlet tmi	1)	95	97	99	100	102	103
	2)	95	97	100	101	102	103
	3)	96	98	100	102	103	104
Mean tm, Deg F		94	96	97	98	99	100
Mean tm, Deg A		554	556	557	558	559	560
Results :	**Y =**	1.005	1.005	1.005	1.005	1.006	1.006
Averages :	**Y =**	1.005					

METER BOX CALIBRATION

Date : 07/11/01
Calibrated By : J.C.
Dry Gas Meterbox ID : K2

Barometric Pressure, Pb = 28.11 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.		5.000	5.000	5.000	5.000	5.000	5.000
Gas Volume Dry Gas Meter							
M Final		149.140	154.207	159.295	164.392	169.499	174.610
M Initial		144.090	149.140	154.207	159.295	164.392	169.499
Vd, cu. ft.		5.050	5.067	5.088	5.097	5.107	5.111
Wet Test Meter							
tw Deg F		85	85	85	85	85	85
tw Deg A		545	545	545	545	545	545
Dry Gas Meter Outlet, tmo	1)	94	95	96	96	97	97
	2)	94	95	96	96	97	97
	3)	95	95	96	96	97	97
Dry Gas Meter Inlet tmi	1)	91	96	100	102	103	105
	2)	93	98	101	103	104	106
	3)	96	100	103	104	105	106
Mean tm, Deg F		94	97	99	100	101	101
Mean tm, Deg A		554	557	559	560	561	561
Results :	**Y =**	1.005	1.006	1.006	1.006	1.006	1.006

Averages : **Y =** **1.006**

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/6220/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 = 6.6640	T2 = 1769.3
Z3 = 4.9410	T3 = 1770.9	R3 = 3134.9
Avg. Concentration:	1770.	PPM

Calibration Curve

Concentration = A + B1 + C2 + D3 + E4	
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		dscf=	1.500
mcf	1			
Hg	30.08			
DH	0.12			
temp	69	529	ppm =	1778
ml BA ++	621			
Normality	0.0101			
			Run1	1773
			Run 2	1761
			Run3	1778
Tank I.D. #	ALMO49127		avg.	1771

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

Robert Dowd
Q.C. Laboratory Manager

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

METER BOX CALIBRATION

Date : 07/11/01
Calibrated By : J.C.
Dry Gas Meterbox ID : K2

Barometric Pressure, Pb = 28.11 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.		5.000	5.000	5.000	5.000	5.000	5.000
Gas Volume Dry Gas Meter							
M Final		179.682	184.756	189.839	200.016	205.109	210.211
M Initial		174.610	179.682	184.756	194.927	200.016	205.109
Vd, cu. ft.		5.072	5.074	5.083	5.089	5.093	5.102
Wet Test Meter							
tw Deg F		85	85	85	85	85	85
tw Deg A		545	545	545	545	545	545
Dry Gas Meter Outlet, tmo	1)	95	96	96	97	97	98
	2)	95	96	96	97	97	98
	3)	95	96	97	97	97	98
Dry Gas Meter Inlet tmi	1)	99	100	101	102	103	104
	2)	99	101	102	103	104	105
	3)	100	101	102	103	104	105
Mean tm, Deg F		97	98	99	100	100	101
Mean tm, Deg A		557	558	559	560	560	561
Results :							
	Y =	1.006	1.007	1.007	1.007	1.007	1.007

Averages :

Y = 1.007

METER BOX CALIBRATION

Date : 07/11/01
Calibrated By : J.C.
Dry Gas Meterbox ID : K2

Barometric Pressure, Pb = 28.11 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.		5.000	5.000	5.000	5.000	5.000	5.000
Gas Volume Dry Gas Meter							
M Final		215.294	220.386	225.481	230.580	235.682	240.785
M Initial		210.211	215.294	220.386	225.481	230.580	235.682
Vd, cu. ft.		5.083	5.092	5.095	5.099	5.102	5.103
Wet Test Meter							
tw Deg F		85	85	85	85	85	85
tw Deg A		545	545	545	545	545	545
Dry Gas Meter Outlet, tmo	1)	97	97	98	98	98	98
	2)	97	98	98	98	98	98
	3)	97	98	98	98	98	98
Dry Gas Meter Inlet tmi	1)	100	102	103	104	105	106
	2)	100	103	104	105	105	106
	3)	102	103	104	105	106	106
Mean tm, Deg F		99	100	101	101	102	102
Mean tm, Deg A		559	560	561	561	562	562
Results :	**Y =**	1.006	1.007	1.007	1.007	1.007	1.008
Averages :	**Y =**	1.007					

WET TEST METER CALIBRATION LOG

Wet Test Meter Serial Number AA455 Date 8-20-01

Range of Wet Test Meter Flow Rate 0 - 0.25

Volume of Test Flask Vs 37.850 Hs

Satisfactory Leak Check? Yes

Ambient Temperature of Equilibrate Liquid in Wet Test Meter and Reservoir 82°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	3.007	-.233
2	Ø	3.0	Reset to Ø	3.0	3.010	-.332
3	Ø	3.0	Reset to Ø	3.0	3.011	-.365

a - Must be less than 10 mm H_2O (0.4 ' H_2O)

Calculations:

b - Vm - Vf - Vi

c - % error = $\frac{100\,(V_m - V_s)}{V_s}$ = Avg -.308 (±1 %)

SO_2 ROTAMETER CALIBRATION

Last Cal. : 10-12-01 By : Cp W Date : 5-13-02 By : Cp W

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

Barometric Pressure : 30.04 " Hg Temperature : 66.8

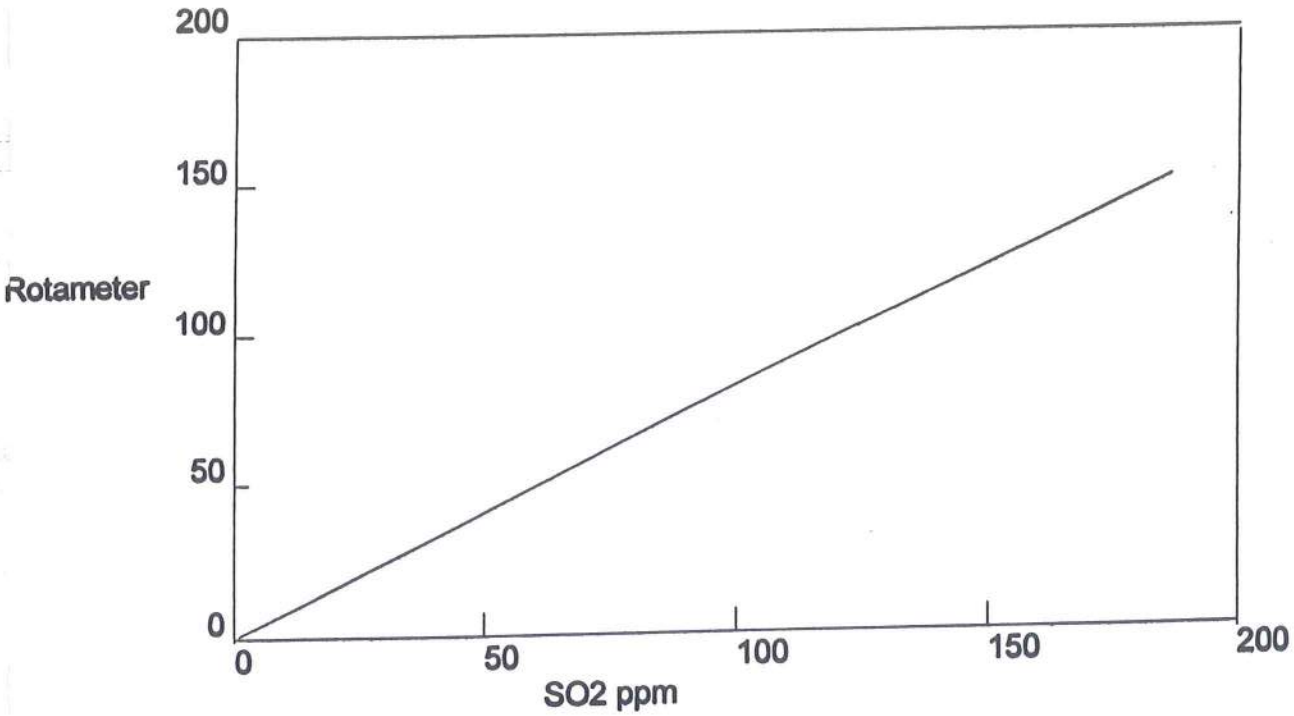
RUN #	50 CC/MINUTE DIGICAL VOLUME	100 CC/MINUTE DIGICAL VOLUME	150 CC/MINUTE DIGICAL VOLUME
1	56.1	128.9	185.6
2	56.0	128.7	185.5
3	55.9	128.7	185.7
4	56.0	128.9	185.8
5	56.0	129.0	185.9
6	56.2	128.8	185.7
7	55.9	129.0	185.6
8	56.0	128.9	185.7
9	56.2	129.0	185.6
10	56.1	128.9	185.8
AVERAGE	56.0 cc/min	128.9 cc/min	185.7 cc/min

SETTING	cc/min
0	0.0
50	56.0
100	128.9
150	185.7

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

100 CC / MINUTE = 80.8

SO2 Rotameter
05/13/02



Regression Output:

Constant	-1.85
Std Err of Y Est	5.2254186435
R Squared	0.9972557251
No. of Observations	4
Degrees of Freedom	2
X Coefficient(s)	1.26
Std Err of Coef.	0.0467375652

TRACER GAS TRAIN RESPONSE TIME

DATE: 5-13-02

Elapsed Time	SO_2 Conc. (v.)	SO_2 Conc. (v.)	SO_2 Conc. (v.)
00 sec	.515	.514	.515
15	.275	.281	.280
30	.170	.174	.173
45	.101	.099	.096
60	.050	.049	.048
75	.032	.033	.035
90	.018	.018	.016
105	.011	.013	.010
120	.006	.006	.006
135	.002	.003	.002
150	.000	.001	.000
165		.000	
180			
Initial Response	11	11	11
95 % Response	82	82	82
Flow Rate	1.5	1.5	1.5

CEM GAS TRAIN RESPONSE TIME

Elapsed Time	CO_2 Conc. (v.)	CO_2 Conc. (v.)	CO_2 Conc. (v.)	O_2 Conc. (v.)	O_2 Conc. (v.)	O_2 Conc. (v.)	CO Conc. (v.)	CO Conc. (v.)	CO Conc. (v.)
00 sec	.499	.500	.498	.500	.500	.499	.515	.516	.516
15	.482	.484	.483	.572	.574	.571	.230	.225	.226
30	.303	.307	.305	.733	.740	.739	.049	.048	.046
45	.142	.140	.146	.804	.800	.802	.016	.015	.014
60	.060	.062	.062	.825	.821	.823	.007	.004	.005
75	.029	.028	.028	.828	.828	.829	.002	.001	.002
90	.014	.013	.012	.830	.830	.831	.000	.000	.000
105	.008	.009	.007						
120	.005	.005	.004						
135	.003	.003	.002						
150	.001	.001	.001						
165	.000	.000	.000						
180									
Initial Response	14	15	14	11	10	10	9	10	9
95 % Response	80	80	80	53	53	53	38	38	38
Flow Rate	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5

ORSAT ANALYSIS DATA SHEET

DATE: 5-14-02

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	12.4	12.5	12.47	12.49	CC127767
O_2	12.5	12.5	12.5	12.50	12.56	
CO	4.8	4.8	4.8	4.80	4.80	
CO_2	21.2	21.2	21.2	21.2	21.23	CC55904
O_2	21.1	21.1	21.1	21.1	21.10	
CO	8.6	8.6	8.6	8.6	8.60	
CO_2	6.2	6.2	6.2	6.2	6.25	AAL21084
O_2	6.3	6.2	6.2	6.33	6.24	
CO	2.0	2.0	2.0	2.0	2.01	
CO_2						
O_2						
CO						

CO_2 ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

JOTUL
F500
MAY 2002

Date: 05-15-02

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

Calibration by: D. Washington

Cal Gas Flow: 1.5 SCFH Measured by: Rotameter

BP: 30.23 Instrument ID: PRINCO

Temp: 76 Instrument ID: TR

Cylinders:

1. # 042TAC 2-A Concentration: 00.00 % CO_2 Cyl. Press.: 2000 PSI
   Certified by: AIR LIQUIDE Date: 02-20-02
2. # CC 12767 Concentration: 12.49 % CO_2 Cyl. Press.: 1420 PSI
   Certified by: AIR LIQUIDE Date: 02-15-02
3. # CC55904 Concentration: 21.23 % CO_2 Cyl. Press.: 910 PSI
   Certified by: AIR LIQUIDE Date: 02-14-00
4. # AAL 21084 Concentration: 6.25 % CO_2 Cyl. Press.: 550 PSI
   Certified by: SCOTT SPECIALTY GASES Date: 05-15-97

Analyzer: **Calibrated Range:** 0-25.0 % **Output:** 0-1.0 V.
Flow: 1.5 SCFH **Measured by:** Rotameter

Calibration Results

Point #	CYL. #	% CO2	EXPECTED METER	EXPECTED DVM	ACTUAL METER	ACTUAL DVM	ADJ. METER	ADJ. DVM
1	1	0.00	00.0	.000	00.0	.002	00.0	.000
2	2	12.49	50.0	.500	52.0	.520	50.0	.500
3	3	21.23	84.9	.849	85.3	.853		
4	4	6.25	25.0	.250	25.4	.254		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 12.442

CO_2 Linear Regression Results:

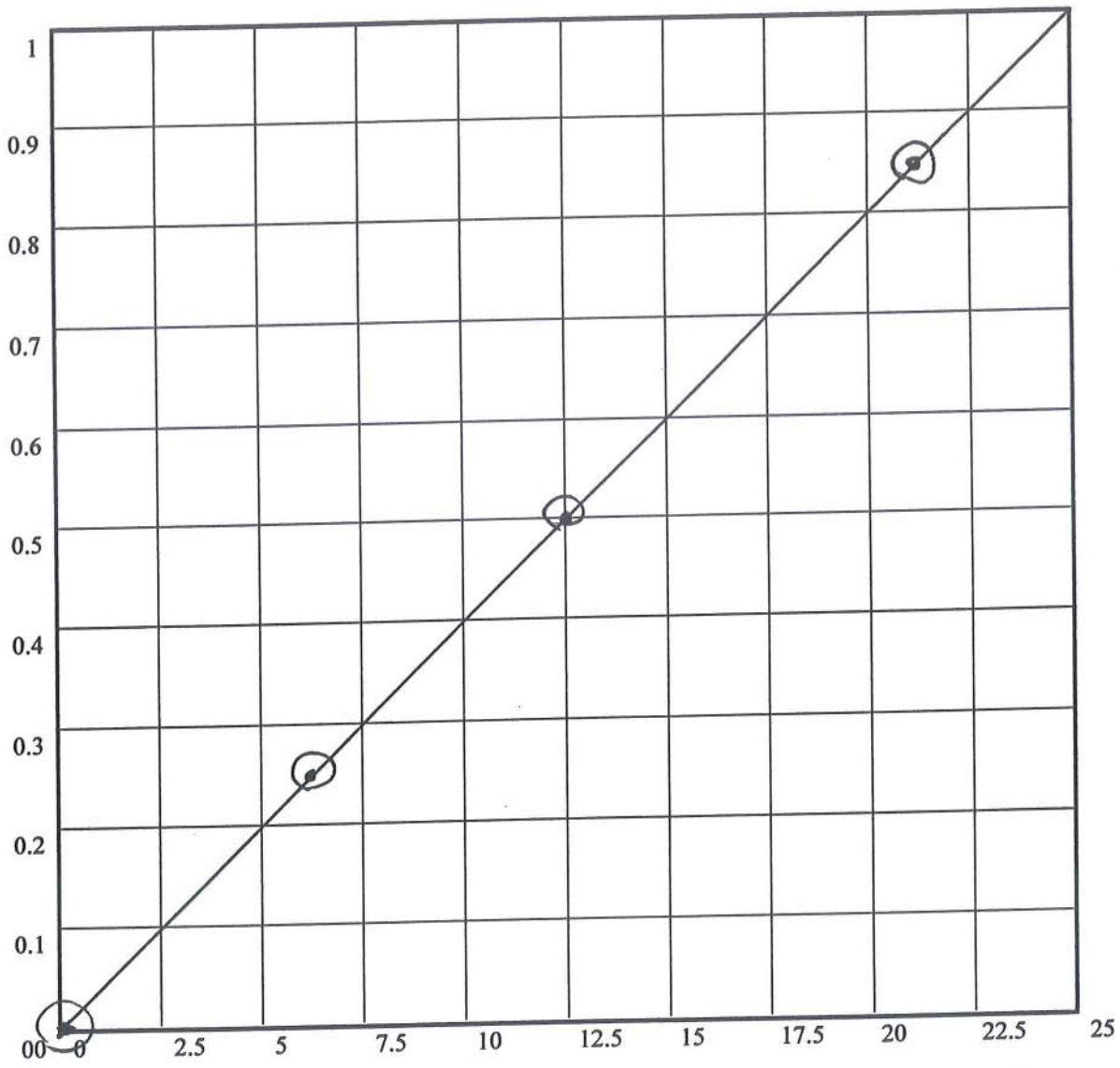
Y = MX +B

Slope (M) = .0008847

Y Intercept (B) = .0401166

Correlation Coefficient (r) = .9999868

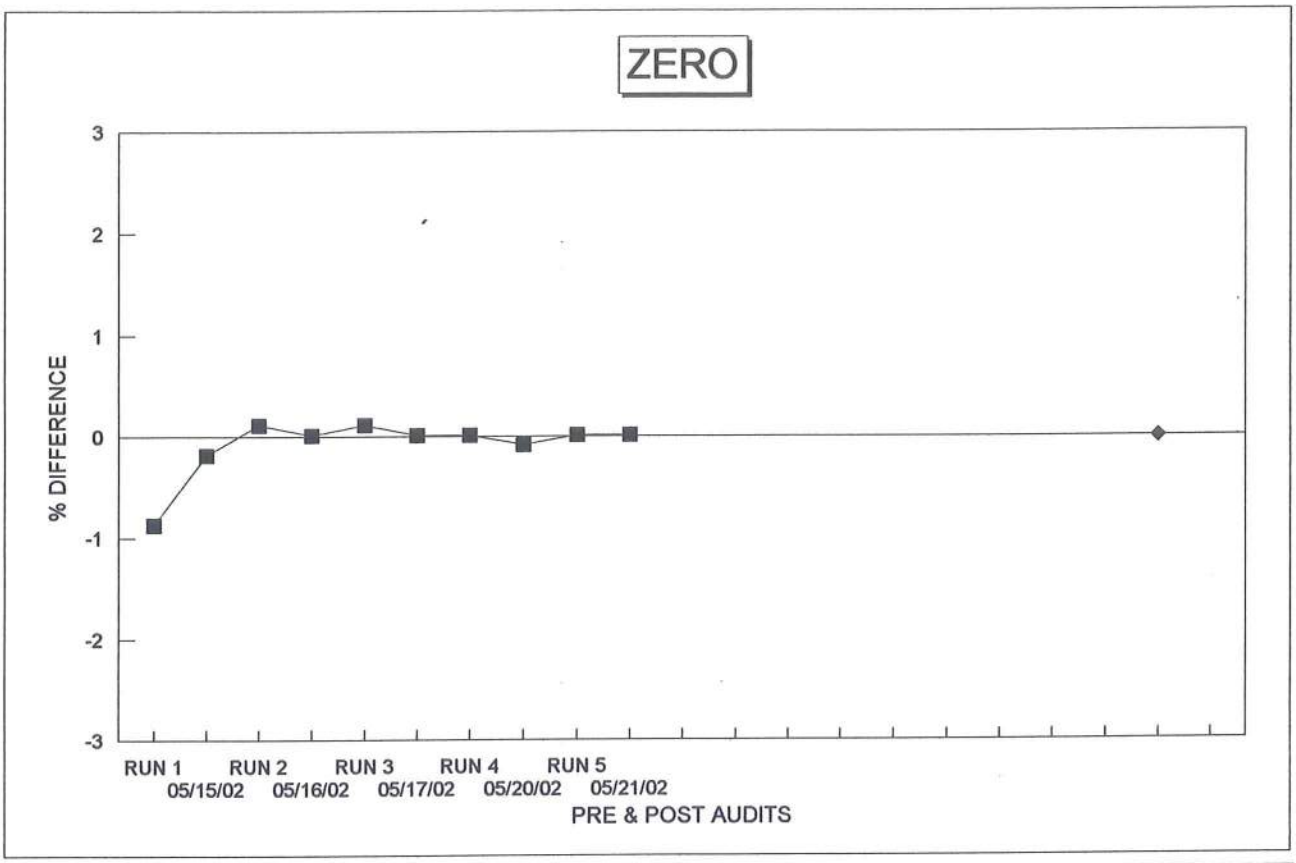
r^2 = .9999737

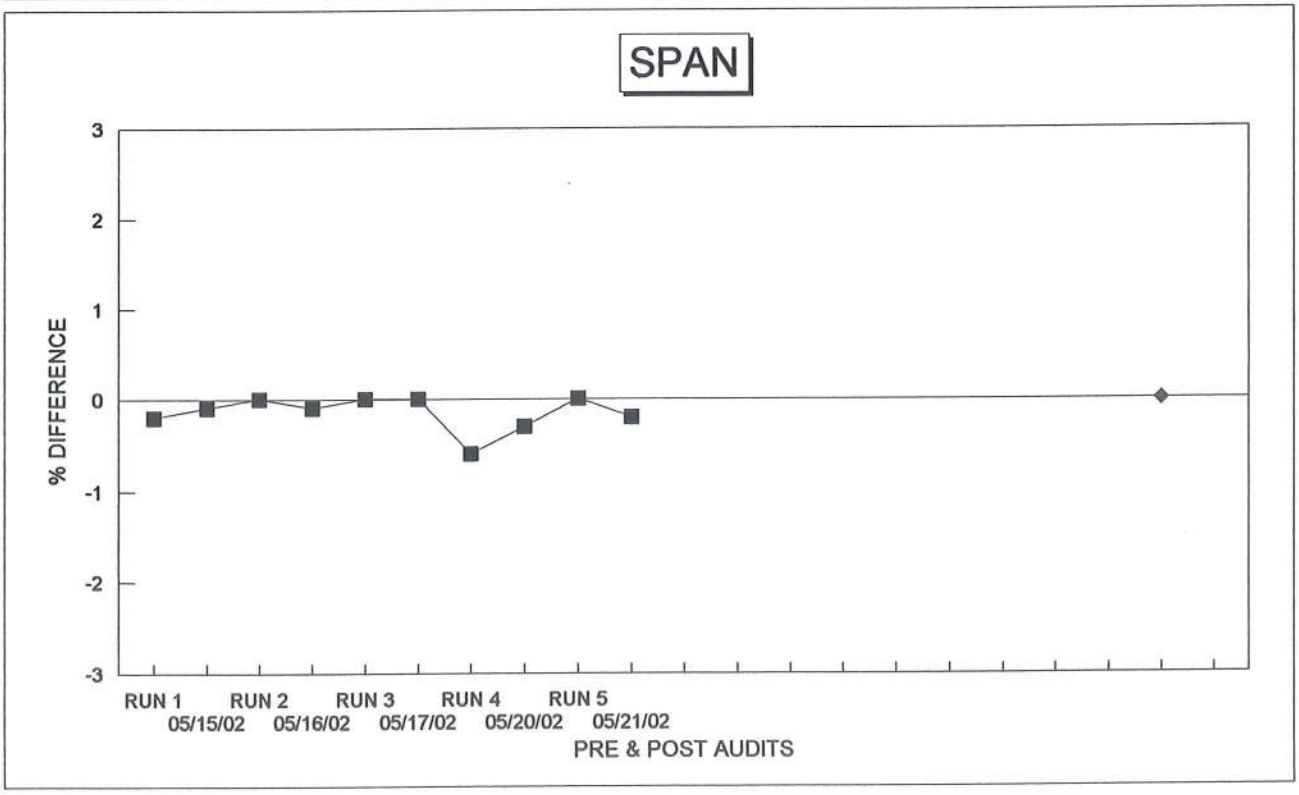


EPA Span Value = ± 2.0% of 25% CO_2 = ± .5%

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

HIGH VOLTS	.853	= 21.308 - 21.23	= .078	= .312	
LOW VOLTS	.254	= 6.345 - 6.25	= .095	= .380	


ZERO
3
2
1
0
-1
-2
-3
% DIFFERENCE
RUN 1
05/15/02
RUN 2
05/16/02
RUN 3
05/17/02
RUN 4
05/20/02
RUN 5
05/21/02
PRE & POST AUDITS


SPAN
3
2
1
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-1
-2
-3
% DIFFERENCE
RUN 1
05/15/02
RUN 2
05/16/02
RUN 3
05/17/02
RUN 4
05/20/02
RUN 5
05/21/02
PRE & POST AUDITS

O_2 ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Date: 05-15-02

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

Calibration by: D. Washington

Cal Gas Flow: 1.5 SCFH Measured by: Rotameter

BP: 30.23 Instrument ID: PRINCO

Temp: 76 Instrument ID: TR

Cylinders:

1. # 042TAC 2-A Concentration: 00.00 % O_2 Cyl. Press.: 2000 PSI
   Certified by: AIR LIQUIDE Date: 02-20-02
2. # CC12767 Concentration: 12.50 % O_2 Cyl. Press.: 1420 PSI
   Certified by: AIR LIQUIDE Date: 02-15-02
3. # CC55904 Concentration: 21.10 % O_2 Cyl. Press.: 910 PSI
   Certified by: AIR LIQUIDE Date: 02-14-00
4. # AAL 21084 Concentration: 6.24 % O_2 Cyl. Press.: 550 PSI
   Certified by: SCOTT SPECIALTY GASES Date: 05-15-97

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	12.90	.515	12.5	.500
3	3	21.10	21.10	.844	21.10	.840		
4	4	6.24	6.24	.250	6.40	.254		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 12.513

O_2 Linear Regression Results:

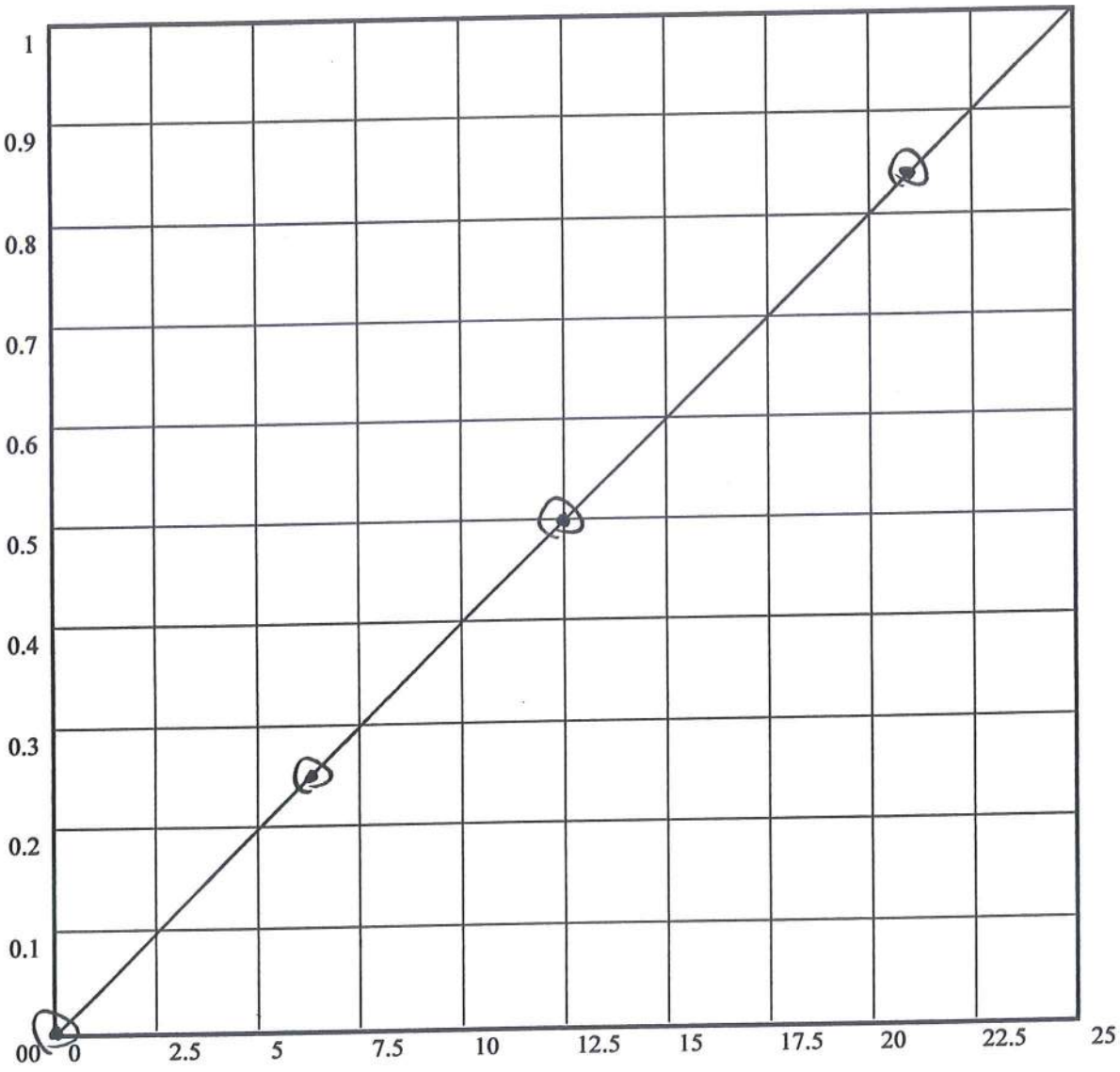
Y = MX +B

Slope (M) = .0025912

Y Intercept (B) = .0397499

Correlation Coefficient (r) = .9999739

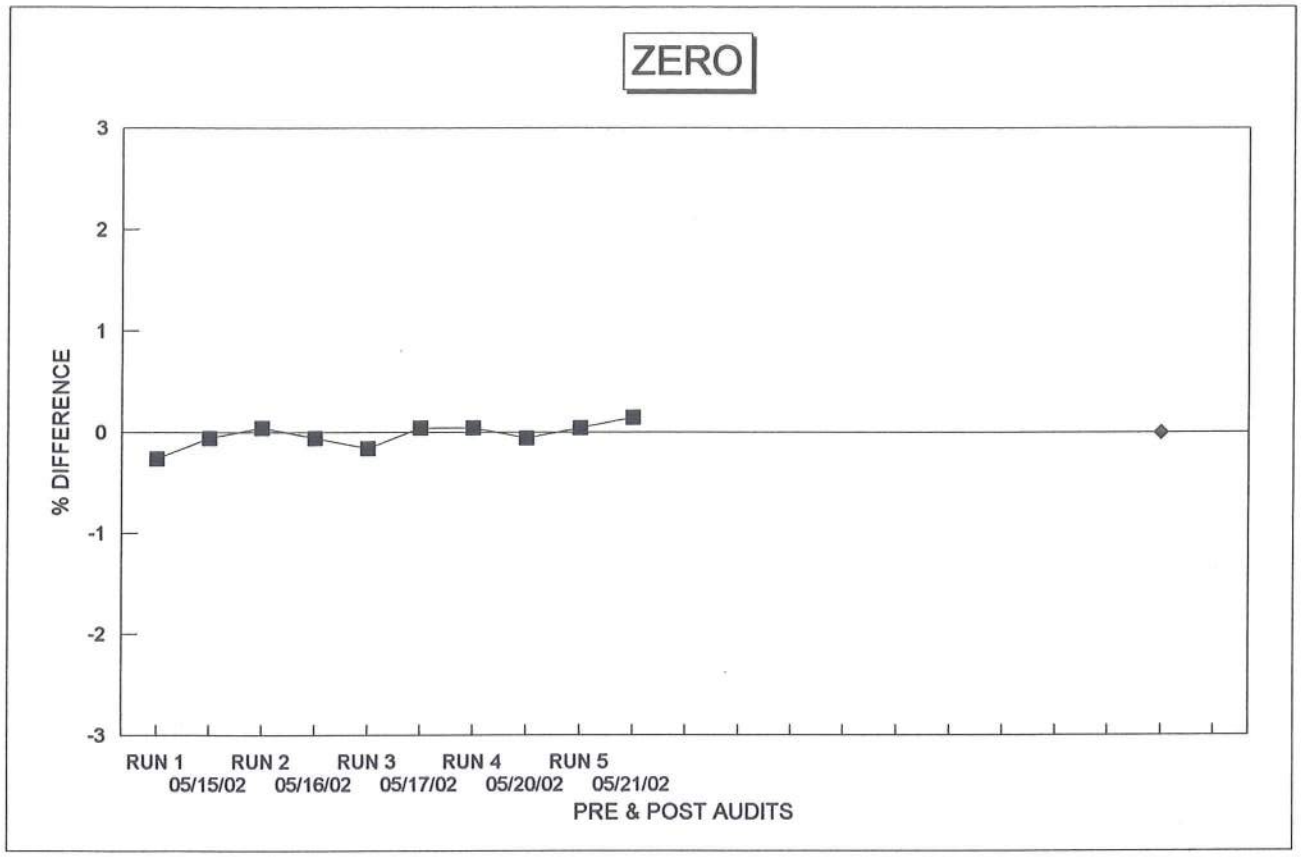
r^2 = .9999478

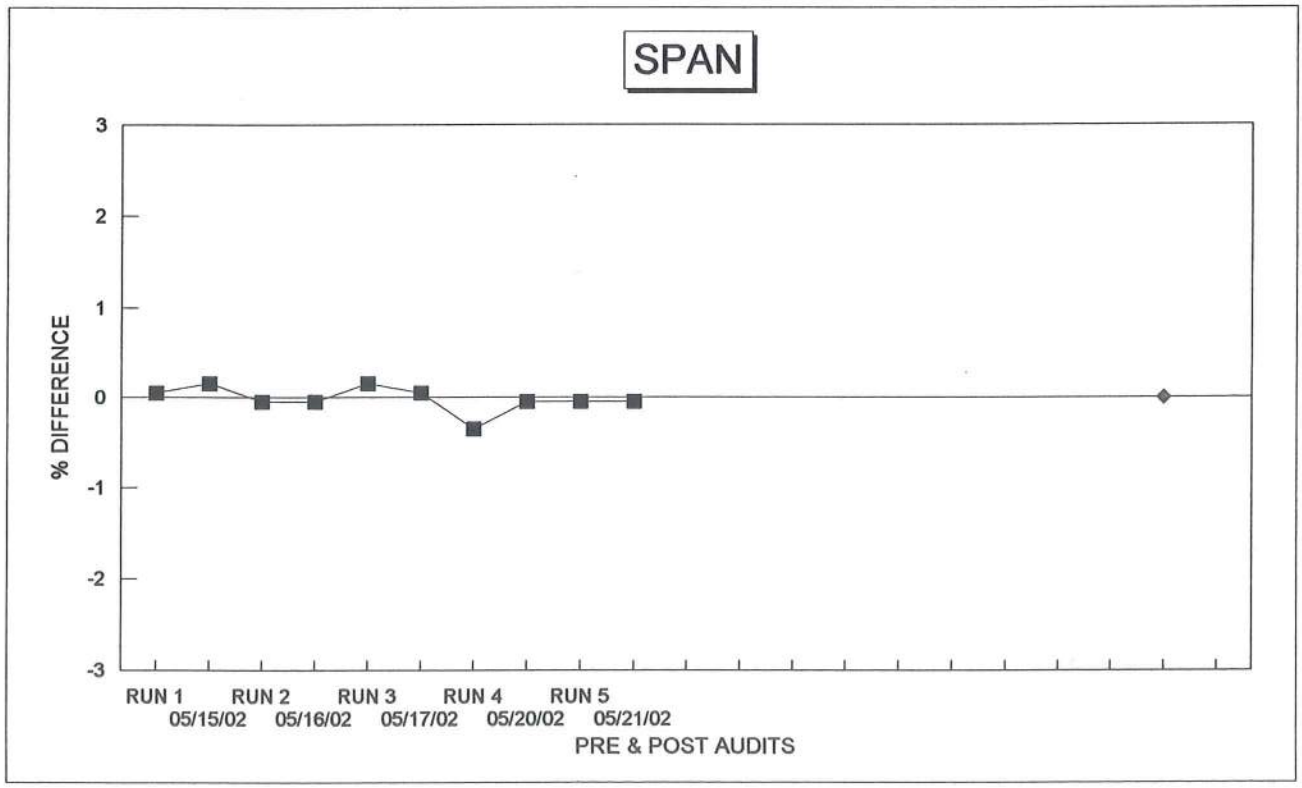


EPA Span Value = ± 2.0% of 25% O_2 = ± .5%

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

HIGH VOLTS	.840	= 21.00 - 21.10	= -.100	=	-.400
LOW VOLTS	.254	= 6.35 - 6.24	= .110	=	.440


ZERO
3
2
1
0
-1
-2
-3
% DIFFERENCE
RUN 1
05/15/02
RUN 2
05/16/02
RUN 3
05/17/02
RUN 4
05/20/02
RUN 5
05/21/02
PRE & POST AUDITS


SPAN
3
2
1
0
-1
-2
-3
% DIFFERENCE
RUN 1
05/15/02
RUN 2
05/16/02
RUN 3
05/17/02
RUN 4
05/20/02
RUN 5
05/21/02
PRE & POST AUDITS

CO ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Date: 05-15-02

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

Calibration by: D. Wadington

Cal Gas Flow: 1.5 SCFH Measured by: Rotameter

BP: 30.23 Instrument ID: PRINCO

Temp: 76 Instrument ID: TR

Cylinders:

1. # 042TAC 2-A Concentration: 00.00 % CO Cyl. Press.: 2000 PSI
   Certified by: AIR LIQUIDE Date: 02-20-02
2. # CC12767 Concentration: 4.80 % CO Cyl. Press.: 1420 PSI
   Certified by: AIR LIQUIDE Date: 02-15-02
3. # CC55904 Concentration: 8.60 % CO Cyl. Press.: 910 PSI
   Certified by: AIR LIQUIDE Date: 02-14-00
4. # AAL 21084 Concentration: 2.01 % CO Cyl. Press.: 550 PSI
   Certified by: SCOTT SPECIALTY GASES Date: 05-15-97

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	00.1	.001	00.0	.000
2	2	4.80	48.0	.480	48.0	.480	48.0	.480
3	3	8.60	86.0	.860	86.3	.863		
4	4	2.01	20.1	.201	19.9	.199		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 4.993

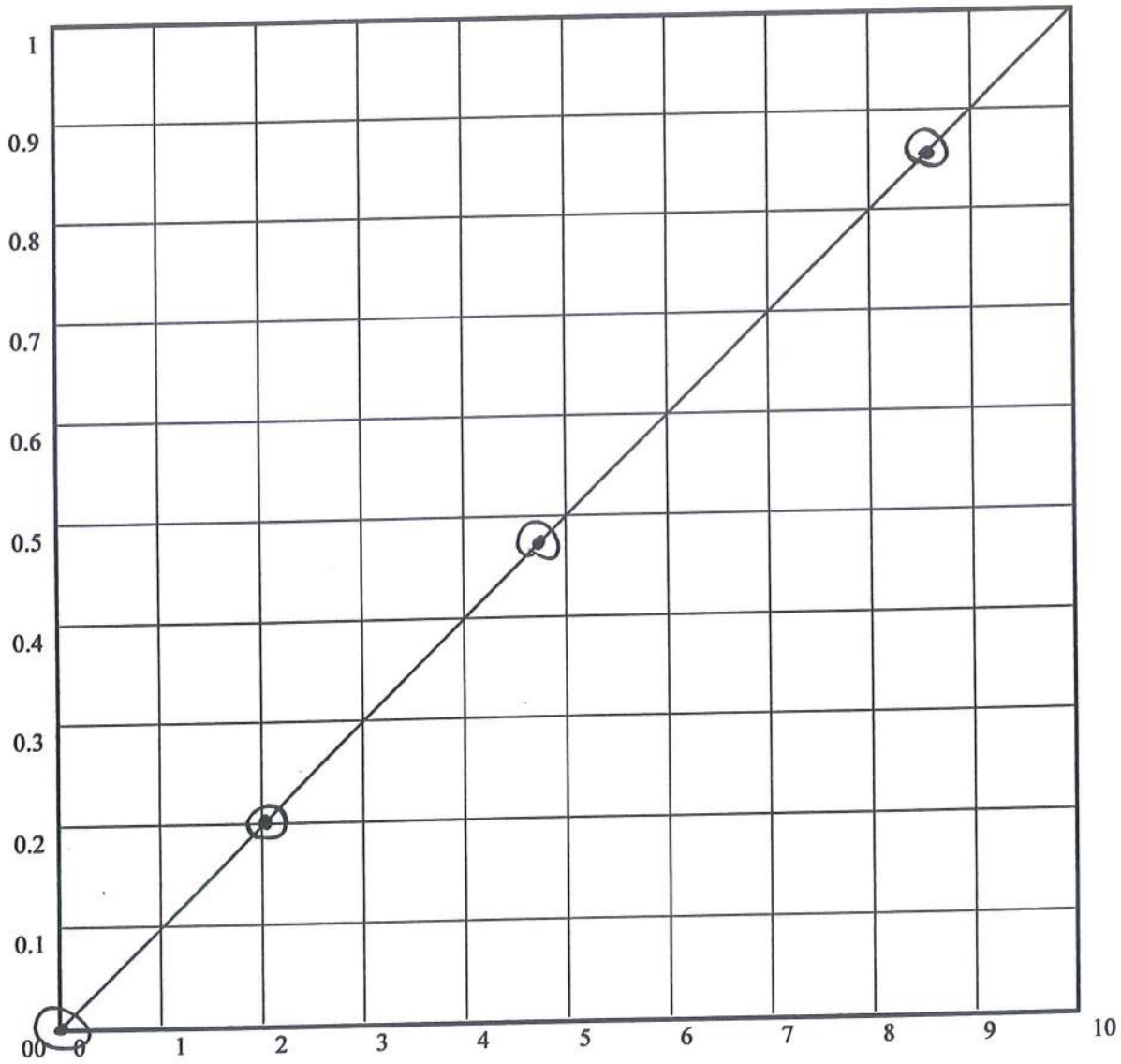
CO Linear Regression Results:

Y = MX +B
Slope (M) = -.0014073

Y Intercept (B) = .1004302

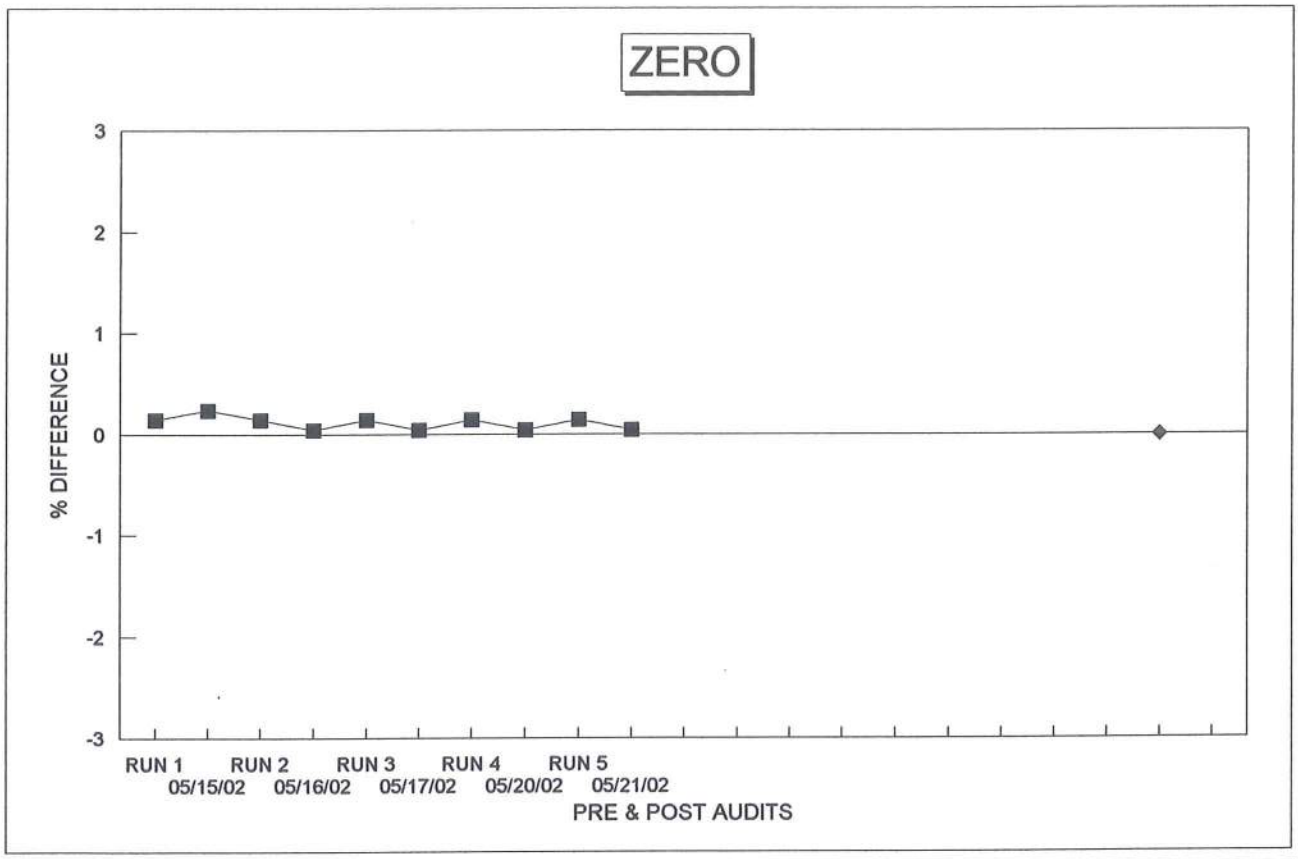
Correlation Coefficient (r) = .9999940

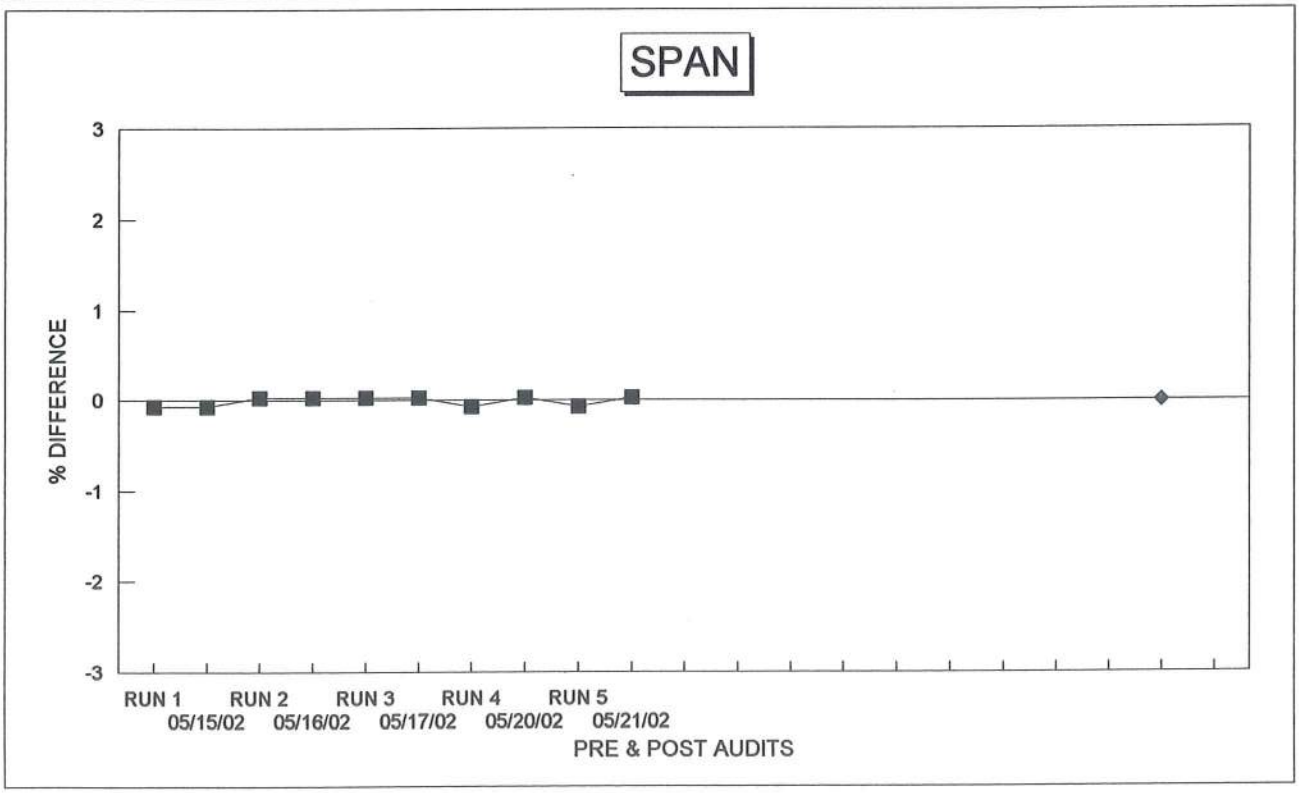
r^2 = .9999880



EPA Span Value = ± 2.0% of 10% CO = ± .2%
Cal Volts = Cal Volt Conc - Std Conc = ± Conc Diff = ± Δ %

HIGH VOLTS	.863	= 8.63 - 8.60	= .030	=	.300
LOW VOLTS	.199	= 1.99 - 2.01	= -.020	=	-.200


ZERO
3
2
1
0
-1
-2
-3
% DIFFERENCE
RUN 1 05/15/02
RUN 2 05/16/02
RUN 3 05/17/02
RUN 4 05/20/02
RUN 5 05/21/02
PRE & POST AUDITS


SPAN
3
2
1
0
-1
-2
-3
% DIFFERENCE
RUN 1 05/15/02
RUN 2 05/16/02
RUN 3 05/17/02
RUN 4 05/20/02
RUN 5 05/21/02
PRE & POST AUDITS

SO_2 ANALYZER
MULTIPOINT CALIBRATION REPORT FORM

Date: 05-15-02

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

Calibration by: D. Wadington

Cal Gas Flow: 1.5 SCFH Measured by: Rotameter

BP: 30.23 Instrument ID: PRINCO

Temp: 76 Instrument ID: TR

Cylinders:

1. # 042TAC 2-A Concentration: 00.00 % SO_2 Cyl. Press.: 2000 PSI
   Certified by: AIR LIQUIDE Date: 02-20-02
2. # CC62184 Concentration: 1290 % SO_2 Cyl. Press.: 1350 PSI
   Certified by: AIR LIQUIDE Date: 01-29-01
3. # ALMO 49127 Concentration: 1770 % SO_2 Cyl. Press.: 940 PSI
   Certified by: SCOTT SPECIALTY GASES Date: 05-15-97
4. # ALMO 52285 Concentration: 506 % SO_2 Cyl. Press.: 850 PSI
   Certified by: SCOTT SPECIALTY GASES Date: 05-15-97

Analyzer: **Calibrated Range:** 0-2500 PPM **Output:** 0-1.0 V.
Flow: 1.5 SCFH **Measured by:** Rotameter

Calibration Results

Point #	CYL. #	PPM SO2	EXPECTED		ACTUAL		ADJ.	
			METER	DVM	METER	DVM	METER	DVM
1	1	0.00	00.0	.000	00.2	.002	00.0	.000
2	2	1290	51.6	.516	51.9	.519	51.6	.516
3	3	1770	70.8	.708	70.8	.708		
4	4	506	20.2	.202	19.7	.197		
5	1	0.00	00.0	.000	00.0	.000		

.5 = 1252.349

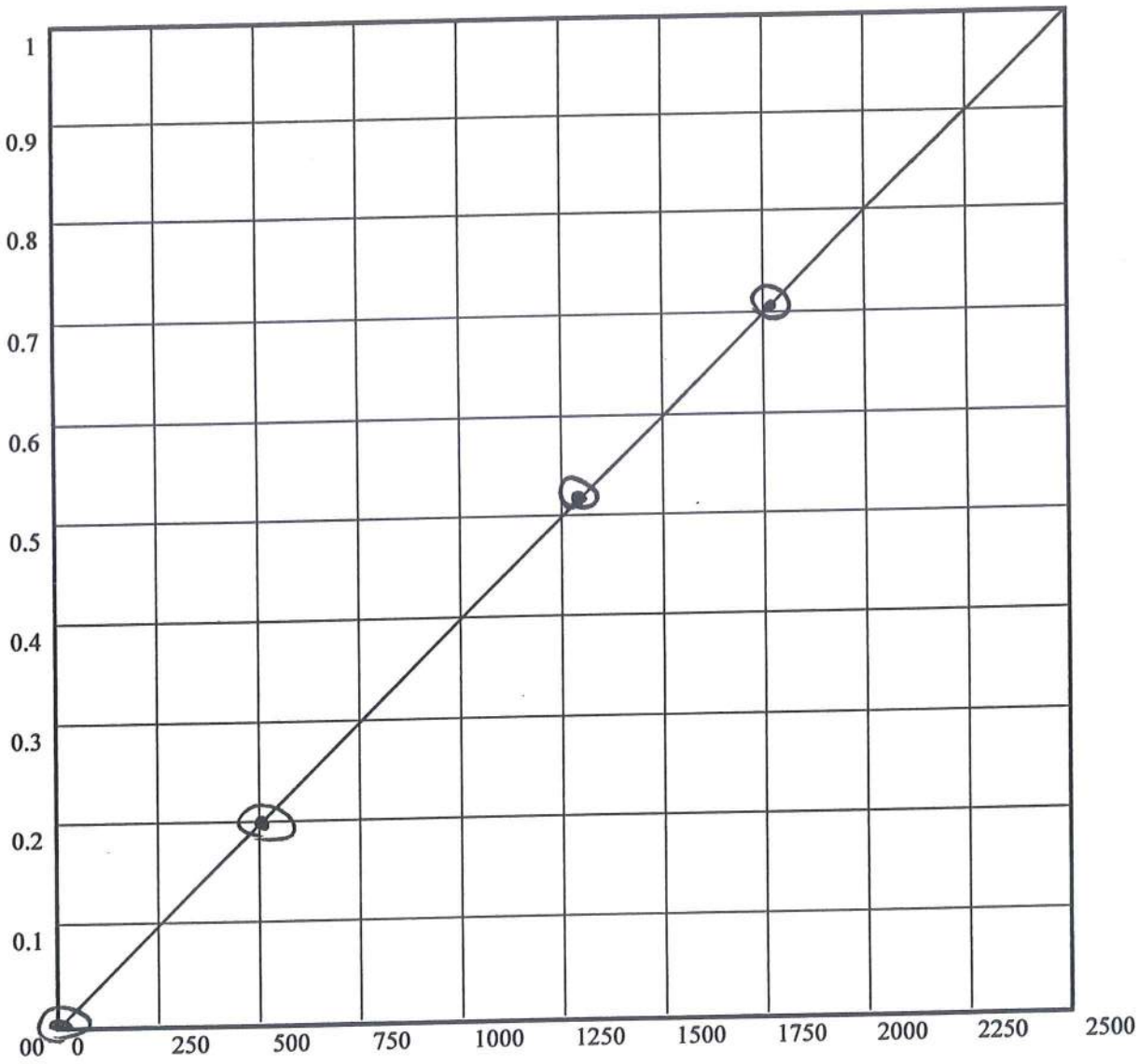
SO_2 Linear Regression Results:

Y = MX +B
Slope (M) = -.0023403

Y Intercept (B) = .0004011

Correlation Coefficient(r) = .9999676

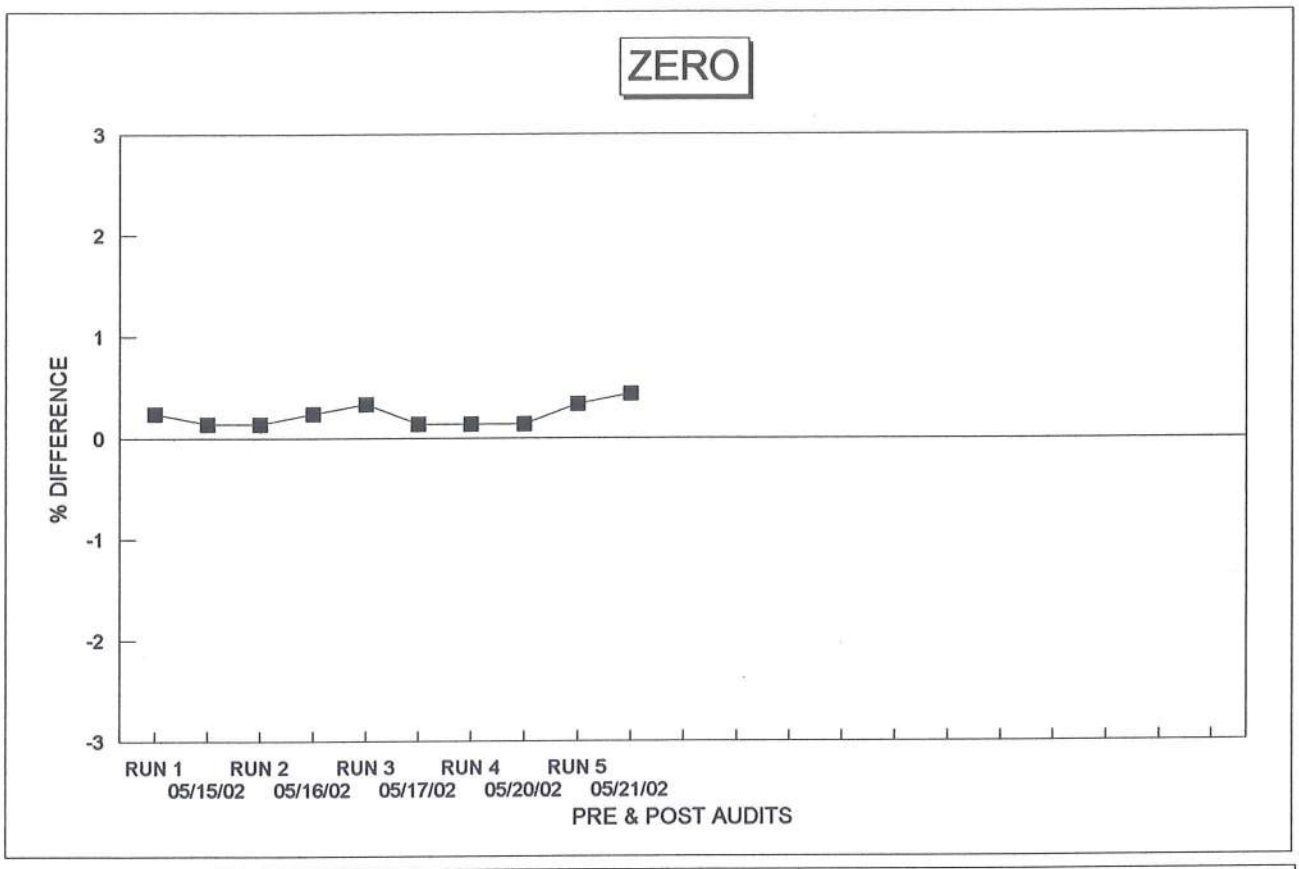
r^2 = .9999351

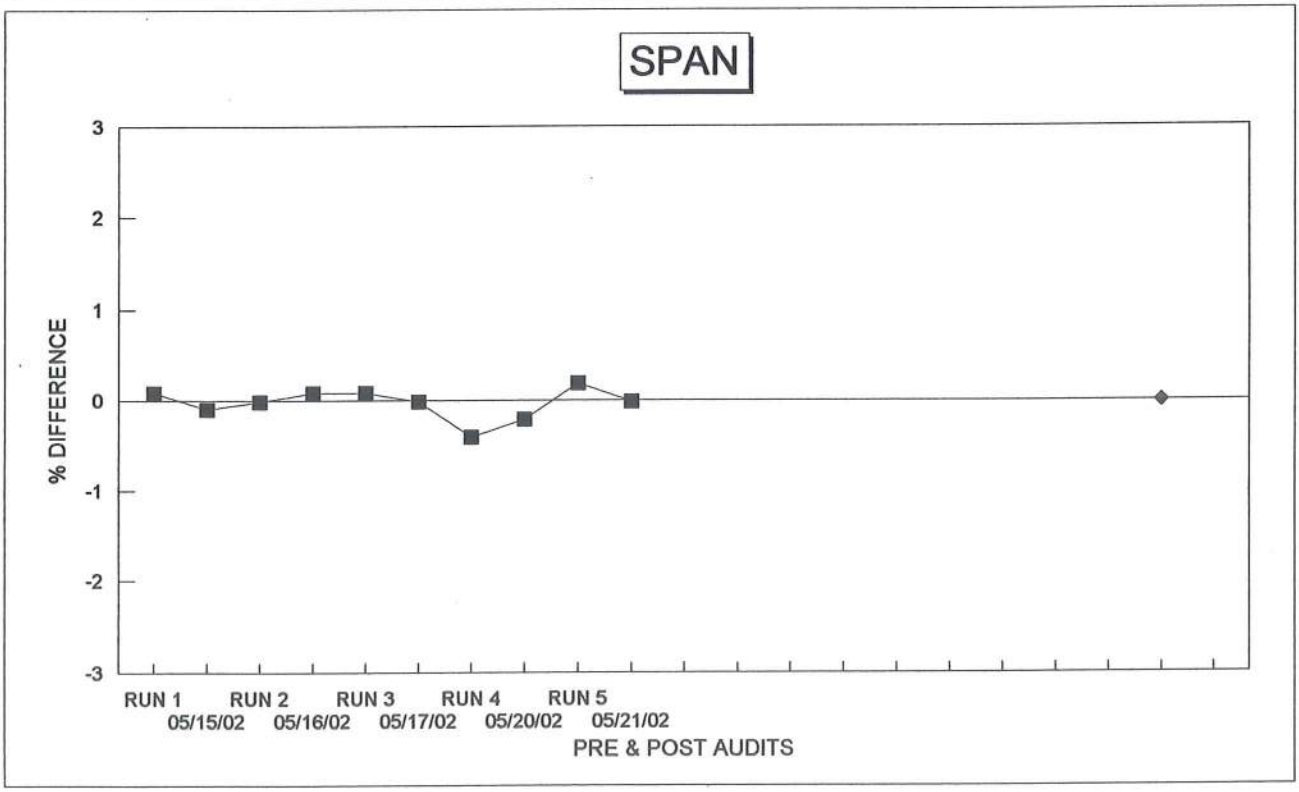


EPA Span Value = ± 2.0% of 2500 PPM SO_2 = ± 50 PPM
Cal Volts = Cal Volt Conc - Std Conc = ± Conc Diff = ± Δ %

HIGH VOLTS	.708	= 1770.0 - 1770.0	= ϕ	=	ϕ
LOW VOLTS	.197	= 492.5 - 506	= -13.50	=	-.540

SO2 Jotul F500





Scott Specialty Gases

Shipped From: 500 WEAVER PARK RD
LONGMONT CO 80501
Phone: 303-442-4700 Fax: 303-772-7673

CERTIFICATE OF ANALYSIS

ENERGY & ENV MEASUREMENT

C/O ED WADINGTON
3730 N. PELLEGRINO DR.
TUCSON AZ 85749

PROJECT #: 08-34135-005
PO#: VERBAL
ITEM #: 08024520 4AL
DATE: 4/24/97

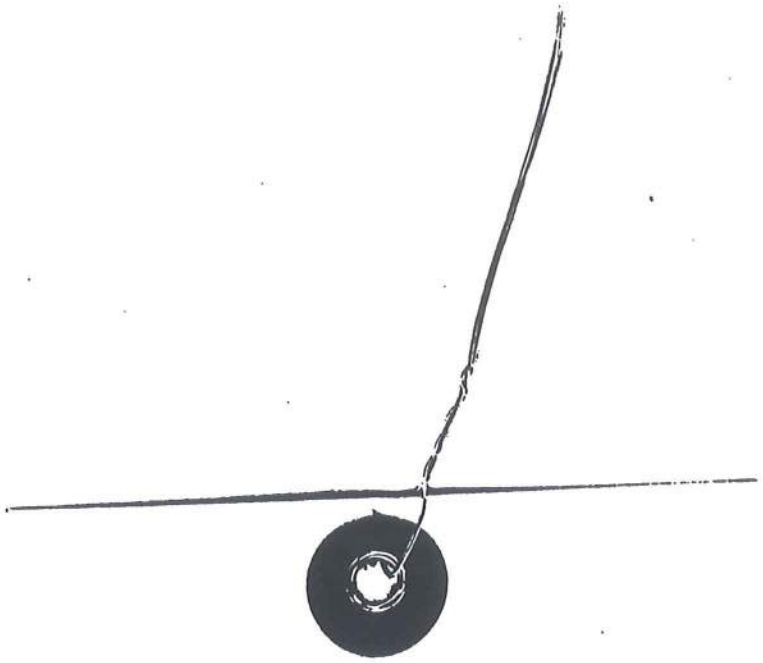
CYLINDER #: AAL21084
FILL PRESSURE: 2015 PSIA
BLEND TYPE : CERTIFIED MASTER GAS

ANALYTICAL ACCURACY: +/-2%
PRODUCT EXPIRATION: 4/24/2000

COMPONENT	REQUESTED GAS CONC MOLES		ANALYSIS (MOLES)	
ARBON DIOXIDE	6.25	%	6.25	%
CARBON MONOXIDE	2.	%	2.01	%
OXYGEN	6.25	%	6.24	%
ITROGEN	BALANCE			BALANCE

GA 590 2015 PSIA

NALYST: Diana Beehler
DIANA BEEHLER



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

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 # CC-12767 CGA 590

PRES 1650 VOL 150CF

TEST # 04602 DATE 02-15-02

Analytical Method GC/Paramagnetic

	Requested	Analyzed
Hydrogen		
Nitrogen	Bal.	Bal.
Argon		
Air		
Carbon Monoxide	5%	4.80%
Methane		
Oxygen	12.5%	12.5%
Helium		
Carbon Dioxide	12.5%	12.49%

SIGNED

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/6220/AAB9400251	03/20/97	Scott Enhanced FTIR

ANALYZER READINGS

(Z = Zero Gas R = Reference Gas T = Test Gas r = Correlation Coefficient)

First Tried Analysis

SULFUR DIOXIDE *

Date: 04/14/97 Response Unit: PPM

Z1 = 0.3847	R1 = 487.72	T1 = 508.77
R2 = 488.78	Z2 = 1.8201	T2 = 508.89
Z3 = 1.8425	T3 = 508.78	R3 = 488.89
Avg. Concentration:	508.8	PPM

Second Tried Analysis

Date: 04/21/97 Response Unit: PPM

Z1 = 0.3241	R1 = 488.29	T1 = 508.43
R2 = 488.83	Z2 = 1.8098	T2 = 508.78
Z3 = 0.8340	T3 = 508.74	R3 = 488.69
Avg. Concentration:	508.6	PPM

Calibration Curve

Concentration = A + B•z + C•z² + D•z³ + E•r

r = 0.999990

Constants:

A = 0.000000	
B = 1.000000	C = 0.000000
D = 0.000000	E = 0.000000

Special Notes:

ANALYST: Devon VanFeldt
Devon VanFeldt

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

Cyl. Number: CC [illegible]184	Cyl. Pressure:* 2000PSIG	Lot Number: SFS34489
Assay Date: 0[illegible]1	Expiration Date: 01/29/04	Document Number: 7638112
Customer: AIR LIQUIDE TAC[illegible]MA, WA	P.O. Number: LOKKEE	Item Number:

*[illegible]e is valid only to 150 psig

COMPONENT Name	REQUESTED Concentration	ASSAY Concentration
Sulfur Dioxide	1260 ppm	1290 ± 20 ppm
Nitrogen	Balance	Balance

[illegible]rotocol
S[illegible]tion No. 2.2, Procedure : G-1

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

Ana[illegible]t: Thuan Tran
A[illegible]ved by: John Oliveri

Sulfur Dioxide

GAS ANALYZER EMPLOYED

Mar[illegible]acturer:	Horiba
M[illegible] Number:	CMA-331A
S[illegible] Number:	56674503
[illegible]R Last Calibrated:	01/12/01
Analytical 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

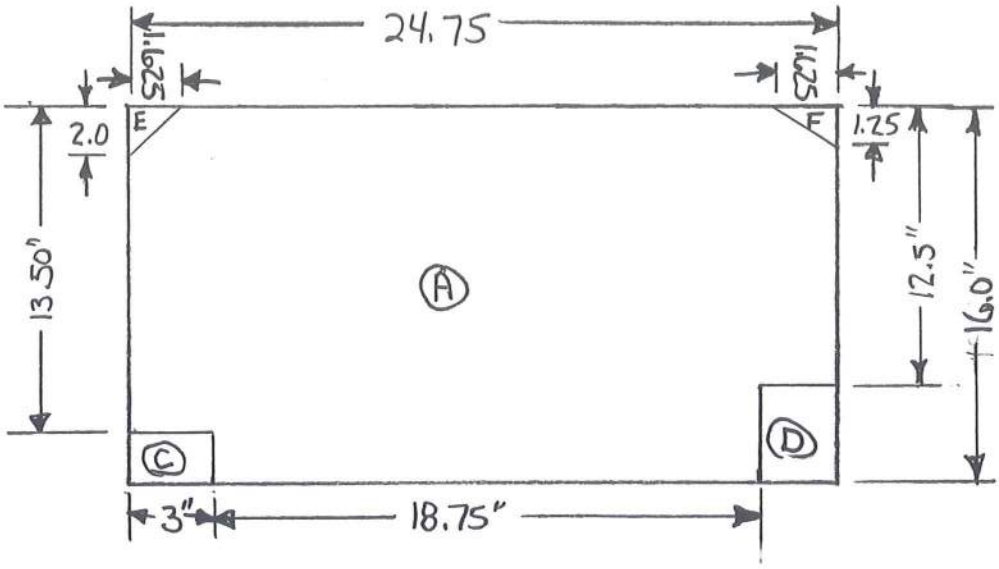
	01/29/01 Triad 4	01/29/01 Triad 5	01/29/01 Triad 6	Sulfur Dioxide Units
Zero	0	0	0	Vdc
Reference	153	153	153	Vdc
Candidate	128	128	128	Vdc
Result	1288	1288	1288	ppm
Evaluation	VALID	VALID	VALID	

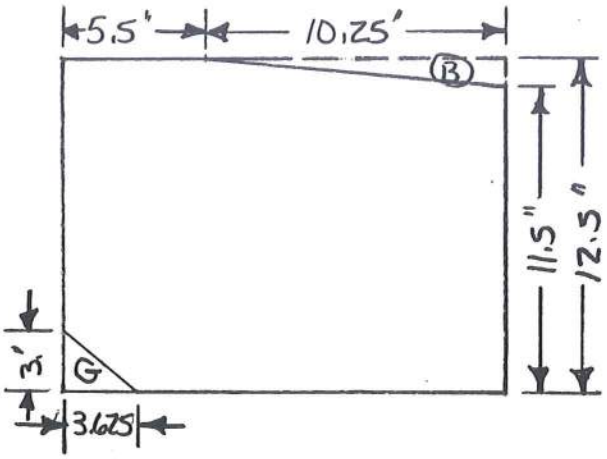
MEAN ANALYTICAL RESULT: 1288 ppm

Analyst: [illegible]

Approved By: [illegible]

FIREBOX VOLUME CALCULATIONS AND FUEL LOAD CALCULATIONS FOR THE JOTUL F500 WOODSTOVE





A = 24.75 × 16.0 × 12.5	=	4950.000
− B = .5(10.25 × 24.75 × 1.0)	=	126.844
− C = 3 × 2.50 × 12.5	=	93.750
− D = 3 × 3.50 × 12.5	=	131.250
− E = .5(2 × 1.625 × 11.5)	=	18.688
− F = .5(1.25 × 1.625 × 11.5)	=	11.680
− G = .5(3 × 3.625 × 18.75)	=	101.953
		4465.835 in.^{3}
	=	2.584 ft^3

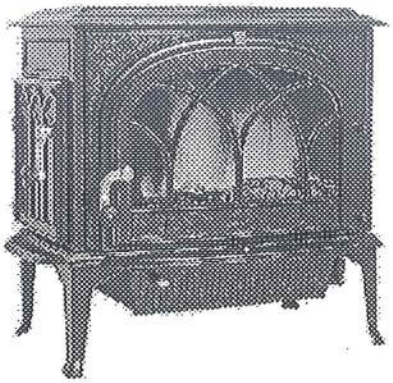
Fuel Load Range =

LOW	IDEAL	HIGH
16.3	18.091	19.8

Jøtul F 500

Jøtul F 500

Installation and Operating Instructions for USA/Canada



JØTUL

Monterings- og bruksanvisningen må oppbevares under hele produktets levetid. These instructions must be kept for future references. Wir empfehlen Ihnen, die Montage- und Bedienungsanleitung für spätere Zwecke sorgfältig aufzubewahren. Ce document doit être conservé pendant toute la vie de l'appareil.

USA/CANADA

Installation and Operating Instructions for the USA

Installation et fonctionnement pour Canada

Safety notice: If this solid fuel room heater is not properly installed, a house fire may result. For your safety, follow the installation directions. Contact local building or fire officials about restrictions and installation inspection requirements in your area. Kindly save these instructions for future reference.

Avis de sécurité: Une installation non appropriée de ce poêle de chauffage risque de provoquer un incendie. Assurez votre sécurité en respectant les directives d'installation suivantes. Consultez les autorités locales du bâtiment ou de la prévention des incendies au sujet des restrictions et exigences relatives aux inspections d'installations dans votre région.

Tested and listed by ITS, Intertek Testing Services, Middleton, Wisconsin.
Tested to U.S. Standards: ANSI/UL 1482 and ANSI/UL 737, Canadian Standards: CAN/ULC-S627-M93

Standards:

The Jøtul F 500 woodstove has been tested and listed to;
U.S. Standards: ANSI/UL 1482 & ANSI/UL 737.
Canadian Standards: CAN/ULC-S627-M93

Tests performed by:
ITS Intertek Testing Services, Middleton, WI

Manufactured by:
Jøtul A.S, P.O. Box 1411, N-1602 Fredrikstad, Norway

Distributed by:
Jøtul North America, P.O. Box 1157, 400 Riverside Street, Portland, ME 04104

This heater meets the U.S. Environment Protection Agency's Emissions limits for wood heaters manufactured and sold after July 1, 1990.

Under specific test conditions, this heater has shown heat output at rates ranging from 11,900 to 34,600 BTU's per hour.

The Jøtul F 500 woodstove is ***only*** listed to burn wood. Do not burn any other fuels.

When installing, operating and maintaining your Jøtul F 500 woodstove, follow the guidelines presented in these instructions, and make them available to anyone using or servicing the stove.

A number of areas require a building permit to install a solid fuel burning appliance.

In the U.S., the National Fire Protection Association's Code, NFPA 211, *Standards for Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances*, or similar regulations, may apply to the installation of a solid fuel burning appliance in your area.

In Canada, the guideline is established by the CSA Standard, CAN/CSA-B365-M93, *Installation Code for Solid-Fuel-Burning Appliances and Equipment.*

Always consult your local building inspector or authority having jurisdiction to determine what regulations apply in your area.

Jøtul North America Inc.
400 Riverside Street
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USA

Table of contents:

Safety notices:

- Be sure to read this entire manual before you install or use your new Jøtul F 500 woodstove.
- If this room heater is not properly installed, a house fire may result. To reduce the risk of fire, follow the installation instructions. Failure to follow these instructions may result in property damage, bodily injury, or even death.
- Jøtul recommends that you have your new Jøtul F 500 installed by a professional installer of solid fuel burning appliances.
- Extremely hot while in operation! Keep children, clothing and furniture away. Contact may cause skin burns.
- Avoid creating a low pressure condition in the room where the stove is operating. Operating an exhaust fan or a clothes dryer could create a low pressure area, causing poisonous gases to come out of the stove into the room.
- You can prevent low pressure conditions by providing adequate combustion air within 24" (610mm) but not closer than 12" (305mm) from the stove. Or, simply install the optional outside air manifold system, which allows the direct connection of air from outside the house to the stove.
- Do not use chemicals or fluids to start the fire. Some fuels will, during combustion, separate carbon monoxide and generate it in the burn chamber. Carbon monoxide is toxic, so please follow the guidelines in this manual for proper operation of your Jøtul F 500.
- If you for some reason experience smoke "roll-out" from the stove, it may activate smoke detectors if installed in the house.

USA/CANADA

Installation:

If this solid fuel room heater is not properly installed a house fire may result. For your safety, follow the installation directions. Contact the local building or fire officials about restrictions and installation inspection requirements in your area.

Reminder:
Your local officials have final authority in determining if a proposed installation is acceptable. Any requirement, that is requested by the local authority having jurisdiction, that is not specifically addressed in this manual, defaults to NFPA 211, and local codes in the U.S. or in Canada, CAN/CSA-B365-M and local codes.

Assembly before Installation

The Jøtul F 500 is shipped with the flue collar, gasketing and hardware inside the stove.

- To install the flue collar in the top or rear exit position remove the tape from the gasketing and adhere to the groove on the back of the stove around the flue opening.
- Place the flue collar on the stove in the top or rear exit position and secure with the nut, bolt and washer.
- The nut and washer are placed on the inside of the stove.

Chimney Connector

The chimney connector is a single walled pipe used to connect the stove to the chimney. For use with the Jøtul F 500, the chimney connector must be 6" (152mm) in diameter, with a minimum thickness of 24 gauge black steel.

- Aluminum and Galvanized steel pipe is not acceptable for use with the Jøtul F 500. These materials cannot withstand the extreme temperatures of a wood fire and can give off toxic fumes when heated.
- **Do not use the connector pipe as a chimney.**
- Each chimney connector or stove pipe section must be installed to the stove flue collar and to each other with the male (crimped) end toward the stove. **See figure 2, page 13.**
- This prevents any amount of condensed or liquid creosote from running down the outside of the pipe or the stove top.
- All joints, including the flue collar connection must be secured with three sheet metal screws.
- For the best performance the chimney connector should be as short and direct as possible, with no more than two 90° elbows.
- **The maximum horizontal run is 36" (915mm) and a recommended total length of stove pipe should not exceed 10 feet.**
- Always slope horizontal runs upward 1/4" (6,35mm) per foot toward the chimney.
- No part of the chimney connector may pass through an attic or roof space, closet or other concealed space, or through a floor or ceiling.
- All sections of the chimney connectors must be accessible for cleaning.
- Where passage through a wall or partition of combustible construction is desired, the installation must conform with NFPA 211 or CAN/CSA-B365, and is also addressed in this manual.
- **Do not connect this unit to a chimney flue servicing another appliance.**

Chimneys:

There are two types of chimneys suitable for the Jøtul F 500:

1. A code- approved masonry chimney with a flue liner.
2. A prefabricated chimney complying with the requirements for Type HT (2100°F) chimneys per UL 103 or ULC S629.

The chimney size should not be less than the cross-sectional area of the flue collar, and not more than three times greater than the cross-sectional area of the flue collar.

When selecting a chimney type and the location for the chimney in the house, keep this in mind: it is the chimney that makes the stove work, not the stove that makes the chimney work. This is because a chimney actually creates a suction, called "draft", which pulls air through the stove.

Several factors affect draft: chimney height, cross-sectional area (size), and temperature of the chimney, as well as the proximity of surrounding trees or buildings.

As a result, a short masonry chimney on the exterior of a house will give the poorest performance. This is because it can be very difficult to warm the chimney thereby creating inadequate draft. In extremely cold northern areas it may be necessary to reline the chimney or extend its height to help establish draft.

Conversely, a tall masonry chimney inside the house is easier to keep warm and will perform the best.

The following guidelines give the necessary chimney requirements based on the national code (ANSI-NFPA 211for the US. And CSA CAN-B365 for Canada). However, many local codes differ from the national code to take into account climate, altitude, or other factors.

Notice:

It is important that you check with your local building officials to find out what codes apply in your area before installing your new Jøtul F 500.
Remember: Your local inspector(s) have the final authority in approving your installation. It is always best to consult with them prior to the installation.

Masonry Chimneys

When installing the Jøtul F 500 into a masonry chimney you must conform to all of the following guidelines:

- The masonry chimney must have a fireclay liner or equivalent, with a minimum thickness of 5/8" (16mm) and must be installed with refractory mortar. There must be at least 1/4" (6,35mm) air space between the flue liner and chimney wall.
- The fireclay flue liner must have a nominal size of 8" X 8", and should not be larger than 8" X 12". If a round fireclay liner is to be used it must have a minimum inside diameter of 6" (157mm) and not larger than 8" (208mm) in diameter.
- If a chimney with larger dimensions is to be used, it should be relined with an appropriate liner that is code approved.
- The masonry wall of the chimney, if brick or modular block, must be a minimum of 4"(106mm) nominal thickness. A mountain or rubble stone wall must be at least 12" (310mm) thick.
- A newly-built chimney must conform to local codes and in their absence must recognize national regulations. When using an existing chimney, it must be inspected by a licensed professional chimney sweep, fire official, or code officer, to ensure that the chimney is in proper working order.
- No other appliance can be vented into the same flue.
- An airtight clean-out door should be located at the base of the chimney.

Prefabricated Chimneys

If a prefabricated metal chimney is to be used it must be a chimney type that is tested and listed for use with solid fuel burning appliances.
That means a chimney that is tested to the following:

High Temperature (HT) Chimney Standard UL 103 for the U.S. and High Temperature Standard ULC S-629 for Canada.

The manufacturer's installation instructions must be followed precisely. Always maintain the proper clearance to combustibles as established by the pipe manufacturer. This clearance is usually a minimum of 2" (56mm), although it may vary by manufacturer or for certain chimney components.

Chimney Height

Whether a masonry chimney or prefabricated metal chimney is used it must be the required height above the roof line.

The requirement is:
The chimney must be at least 3 feet higher than the highest point where it passes through the roof and at least 2 feet higher than the highest part of the roof or structure that is within 10 feet of the chimney, measured horizontally. **See figure 3, page 13.**

Chimneys shorter than 14 feet may not provide adequate draft. This could result in smoke spilling into the room from the stove when loading the stove, or when the door is open. In addition, inadequate draft can cause back puffing, which is a build up of gases inside the firebox.
Other times, chimney height can create excessive draft which can cause high stove temperatures and short burn times. Excessive drafts can be corrected by installing a butterfly damper. If you suspect you have a draft problem, consult your dealer.

Wall Pass-throughs

When your installation unavoidably requires the chimney connector to pass through a combustible wall to reach the chimney, always consult your local building officials, and be sure any materials to be used have been tested and listed for wall pass-throughs.

In the U.S.

The National Fire Protection Association's publication, NFPA 211, Standard for Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances permits four methods for passing through a combustible wall. Before proceeding with any method be sure to consult with your local building officials to discuss any local code requirements.

Common Method:

- When passing through a combustible wall to a masonry chimney this method requires the removal of all combustible materials from at least 12" (310mm) around the chimney connectors proposed location. With a 6" (157mm) round liner the minimum area required would be 31" x 31" (792x792mm) square.
- The space is then filled with at least 12" (310mm) of brick around a fireclay liner. Remember, the liner must be ASTM C35 or equivalent, with a minimum wall thickness of 5/8" (16mm).
- It is important to remember to locate the pass-through at least 18"(457mm) from the ceiling for proper clearance to combustibles.
- It will be necessary to cut wall studs, install headers, and construct a sill frame to maintain the proper dimensions and to support the weight of the brick.
- The bricks must be solid brick with a minimum of
- 3 1/4" (83mm) thick (4" (106mm) nominal).
- Refractory mortar must be used at the junction of the chimney and the pass-through liner. The pass-through liner must not penetrate the chimney liner beyond the inner surface of the chimney liner. Use extreme care when constructing the hole in the chimney liner, the tiles can shatter easily. **See figure 4, page 13.**

In Canada

In Canada the standard has been established by the Canadian Standard Association. The installation must conform to CAN/CSA-B365, Installation Code for Solid Fuel Burning Appliances and Equipment. Before proceeding be sure to consult your local building inspector.

USA/CANADA

Common Method:
This method requires the removal of all combustible materials from at least 18" (457mm) around the chimney connector's proposed location. With a 6" (157mm) round liner the minimum area required would be 43" x 43" square (1092x1092mm).

It is important to remember to locate the pass-through at least 18" (457mm) from the ceiling to maintain the proper clearance to combustibles.

The space that is cleared of combustible materials must then remain empty. Sheet metal panels can then be used to cover the area. However, when using a panel on both sides of the wall each cover must be installed on noncombustible spacers at least 1"(25,4mm) from the wall. If one panel of sheet metal is to be used it may be installed flush to the wall.

See section 5.3.1 and 5.3.2 of CAN/CSA - B365-M91.
Consult your local building inspector, authorized Jøtul Dealer, NFPA 211 in the U.S. or CAN/CSA-B635 in Canada for other approved wall pass-through methods.

Connecting to the chimney:

Masonry Chimney Thimbles

When installing a Jøtul F 500 into a masonry chimney through a "thimble"(the opening through the chimney wall to the flue), the thimble must be lined with ceramic tile or metal and be securely cemented in place.

The chimney connector/stove pipe must slide completely inside the thimble to the inner surface or the flue liner. It may be necessary to make use of a thimble sleeve (a pipe with a slightly smaller diameter than standard stove pipe). This special pipe can be easily installed into a thimble. **See figure 5, page 14.**

Make sure the connector pipe or thimble sleeve does not protrude into the flue liner, thereby restricting the area the smoke has to flow through. This bottle-neck will have a negative affect on the chimney system.
The chimney connector should be sealed at the thimble with refractory cement and the stove pipe leading to the stove should have a minimum of three screws.

Do not connect this stove to a chimney flue servicing another appliance of any kind.

Hearthmount Into a Masonry Fireplace

The Jøtul F 500 may be installed into a masonry fireplace provided the height of the opening is a minimum of 31" (787mm).

When installing the Jøtul F 500 into a masonry fireplace, code requires that the fireplace damper plate be removed or securely fixed in the open position. A connector pipe must then extend from the stove's flue exit through the damper area of the fireplace and into the chimney tile liner. **See figure 6, page 14.**

The inside area of the flue liner must not be less than the area of the stove's flue exit, and cannot be more than three times greater than the cross sectional area of the stove's flue exit.
If the chimney liner is too large to accommodate the stove, an approved relining system must be installed to resize the flue.
A new sheet metal damper block-off plate must be installed around the connector pipe at the damper frame and sealed with the proper sealant (usually High-Temp Silicone).

Fireplace installation must also observe the proper clearances to surrounding trim and mantels (addressed in clearance section of this manual). In addition, fireplace installations must also adhere to the floor protection guidelines specified in the following section.

Prefabricated Chimneys

When installing the Jøtul F 500 to a prefabricated metal chimney always follow the pipe manufacture's instructions and be sure to use the components that are required. This usually includes some type of "smoke pipe adapter" that is secured to the bottom section of the metal chimney and allows the chimney pipe to be secured to it with three sheet metal screws. **See figure 7, page 14.**

Clearances to Combustibles:

Floor Protection

Floor protection under the stove must be constructed of a non-combustible material for protection from radiant heat, sparks, and embers.

Individual sections of floor protection must be mortared together to prevent sparks from falling through to combustible materials. Any carpeting must be removed from under the floor protection.

In the U.S. and Canada

The Jøtul F 500 must be installed on a non-combustible surface extending:

A minimum of **18" (457mm)** in front of the stove and the left side load door (measured from the legs).
And **8" (200mm)** on the left side and back of the stove (measured from side and back panels).

This will result in a minimum floor protection of **56"W X 50,5"D.(1422mmx1283mm)** **See figure 8, page 14.**

In a rear vent installation the floor protection must also extend under the stove pipe a minimum of **2" (50mm)** beyond either side of the pipe.

Alternate hearth protection
A hearth pad measuring **46"wide X 50,5"** deep **(1168mmx1283mm)**can be used ***only if the left side door is looked to prevent use***.

When constructing a new hearth or floor pad, consult appendix a at the back of this manual for alternate materials and methods.

Clearances to Walls and Ceilings

The following clearances have been tested to UL and ULC standards and are the minimum clearances specifically established for the Jøtul F 500.

The following diagrams give the required clearances you must maintain when installing the Jøtul F 500 near combustible surfaces. **See pages 16-17.**

A combustible surface is anything that can burn (i.e. sheet rock, wall paper, wood, fabrics etc.). These surfaces are not limited to those that are visible and also include materials that are behind non-combustible materials.

If you are not sure of the combustible nature of a material, consult your local fire officials. Contact your local building officials about restrictions and installation requirements in your area.
Remember: "Fire Resistant" materials are considered combustible; they are difficult to ignite, but will burn. Also "Fire-rated" sheet rock is also considered combustible.

Using Shields to Reduce Clearances

Pipe shields: When using listed pipe shields to reduce the connector clearance to combustibles, it must start 1"(25,4mm) above the lowest exposed point of the connect pipe and extend vertically a minimum of 25" (635mm) above the top surface of the stove.

Double wall pipe: Listed double wall pipe is an acceptable alternative to connector pipe heatshields.

Wall-Mounted Protection: When reducing clearances through the use of wall mounted protection:

In the U.S. refer to NFPA 211, Standard for Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances, for acceptable materials, proper sizing and construction guidelines.

In Canada, refer to CAN/CSA-B365, Installation Code for Solid-Fuel Burning Appliances and Equipment, also for acceptable materials, proper sizing and construction guidelines.

Stove Mounted Heatshield: A stove rear heatshield has been specifically designed for the Jøtul F 500.
Rear heatshield part # 154329.

No other heat shield may be used.
See pages 16-17 for complete clearance requirements and diagrams.

Notice
Accessories for wood stoves for clearance reduction have been developed by many manufacturers. If not following the methods of the installation codes, be sure that any accessory you choose has been tested by an independent laboratory and carries the laboratory's testing mark. Make sure to follow all of the manufacturer's instructions.

Always contact your local building inspector or fire officials about restriction and requirements in your area. Reminder, it is the local officials who have final authority in the installations approval.

USA/CANADA

Alcove Installation:

The Jøtul F 500 can be installed in an alcove situation provided: **See figures 9 and 10, page 14.**

1. The stove must be installed with listed double walled pipe.
2. In a protected alcove installation both side walls and rear wall must be protected per NFPA 211 or CAN/CSA-B365. The wall protection must be elevated 1"(24,5mm) from the floor and at least 1" (24,5mm)off the combustible wall to allow for an air-flow.
3. The height of the wall protection including the bottom air space must be 48"(1219mm).
4. The bottom heatshield **is required in all** alcove installations.
5. If a listed (UL/ULC) hearth board is not used the hearth that is constructed must have a minimum r value of 1.6 **(see appendix a, page 19).**
6. Minimum ceiling height in an unprotected installation, off the top of the stove is 48"(1219mm). The minimum ceiling height off the top of the stove in a *protected* ceiling installation is 15"(380mm).

Use of the left side load door is prohibited in alcove installations.

Mobile Home Installations:

The Jøtul F 500 has been approved for use in mobile homes in the U.S. and Canada, provided:

1. The stove is secured to the floor or the mobile home. Floor mounting kit #750304.
2. The stove is provided outside air for combustion. Outside Air kit #154333 (see page 11 for more details)
3. The stove must be grounded to the mobile home frame per NFPA 70.

As always, consult with your local building inspector or fire officials about restrictions and requirements in your area prior to installing the stove.

Warning:
Do not install in a bedroom/sleeping room. The structural integrity of the mobile home's floor, wall, ceiling/roof must be maintained.

Operation:

Before building a fire in your new Jøtul F 500, please read the following section carefully and completely.

This stove is designed to burn natural wood **only**. Wood that has been air-dried for a period of 6 to 14 months will provide the cleanest most efficient heat.

Do not burn:

* Coal	* Treated or painted wood
* Garbage	* Chemical Chimney cleaners
* Cardboard	* Colored paper
* Solvents	* Any synthetic fuel or logs

The burning of any of these materials can result in the release of toxic fumes. Never use gasoline, gasoline-type lantern fuel, kerosene, charcoal lighter fluid, or similar liquids to start or "freshen-up" the fire. Always keep such liquids away from the heater at all times.

Important
Never build or allow the fire to rest directly on the glass. The logs should always be spaced at least one inch from the glass to allow for proper air flow within the stove.

Controls on The Jøtul F 500

A single air control lever controls the burn time and heat output of the stove. This primary air control lever is located on the front of the stove directly above the ashlip. The primary air lever controls the amount of air that enters the stove for combustion.

When first starting or reviving the fire: The primary control lever should be at the far right position, which allows the maximum amount of air into the stove.
The more air entering the stove, the hotter the fire, the shorter the burn time. Moving the lever to the left reduces the air-flow into the stove which prolongs the fire at a lower heat output. **See figure 11, page 15.**

Breaking in Your New Stove

Your new Jøtul F 500 is constructed of cast iron and stove furnace cement. This type of construction requires the stove to be "broken-in" gradually so that heat expansion does not occur too quickly and cause damage.

Complete the following steps for the proper break-in procedure for the Jøtul F 500:

To monitor the stove's temperature, Jøtul recommends the use of a magnetic stove-top thermometer, *placed directly on the corner of the stove's top plate.*

1. Light a small fire, newspaper and kindling only, only allow the stove to reach a maximum surface temperature of 200°. Burn for approximately1 hour.
2. Allow stove to cool to room temperature.
3. Light a second fire, allowing the stove to reach a maximum temperature of 300° for 1 hour.
4. Cool the stove to room temperature.
5. Light a third fire and gradually allow the stove to reach a surface temperature of 400°
6. Cool stove to room temperature. This completes the "break-in" procedure.

Never allow the stove to exceed a 400° surface temperature during any "break-in fire" with the exception of the last "break-in" fire.

Note: It is normal for a new painted stove to emit an odor and even smoke during its first several fires. This is caused by the seasoning of the high temperature paint and will diminish with each fire and will eventually disappear. Opening a window or door to provide additional ventilation will reduce the odor as this process takes its course.

Starting and Maintaining a Fire

Burn only solid wood directly on the bottom grate of the stove, do not elevate the fire in any way.

- The ash pan door on the stove must always be securely closed when the stove is in operation.
- Burning the stove with the ash pan door open will overfire the stove and cause interior damage.
- With the primary air control lever in the full open position, start with several sheets of crumbled newspaper placed directly on the grate. On top of the newspaper, place several pieces of small dry kindling (approx. 1"(24,5mm) in diameter) with two to three larger logs (approx. 3"(76mm) to 5"(127mm) in diameter) on top.
- Light the fire and close the door, slowly building the fire by adding larger and larger logs. Be sure to follow the break-in procedure before creating a fire that will damage the stove.
- Once the stove has reached a surface temperature range of between 400° and 600°, adjust the primary air control lever as necessary to generate the heat output and burn time desired.
- Jøtul recommends the use of a magnetic stove top thermometer to monitor the surface temperature of the stove. The optimum surface temperature range for the most efficient burn is between 400° to 600°. See figure 12, page 15, for the optimum locations of a stove-top thermometer.

Adding Fuel

When reloading the stove while it is still hot and a bed of hot embers still exist, follow this reloading procedure:

- Always wear gloves when tending to the stove.
- Push the air control lever to the full open position (far right).
- Wait a few seconds before opening the door.
- Use a stove tool or poker to distribute the hot embers equally around the firebox.
- Load the fuel, usually with smaller logs first.
- Close the door, be sure to latch the door tightly.
- Wait 5–10 minutes before adjusting the primary air to the desired heat output setting. (If you have at least a 2"(50mm) thick ember bed when reloading, it may be possible to close the door and immediately adjust the air control setting).

The Formation of Creosote

When wood is burned slowly and at low temperatures, it produces tar and other organic vapors, which combine with moisture to form creosote. The slow moving smoke carries the creosote vapors, which condense in the cooler chimney flues, and this creosote then sticks to the chimney walls.

The creosote that accumulates in the chimney is highly flammable and is the fuel of chimney fires. To prevent chimney fires it is important to have the chimney and chimney connector pipe inspected and/or cleaned semi-annually. A qualified chimney sweep or other authorized service person can provide this service.

It is also important to remember that chimney size, temperature and height all affect draft which in turn affects the formation of creosote. Be sure to follow the installation and operation guidelines established in this manual.

Maintenance:

For your protection always wear safety gloves when handling the ash pan.

Ash removal

Ash removal will be required periodically depending on how frequently the stove is used. Conveniently, the Jøtul F 500 is equipped with an ash pan assembly for easy ash removal, without the need for opening the front door.

The ash pan door is located under the front ashlip of the stove. To open the ash door insert the pin on the end of your specially designed ash tool into the hole on the ash door latch. Rotate the door counterclockwise to unlatch the door and clockwise to latch the door.

Remove the ash pan. When the stove is in operation always close the ash door before leaving to dispose of the ashes.

The ashes should be placed in a metal container equipped with a tight sealing lid. The container should be placed on a noncombustible floor or on the ground, well away from all combustible materials, pending final disposal. If the ashes are disposed of by burial in soil or otherwise locally dispersed, they should be retained in the closed container until all cinders have thoroughly cooled.

WARNING. Do not, at any time, operate this stove with the ash pan door open. This condition will lead to overfiring and will damage the stove. This damage is not covered under warranty. Only empty the ash drawer before refueling, when the fire is low or out. The ash door should be open only long enough to empty the ash drawer and then securely closed. Inspect the gasket on the ash pan door regularly and replace as necessary.

Glass Care

Cleaning:

On occasion it will be necessary to clean the carbon deposits and fly ash off of the glass. If the carbon and fly ash are allowed to remain on the glass for an extended period of time it could eventually cause the glass to become etched and cloudy. Any creosote, which might deposit on the glass, should burn off during the next hot fire.

The proper cleaning procedure is as follows:

1. Glass needs to be completely cool.
2. Only use a cleaner that is specifically designed for this purpose. The use of abrasives will damage the glass and ultimately leave the glass frosted.
3. Rinse and dry glass completely before burning your stove.

Never operate the stove with a cracked or broken glass panel.

Glass removal:

Always operate the doors slowly and cautiously to avoid cracking or breaking the glass. Never use the door to push wood into the firebox. If the glass becomes cracked or broken follow this procedure for replacement:

1. Remove the door from the stove and place on a flat surface.
2. Carefully remove all of the glass clips from the inside of the door.
3. Gently remove all pieces of the glass panel and gasketing.
4. Remove all remaining debris from the glass area using a wire brush.
5. Apply a small bead of gasket/stove cement and the new gasket. Do not overlap the ends of the gasket rope.
6. Center the new glass panel over the gasket and reinstall the glass clips. **See figure 13, page 15.**

Important: The side of the glass treated with an infrared coating (marked on the perimeter) should always be facing outward. It is extremely important to tighten the glass clips slowly and in a repeating pattern, like tightening the lugs on an automobile wheel.
It may be necessary to retighten the glass clips after the stove has burned and the gasketing has been seated.

Important:
Replace glass only with a ceramic glass panel specifically designed for the Jøtul F 500. Do not use substitutes. Replacement glass panels can be ordered through your Jøtul dealer.

General maintenance

Like your car, regular maintenance prolongs the life of your stove. The following procedures do not take long and are generally inexpensive, but when done consistently, increase the life of your stove and in turn, increase your years of enjoyment.

At least once a year you should perform the following maintenance procedures:

1. Thoroughly clean the stove. Enamel surfaces should be cleaned with soap and water.
2. Empty stove of all soot and ashes. Only use a vacuum for this job if the vacuum is specifically designed for ashes.
3. Inspect the stove: Using a strong light inspect the stove inside and out for cracks or leaks. Replace all cracked parts and repair any cement leaks with furnace cement.

Gaskets

Check doors and window gaskets for tightness.
To check the seal of the front door, close and latch the door on a dollar bill and slowly try to pull the dollar bill free. If it can be easily removed then the seal is too loose. Check several spots around the door, and repeat the procedure on the ash pan door as well.

- If gaskets need to be replaced, scrape out the old gasket and cement and clean the area with a wire brush.
- Apply a small bead of cement and push in the new gasket.
- After closing and latching the doors wipe clean any excessive cement that has come from beneath the gasketing.

Gaskets for:

Description		Size	Length
Top Cover	Id360	3/8"/Ø8,7mm	x3,4'/1050mm
Top Plate	Id 375	3/8"/Ø9,5mm	x7'/2100mm
Smoke Outlet	Id 250	3/16"/Ø6,4mm	x3'/930mm
Ash Housing	Id 250	3/16"/Ø6,4mm	x4,2'/1300mm
Ash pan door,	Id250	1/4"/ø6,4 mm	x 4,6 '/1100 mm
Front door,	Id375	3/8"/ø9,5 mm	x 6'/1800 mm
Left side door,	Id375	3/8/ø9,5 mm	x 4,2'/1300 mm
Glass,	Id250	3/8"/ø8,7 mm	x 5'/1500 mm

The Jøtul F 500 is designed to burn cleanly and efficiently when used according to the guidelines expressed in these operating instructions. However, to maintain the proper performance, a yearly chimney inspection and cleaning is necessary. Failure to keep the chimney system free of creosote and build up could result in a serious chimney fire.

Accessories:

Many accessories have been manufactured for use with the Jøtul F 500. Only use accessories that are specifically designed for the Jøtul F 500.

Firescreen

The Jøtul F 500 has been approved for use as an open fireplace, with front door open. This feature is especially nice when the ambience of a fire is desired. Some care should be taken when operating the stove as a fireplace.

- Always have the firescreen in place, attached to the stove front.
- Never over load the stove: For the best appearance burn in the traditional three log configuration.
- Reminder, when burning the stove with the screen in place, you are sacrificing efficiency for aesthetics, and you will be consuming wood at a much faster rate.

Warning: **Operate your Jøtul F 500 with the front door fully open and the firescreen in place, or fully closed. Partially opened doors may result in overfiring. Also, if doors are left partly open, gas and flame may be drawn out of the stove opening, creating risks from both fire and smoke.**

Outside Air Kit

In certain installations it may be necessary to provide outside air to your Jøtul F 500 wood stove. Guidelines to determine the need for additional combustion air may not be adequate for every situation. If in doubt, it is advisable to provide additional air.

The outside air kit includes an adapter to mount onto the stove that will accept the fresh air pipe. Installation will require some additional materials:

A. The appropriate length of metallic pipe for a conduit of the outside air (4" (100mm) diameter).
B. A rain/weather resistant cap for the outside of the house.
C. A rodent screen - that is no larger than 1/4"(6,4mm) mesh.

Outside air may be required if:

1. The Jøtul F 500 does not "draw" steadily, smoke rollout occurs, fuel burns poorly, or back-drafts occur whether or not there is combustion present.
2. Existing fuel-fired equipment in the house, such as fireplaces or other heating appliances, smell, do not operate properly, suffer smoke roll - out when opened, or back-draft whether or not there is combustion present.
3. Opening a window slightly on a calm (windless) day alleviates any of the above symptoms.
4. The house is equipped with a well-sealed vapor barrier and tight fitting windows and/or has any powered devices that exhaust house air.
5. There is excessive condensation on the windows in the winter.
6. A ventilation system is installed in the house.

If these or other indications suggest that infiltration air is inadequate, additional combustion air should be provided from the outdoors. Outside combustion air can be provided to the appliance by the following means:

Direct connection: The Jøtul F 500 has been tested and listed for use with an outside air kit. This outside air kit is connected directly to the stove. Be sure to follow the instructions provided with the kit.

Indirect method: Outside air is ducted to a point no closer than (12") 300mm from the appliance, to avoid affecting the performance of the appliance.

USA/CANADA

A mechanical ventilation system: If the house has a ventilation system (air change or heat recovery):

A.The ventilation system may be able to provide sufficient combustion make-up air for the solid fuel fired appliance.

B.The homeowner should be informed that the ventilation system might need to be rebalanced by a ventilation technician after installation of the appliance.

Floor Bracket Kit

Use of the floor bracket kit is required in all mobile home installations to secure the stove to the floor. Complete installation instructions and diagrams are supplied with each floor bracket kit.

Rear Heatshield

A stove rear heatshield has been specifically designed for the Jøtul F 500 to reduce clearances off the rear of the stove to combustible materials. Use of the heatshield ***does not*** affect the clearance off the sides of the appliance.

See pages 16-17 for specific clearance requirements. Complete installation instructions are supplied with the heatshield. No other type of heatshield may be used on the rear of the Jøtul F 500.

Bottom Heatshield

A bottom heatshield has been specifically designed for the Jøtul F 500. It is required in all alcove installations. Use of the bottom heatshield ***does not*** affect the floor protection requirements discribed on page 9 of this manual. No other type of heatshield may be used on the bottom of the Jøtul F 500.

Stove-top Thermometer

Jøtul recommends the use of a magnetic stove-top thermometer to monitor the surface temperature of the stove. The optimum surface temperature range for the most efficient, clean burn is between 400° and 600°.

Fig. 1 a

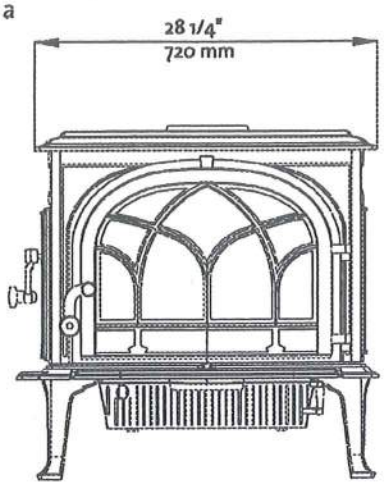


Fig. 1 b

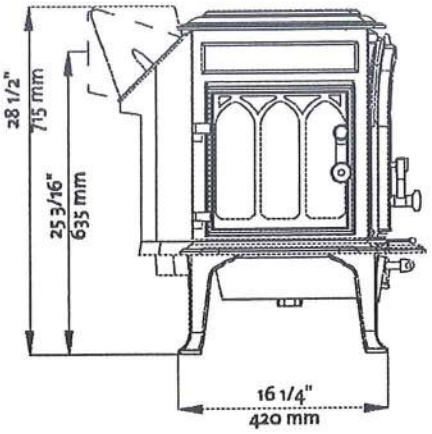


Fig. 1 c

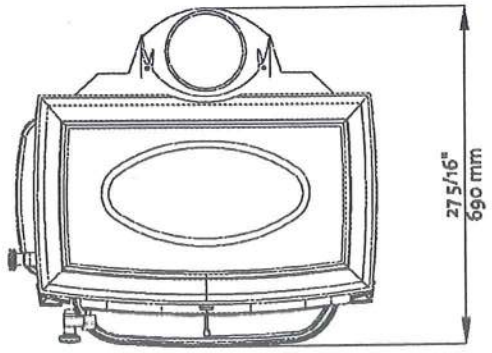


Fig. 2

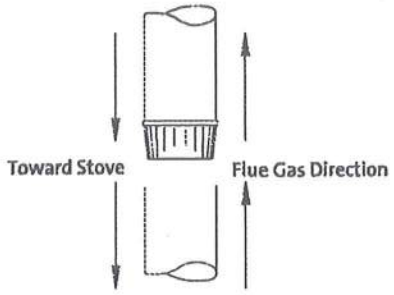


Fig. 3

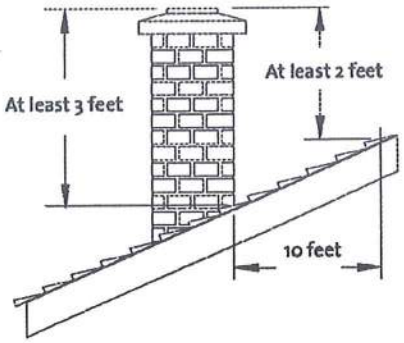
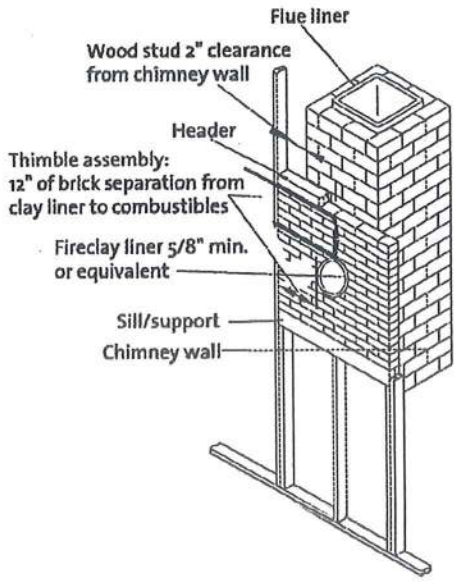


Fig. 4



USA/CANADA

Fig. 5

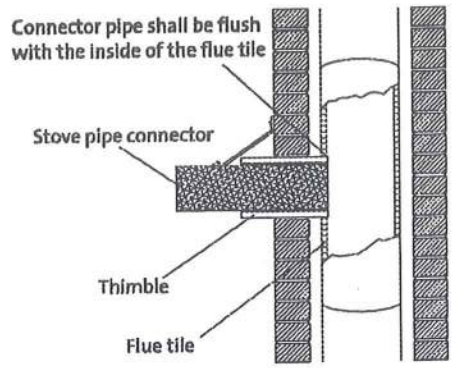


Fig. 8

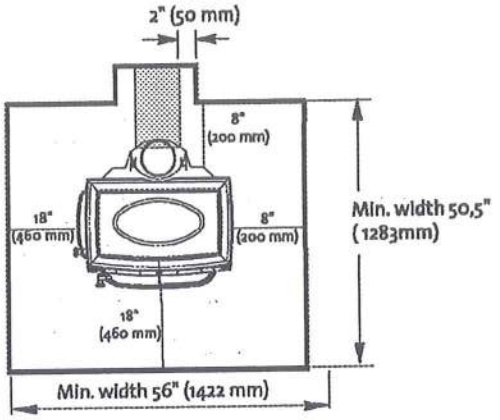


Fig. 6

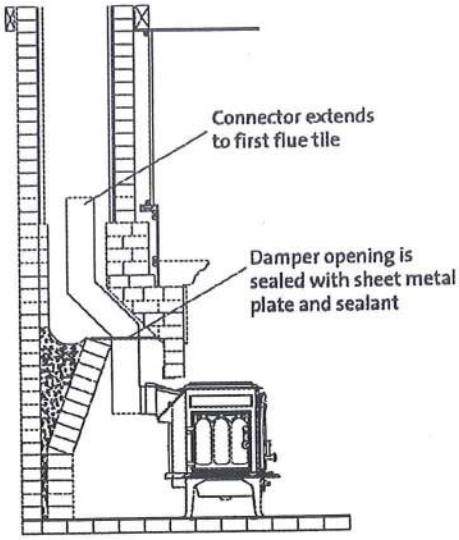


Fig. 9

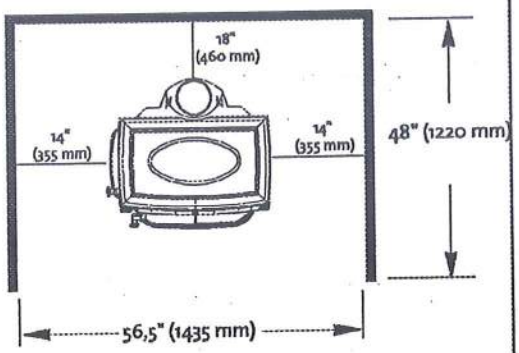


Fig. 7

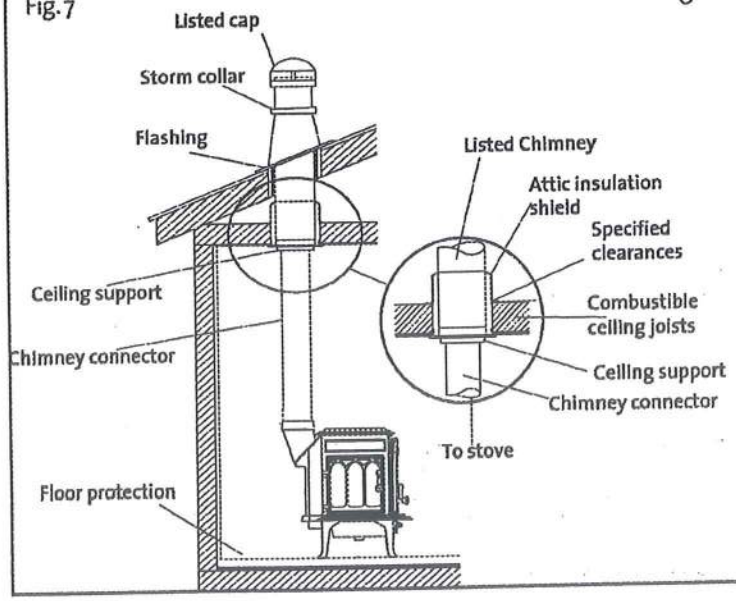


Fig..10

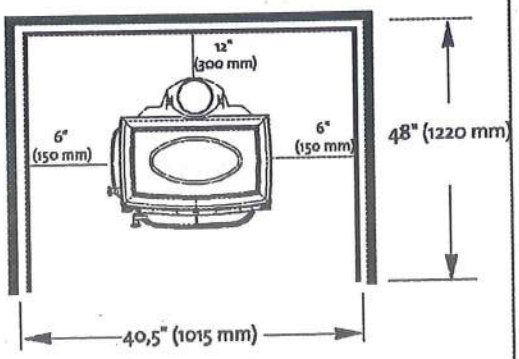


Fig..11

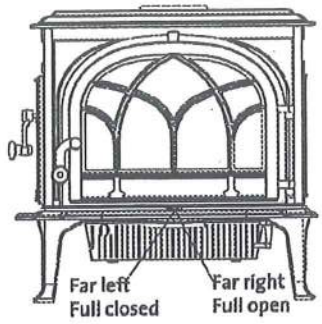


Fig.12

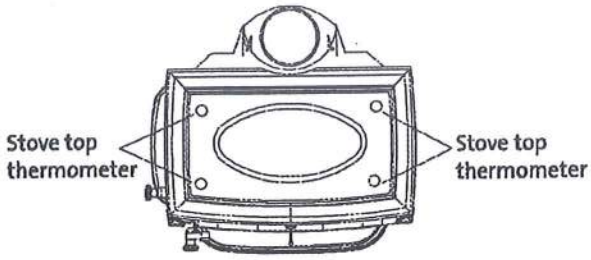
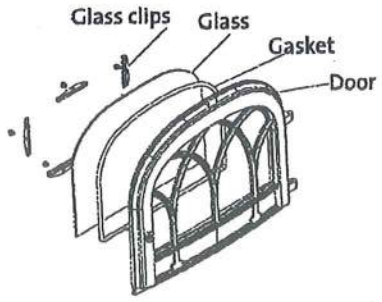


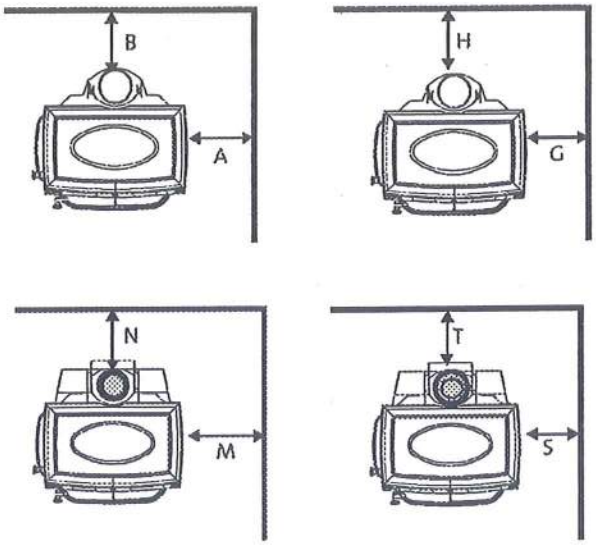
Fig.13



USA/CANADA

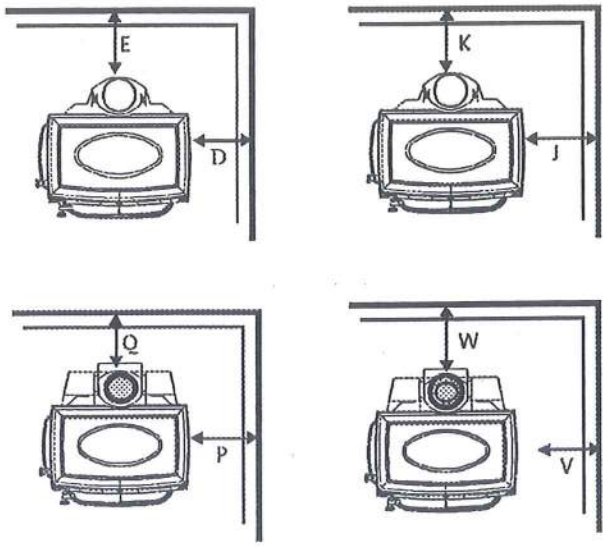
Jøtul F 500 Woodstove Clearances

Unprotected Surface Parallel to the Wall



Protected Surface Parallel to the Wall

PER NFPA 211 or CAN/CSA-B365

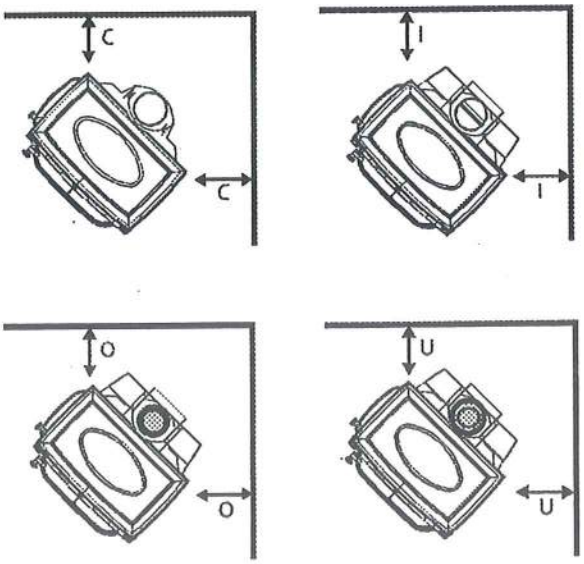


Important:
Connector heatshields and double wall pipe must be a listed product.
Always follow the manufacturer's instructions.

= SINGLE WALL PIPE WITH CONNECTOR SHIELDS

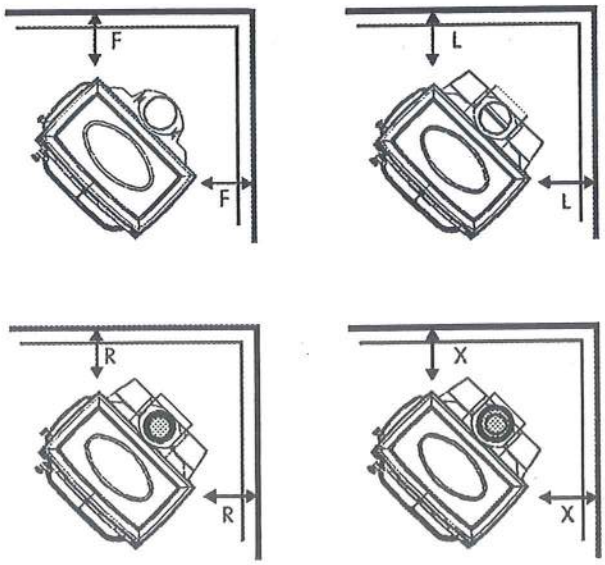
= DOUBLE WALL PIPE

Unprotected Surface Corner Installation



Protected Surface Corner Installation

PER NFPA 211 or CAN/CSA-B365



Jøtul F 500 Woodstove Clearances

Stove clearances	Unprotected surface Parallel installation			Protected surface NFPA 211 Parallel installation		
	Side	Rear	Corner*	Side	Rear	Corner*
Stove- no heatshields Single wall pipe	14" A 355mm	18" B 460mm	13" C 330mm	6" D 150mm	12" E 300mm	9" F 230mm
Stove with rear heatshield Single wall pipe	14" G 355mm	10" H 255mm	9" I 230mm	6" J 150mm	10" K 255mm	9" L 230mm
Stove with rear heatshield With connector shield	14" M 355mm	6" N 150mm	9" O 230mm	6" P 150mm	6" Q 150mm	6" R 150mm
Stove with rear heatshield With double wall pipe	14" S 355mm	6" T 150-mm	9" U 230mm	6" V 150mm	6" W 150mm	6" X 150mm

Connector clearances (pipe)	Unprotected surface Vertical installation	Protected surface NFPA 211 Vertical installation
Single wall pipe	18" 460mm	12" 300mm
Single wall pipe with connector shields	6" 150mm	6" 150mm
Double wall pipe	6" 150mm	6" 150mm

Connector clearances (pipe)	Unprotected surface Horizontal installation	Protected surface NFPA 211 Horizontal installation
Single wall connector	18" 460mm	12" 300mm
Double wall pipe	6" 150mm	6" 150mm
Mantel and trim clearances	Stove to 1" thick or less, side trim	12" 300mm
	Stove to 1" thick or less, top trim	16" 410mm
	Stove to mantel- maximum mantel depth 12"	30" 765mm

*** Attention: Stove and pipe clearances must both be taken into Consideration. The greater clearance dictates the stove's position.**

*** Use of the right side load door is prohibited in alcove and Corner installations.**

APPENDIX
A

JØTUL®
JØTUL NORTH AMERICA

JØTUL U.S.A., INC.
P.O. Box 1157
Portland, Maine 04104
Tel: (207) 797-5912
Fax: (207) 772-0523
Email: jotul@ime.net

May 1, 2002

Chip Wadington
Lokee Testing Labs
13235 Prairie Circle East
Sumner, WA 98390-7250

Dear Mr. Wadington

The following information is being provided to assist you in obtaining test results in the applicable burn rate categories for the Jotul F500.

By removing the inspection cover you will expose the air slider valve which controls primary air. The measurement of the size of the open air passage created by the air slider correlates to the following burn rates.

Opening	Burn rate
< .125"	Low
.125" - .188"	Medium low
.188" - .375"	Medium high
Full open	High

The fan should be activated at 30 minutes after the start of the test run.

Sincerely,

Roger W Purinton

Roger W. Purinton
Project Engineer, Jotul North America

EXAMPLE CALIBRATION/DATA FLOW

All individual test run raw data sheets are organized in a manner that would allow a data reviewer to follow the data as it is being calculated in a step by step fashion. In many cases, the equations used to calculate a specific required data are given on the raw data sheets themselves.

For example, the particulate emission rate in g/dscf is calculated on Data Sheet #7. However, the data used to derive this data begins on Data Sheet #2 (Meterbox Data Sheet) where the meter volume (cubic feet), average meter temperature (°F), average ΔH (in. H_2O), and average Barometric pressure (in. Hg) are recorded and averaged. Each of the averages for these parameters are used in equation 1 on P. 7 where the volume (MCF) is converted to dscf.

The moisture catch total (g. H_2O) on the Particulate Catch/Moisture Data sheet (p. 3) is transferred to P. 7 and the percent stack moisture is calculated in equations 2 and 3.

The gross and net gravimetric (g) particulate catches are determined and calculated on PP. 3-6. Pages 4-1, 4-2 and 4-3 show the initial (tare) constant weights for filters (p. 4-1) and beakers (p. 4-2) and the final constant weights (p. 4-3) for those filters and beakers used for each run. Final and tare weight data is transferred to P. 3 and the gross gravimetric (g) catch for each filter and beaker is calculated. On P. 5 the gravimetric catch for each blank is calculated. The gross gravimetric catch for each filter and beaker is transferred to P. 6 and the net gravimetric catch (g) is calculated, as well as front half and back half catch totals. The net gravimetric catch (g) is transferred to P. 7 and the grain loading/dscf is calculated in equation 4.

Some data sheet specific information is listed below on a page by page basis.

P. 8 The % ambient moisture is determined by interpolating from psychrometric charts which are contained in the State of Oregon Department of Environmental Quality's "Standard Method for Measuring the Emissions and Efficiencies of Woodstoves".

The % relative humidity is determined from the wet bulb/dry bulb temperature readings using the tables found in Section 3.1.2.4 of the State of Montana Air Quality Bureau's Quality Assurance Manual.

P. 10 The uncorrected moisture meter readings are corrected for pin insulation and may or may not be corrected for ambient (wood) temperatures. All corrections are based upon the correction equations or tables supplied by the moisture meter manufacturer. (These are standard, known corrections.)

P. 11 The moisture meter readings are corrected as discussed above.

P. 12 The gas concentrations shown for each gas monitored (CO_2, O_2, CO and SO_2) are determined by converting the analyzer's voltage output recorded on P. 12 to the concentration shown using the analyzer's current calibration curve. The SO_2 concentration is determined using the manufacturer's calibration curve and the current calibration curve.

The cal. W/B (calculated wet bulb) temperature is obtained by first determining the % moisture in the extracted flue gas stream using the temperature data from thermocouples 1 (Wet Bulb) and 2 (Dry Bulb). Then based upon the stack temperature (thermocouple 3) and the % moisture in the extracted gas stream, a calculated wet bulb temperature is determined. All data is derived from the psychrometric tables found in the State of Oregon's "Standard Method for Measuring the Emissions and Efficiencies of Woodstoves".

The following pages contain the equations used to generate the data on Tables 3-5 on the computer printouts:

Dry Gas Volume (standard):

$$V_{m(std)} = \frac{V_m * 17.65 * mcf * \left(P_{bar} + \frac{\Delta H}{13.6} \right)}{T_m}$$

Volume of Water:

$$V_{w(std)} = (0.04707)(ml\ H_2O)$$

Moisture Content:

$$B_{ws} = \left(\frac{V_w}{V_w + V_{m(std)}} \right) * 100$$

Dry Burn Rate:

$$Br = \left(\frac{Wwt - (Wwt * \%\ H_2O)}{2.2046} \right) * \frac{60}{\theta}$$

Carbon Balance (N_t):

$$Nt = \frac{K_3 Nc}{(YCO_2 + YCO + YHC)}$$

Stack Flow Rate (Q_{sd}):

$$Q_{sd} = K_4 N_t Br$$

Particulate Concentration (C_s):

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

Particulate Emission Rate (E):

$$E = C_s Q_{sd}$$

Proportional Rate Variation (Pr):

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

Where:

Br =	dry wood burn rate, kg/hr.
B_{WS} =	Water vapor in the gas stream, proportion by volume.
c_s =	Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, g/dscm (g/dscf).
E =	Particulate Emission Rate, g/hr.
ΔH =	Average pressure differential across the orifice meter (see Figure 5-2), mm H_20 (in. H_20).
K_3 =	1.0 lb/lb (English) 1000 g/kg (metric)
K_4 =	0.02406 dsm^3/g-mole(metric) 384.8 dscf/lb-mole (English)

m_n = Total amount of particulate matter collected, mg.

mcf = Dry gas meter correction factor.

N_c = Gram atoms of carbon/gram of dry fuel (lb/lb), equal to 0.0425.

N_t = Total dry moles of exhaust gas/Kg of dry wood burned.

P_r = Percent of proportional sampling rate.

Pbar = Barometric pressure at the sampling site, mm Hg (in. Hg).

Q_{sd} = Total gas flow rate, dscf/hr.

S_i = Concentration measured at the SO_2 analyzer for the "i^{th}" 5 minute interval, ppm.

S_1 = Concentration measured at the SO_2 analyzer for the first 5 minute interval, ppm

T_m = Absolute average DGM temperature (see Figure 5-2), °K (°R).

T_{std} = Standard absolute temperature, 293°K (528°R).

V_m = Volume of gas sample as measured by dry gas meter, dcm (dcf).

$V_{m(std)}$ = Volume of gas sample measured by the dry gas meter, corrected to standard conditions, dscm (dscf).

$V_{w(std)}$ = Volume of water vapor in the gas sample, corrected to standard conditions, scm (scf).

W_{wt} = Wet wood weight.

Y = Dry gas meter calibration factor.

Y_{CO} = Measured mole fraction of CO (dry).

Y_{CO2} = Measured mole fraction of CO_2 (dry).

Y_{HC} = Assumed mole fraction of HC (dry);
=0.0088 for catalytic woodheaters
=0.0132 for noncatalytic woodheaters
=0.0080 for pellet fired woodheaters

θ = Total sampling time, min.

13.6 = Specific gravity of mercury.

60 = Sec/min.

100 = Conversion to percent.

M5H PARTICULATE SAMPLING TRAIN

1. Probe

   3/8" seamless SS-20" long. Outlet end of probe is attached to a SS outlet fitting with a Sweglock SS union. The probe is unheated except for the portion that is in the stack and the heated filter box. The probe is sealed to the stack with a washer.

2. Filter Holder

   A 3" or 4" standard M5 filter holder. A SS filter support with gasket.

3. Filters

   3" or 4" fiber glass (#25 glass) manufactured by Schleicher and Schuell.

4. Front Half Filter Heater

   A box containing a fan for air circulation and a cone heater. The temperature in the box is monitored with a type K thermocouple and adjusted with a voltage regulator to maintain a temperature below 248 °F.

5. Desiccant

   Indicating silica gel, 6-20 mesh. The silica gel is changed as needed.

6. Filter (Back Half) Holder

   Same as front half 3" or 4" filter.

7. Impinger Gas

   Type K thermocouple threaded into the exit "arm" of the impinger. Ice is added to the cooler whenever necessary to maintain an exit gas temperature less than 68 °F.

8. Meterbox

   RAC Stack Sampler modified by EEMC

   Ranges: 0-1.0" inclined water manometer

   0-10.0" vertical water manometer

   Accuracy: Dry gas Meter 0-999.999 cu ft ±1.0%

   Temperatures are monitored using two type K thermocouples.

SAMPLING PROCEDURES AND INSTALLATION DESCRIPTION

This section is broken into two major parts. The first contains a brief description of the sampling and procedures used by LoKee Testing Laboratory when performing a test using EPA Methods 28, 28A and 5H. The second section contains a complete listing of all equipment in each of the major sampling trains and a diagram of each major train.

LoKee Testing Laboratory uses EPA M5H for the particulate sampling procedure and collects the required data so that efficiency of a unit can be calculated using the Oregon Method.

TEST FACILITY AND WOOD HEATER EQUIPMENT LIST

1. Flue Pipe

   The diameter of the 24 gauge black steel flue pipe used for each stove varies with the size of the stove's flue collar, e.g., 6" flue pipe is used with a 6" flue collar. The joint at the flue collar is sealed with mortar. The pipe is attached to the stove at the flue collar with three sheet metal screws. All sampling ports are sized for the sampling probes and sealed using washers.

2. Insulated Flue Pipe

   The diameter of the insulated flue pipe matches the diameter of the flue collar on the stove. The 6", 7" and 8" pipe meet the requirements of UL 103 HT. The SO_2 injection loop port is sealed with high temperature silicone sealant.

3. Liquid Seal

   The liquid (oil) seal used by LoKee varies in size with the flue pipe. The seals are made of 12 gauge steel. The liquid sealant is mineral oil. The cooler consists of 3/8" copper tubing which is coiled in the bottom of the lower half of the seal. Ambient air is pumped through this line when necessary to cool the seal.

4. Supports

   The lower half of the seal and the 24 gauge steel black flue pipe is supported by the stove. The upper half of the seal and the insulated flue pipe are hung from wooden supports.

5. Platform Scale

   Platform (30" X 30" deck)

   Manufacturer: Weightronics

   Model: platform: DS-014/SN 4479 readout: W1-110/SN 016409

   Type: Electronic

   Range: 0-1000 lb.

Capacity:	1000 lb.
Resolution:	±0.1 lb.
Accuracy:	±0.1%

6. Fuel Balance Scale

LoKee uses the platform scale listed above to weigh the fuel charges.

7. Fuel Storage Area

LoKee stores the fuel in a humidity and temperature regulated room.

8. Moisture Meter

LoKee has two moisture meters which it uses to determine wood moisture levels.

The primary meter is:

Manufacturer:	Delmhorst Instrument Co.	
Model:	RC-1C/SN 16152 with 26-E probe and #496 insulated pins.	
Type:	Electrical Resistance	
Resolution:	±0.1% moisture	
Ranges:	6-11%, 11-25%, 25-80%	
Accuracy:	Moisture	Content Accuracy
	6-12%	±0.5%
	12-20%	±1.0%
	20%-saturation point	±2.0%

Type of Calibration: The RC-1C is equipped with two potentiometers (Zero and Span) which are checked and adjusted on a daily basis. The unit is also checked with a calibration block.

Electrode and Pin Type: 26-E probe and #496 insulated pins

The backup moisture meter:

Manufacturer:	Delmhorst Instrument Co.	
Model:	G-30SN/2477 with 26-E probe and #496 insulated pins	
Type:	Electrical Resistance	
Resolution:	±0.1% moisture	
Accuracy:	Moisture	Content Accuracy
	6-12%	±0.5%
	12-20%	±1.0%
	20%-saturation point	±2.0%

Type of Calibration: Calibration is accomplished with an internal calibration point and a potentiometer. The calibration can also be checked against a calibration block.

Description of Operation: The pins are pounded into the wood to be sampled. The meter reading is recorded on Data Sheet #10 (Wood Moisture) or Data Sheet #11 (Density Determination). This is the uncorrected reading which is then corrected for pin insulation and, as needed, temperature using the correction tables for each parameter supplied by the manufacturer.

9. Temperature Monitors

The temperatures are monitored with Type K thermocouples. Each thermocouple's calibration is checked prior to use.

The thermocouple readout is an Omega Model 410B-K/SN 05/4475, with a range of -58 °F to 1999 °F (type K) and an accuracy of ±0.9 °C, which can be read at ±0.1 °F. EEMC reads and rounds to 1.0 °F. The single channel readout is interfaced with a manually operated selector switch that allows 24 channels to be monitored with the same readout. The thermocouples are attached to the test unit with sheet metal screws. The thermocouples monitoring internal stove temperature are sealed at the point of entry with sealant.

10. Draft Gauge

Manufacturer:	Dwyer
Model:	
Type:	Inclined Water Manometer
Range:	0-0.25" water
Resolution:	0.001" water
Accuracy:	±0.001" water (readability)

11. Anemometer

Manufacturer:	Dwyer
Model:	480 Vaneometer/SN S 222 D
Range:	0-400 FPM
Accuracy:	±5% of full scale from 0-1 FPM

12. Humidity Gauge

Manufacturer:	Bacharach
Model:	SAC
Type:	Sling Psychrometer
Range:	Wet Bulb: 30-110 °F
Dry Bulb:	30-110 °F
Resolution:	±1 °F
Accuracy:	±1 °F

13. Barometer

Manufacturer:	Princo Instruments, Inc.
Model:	NOVA 469

Type:	Mercury Barometer
Range:	20-32" Hg
Resolution:	0.01" Hg
Accuracy:	±0.01" when calibrated and installed as per the manufacturer's written operating instructions.

Equation 6.3.1a of the "Standard Methods for Measuring the Emissions and Efficiencies of Residential Wood Stoves" and equation #1 are programmed into a Hewlett Packard 15C calculator which first calculates stack gas flow rate and then the ΔH. The stack gas flow rate and ΔH are both recorded on Data sheet #2. The ΔH is used to set the flow rate through the dry gas meter at 5 minute intervals during the test.

In order to successfully maintain the correct sampling ratio, the following data is recorded on Data Sheet #2 (Meter Box Data Sheet): temperature (°F) at the SO_2 injection rotameter (Tr), pressure (inches H_2O) at the SO_2 injection rotameter (Pr), SO_2 injection rate (cc/min), barometric pressure (BP) (inches Hg), stack gas SO_2 concentration (ppm SO_2), sampling ratio (Sr), and the average dry gas meter temperature (°F). This data is entered into the HP15C, which is used to first calculate a stack gas flow rate (dscf) and then a ΔH for every sampling interval. The flow rate through the dry gas meter is adjusted and maintained by maintaining the appropriate ΔH.

CEM MONITORS

1. Calibration Gases

   LoKee uses vendor certified (±2.0%) calibration gases for each CEM. The concentrations purchased coincide with ranges specified in M5H. Upon receipt of the cylinder, the concentrations are verified with Method 3 (ORSAT) analysis.

2. Flow Regulators

   LoKee uses a variety of standard gas flow regulators to meter the flow of calibration gases from the cylinders.

3. Point of Injection

   Calibration gases are injected directly into the end of the probe. The line carrying the calibration gases from the cylinders is connected to the probe with a short piece of rubber tubing.

4. Sample Gas Conditioning System

   The combustion gas is conditioned with a train that is a duplicate of a M5H train. It contains the following components:

   SS probe

   Glass 4" M5H filter and holder in a heated box

4 1000 ml glass impingers

Glass 4" M5H filter and holder

Indicating silica gel

Type K thermocouple to monitor exit gas temperature

Thomas pump

5. Filters

The filters used are the same as EPA M5H filters.

6. Manifold and Exhaust

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

7. CO Analyzer

Horiba PIR 2000/SN 408005

Nondispersive infrared (NDIR)

The gas stream flow is controlled by a SS flowmeter downstream of the analyzer. The calibrated range used is 0-10.0% by volume. The resolution is 0.01% CO. The manufacturer's specification given for linearity is ±1.0%.

8. CO_2 Analyzer

Horiba PIR 2000/SN 407069

The CO_2 analyzer is also a NDIR and is operated in exactly the same manner as the CO analyzer. The range of the CO_2 analyzer is 0-25.0% CO_2.

COMBUSTION GAS ANALYZER TRAIN OPERATING INSTRUCTIONS

A. Pretest Preparation, Checks and Audit Procedures

1. Clean the probe with acetone and a brush. Seal the end of the probe for a leak check.
2. Remove the filter holder from the sample box and change the filter.
3. Empty water from all the impingers in the train. Clean all impingers and fill the first 2 with 100 ml of water.
4. Remove the second filter holder from the train and change the filter.
5. Visually check the indicating silica gel in the fourth impinger. If it is visibly impacted by water, replace the silica gel with dry silica gel.
6. Turn on the pump and perform a leak check on the entire train. This is done by placing the exhaust line in water. A successful leak check is accomplished when no bubbles are detected.
7. Slowly release the plug from the probe to prevent any back flushing.
8. Turn off the pump.

9. Turn on the heat in the sample box. Adjust Variac voltage controller so that temperature in the sample box does not exceed 248 °F.
10. Open the bypass valve on the pump.
11. Connect the probe to the zero/span gas delivery line.
12. Turn on the zero gas and adjust the flow rate to 1.5 SCFH.
13. Wait until the zero gas has completely flushed the train and a stable reading is obtained.
14. Record the zero gas readings of the DVM on Data Sheets #15.
15. Turn off the zero gas at the cylinder.
16. Disconnect the zero/span gas delivery line from the zero gas cylinder.
17. Connect the zero/span gas delivery line to the span gas source for each analyzer.
18. Turn on the span gas and adjust the flow rate to 1.5 SCFH. Wait until a stable reading is obtained on each analyzer. Repeat until all three analyzers are spanned properly.
19. Record the span gas readings of the DVM. Record the analyzer's output and all other pertinent information Data Sheets #15.
20. Turn off the span gas at the cylinder.
21. Disconnect the probe from the zero/span gas delivery line.
22. Insert the probe in the stack.
23. Close the bypass valve on the pumps.
24. Approximately 15-20 minutes before the actual start of the test, turn on the pump and adjust the flow through each analyzer until the flow rate is 1.5 SCFH.

B. Operation During Testing

1. Monitor the flow rate to the analyzers periodically to maintain a flow rate of 1.5 SCFH. Make any necessary adjustments.
2. Record data as follows:
   a. At the start of each 5 minute data cycle, record the scale weight, wet bulb/dry bulb, stack gas temperature and static pressure on Data Sheet #12 (Gas Data).
   b. Record the combustion gas (CO_2, O_2 and CO) analyzer data and the SO_2 analyzer data on Data Sheet #12.
   c. Record the remainder of the temperature data.

C. Post Test Checks and Audit Procedures

1. Remove the probe from the stack. (Be careful when handling the probe as it can be quite hot.)
2. Seal the end of the probe.
3. Perform a leak check on the entire train.
4. Slowly release the plug from the end of the probe to prevent any back flushing.
5. Turn off the pump.

6. Open the bypass valve on the pump.
7. Connect the probe to the zero/span gas delivery line.
8. Turn on the zero gas and adjust the flow rate through each analyzer to 1.5 SCFH.
9. Wait until the zero gas has completely flushed the train and a stable reading is obtained from each analyzer.
10. Record the zero gas reading. Record each analyzer's output and all other pertinent information on Data Sheets #15.
11. Turn off the zero gas at the cylinder.
12. Disconnect the zero/span gas delivery line from the zero gas cylinder.
13. Connect the zero/span gas delivery line to the span gas source for each analyzer.
14. Turn on the span gas and adjust until the flow rate through each analyzer to 1.5 SCFH. Wait until the span gas has completely flushed the train and a stable reading is obtained on each analyzer.
15. Record the span gas reading. Record each analyzer's output and all other pertinent information on Data Sheets #15.
16. Turn off the span gas at the cylinder.
17. Disconnect the probe from the zero/span gas delivery line.

D. Determination of the Combustion Gas Train's Response Time

1. The response time of the combustion gas analyzer train is to be determined using the following procedures. It is best to determine the combustion gas analyzer train response time during the "charcoal phase" of a test burn so that CO levels are relatively stable.
   a. Leak check the combustion gas (CEM) analyzer train.
   b. Zero the CO analyzer using ambient air.
   c. Calibrate the CO analyzer.
   d. Insert the probe for the combustion gas analyzer train in the stack.
   e. Sample flue gas until a stable reading is obtained.
   f. Remove the probe from the stack, note the exact CO concentration as measured on the DVM and start a stop watch at the exact time of removal.
   g. Observe the stop watch and DVM. Record the length of time to initial response, i.e., when the CO levels begin to decline.
   h. Continue observing the stop watch and DVM. Record the time when the analyzer's output equals zero (0.000 v).
   i. Repeat steps d-h 2 or 3 times to verify results.

E. Calibration and Audit Procedures for the Combustion Gas Analyzers

1. Calibrate by presenting zero and span gases to each analyzer at the probe and through the entire sampling train. (See Sections 6.7.2 and 6.9 [M5H].) Record the responses on the appropriate calibration forms.
2. Immediately prior to and after each test run, present the zero and span gases to the analyzers through the entire sampling train as is discussed in section C. Record each analyzer's response on Data Sheets #15.
3. Calculate the ± concentration difference and the actual percent difference as follows using the zero and span gas values obtained in #2 above. All calculations are to be based upon the actual gas concentrations involved.

$$\pm \text{ Concentration Difference} = \text{Actual Conc (\%)} - \text{Std Conc (\%)}$$

$$\text{Zero \% Difference} = \frac{\text{Act Conc (\% or ppm)} - \text{Std Conc (\% or ppm)}}{\text{Full Scale Value (\% or ppm)}} * 100$$

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

Then refer to Section 4.2 and 4.3 (M5H) to determine whether the audits are acceptable or not.

TRACER GAS (SO_2) EQUIPMENT

1. SO_2 Injection Probe

   A circular SS loop about 4" in diameter is positioned in the center of the stack. The loop extends outside the stack and is connected to the line leading from the SO_2 injection rotameter with Sweglock fittings. The loop is inserted in the stack at 9.5 ±0.5 ft above the top of the scale.

2. Rotameter

   A rotameter that has been calibrated with a bubble tube. The rotameter is all glass, stainless steel and Teflon. The rotameter has a flow control mechanism which is set to the calibrated flow.

3. Temperature

   The temperature at the injection rotameter is measured with a type K thermocouple.

4. Injection Gas

   Pure SO_2, 99.999% pure, released from the cylinder through a SS regulator and shut off valve.

5. Calibration Gases

LoKee uses vendor certified calibration gases with traceability established in accordance with EPA Protocol #1 as specified in Section 3.3.1 and verified using EPA Method 6.

6. Sample Probe

3/8" SS tubing inserted at 13.5 ±0.5 feet above the platform scale. No obstructions are in the stack between the injection and sample probes.

7. Combustor

Lindberg tube furnace, Model 55035/SN 800125, range 0-2000 °F. The temperature in the tube furnace is monitored with a type K thermocouple and controlled with a Variac voltage regulator. Power adjustments are made as necessary to maintain temperature at 1425 °F ±25 °F.

8. Sample Condenser

The sample condenser consists of 3 modified M5 impingers immersed in a freezer.

A filter assembly

The exit gas temperature is monitored with a type K thermocouple.

9. Filter

A standard EPA M5H 3" or 4" filter.

10. SO_2 Analyzer

Horiba, PIR 2000/SN 403019

Nondispersive infrared (NDIR)

The analyzer is operated as per the manufacturer's instructions at a flow rate of 1.5 SCFH. The calibration range is 0-2500 ppm SO_2 at a resolution of ±25.0 ppm. The manufacturer's specification for linearity is ±1.0%. The voltage response is displayed on a DVM which is converted to ppm using the manufacturer's calibration curves.

11. Flow Control

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

TRACER GAS TRAIN OPERATING INSTRUCTIONS

A. Pretest Preparation and Checks and Audit Procedures

1. Clean the probe with a brush. After cleaning, seal the end of the probe.

   Note: Do Not Use Acetone Or Other Organic Solvents To Clean The Probe Immediately Prior To Running A Test Or Conducting A Leak Check.

2. Turn on the tube furnace in order to insure that the unit is at the correct operating temperature (1425 °F) at the start of the test.
3. Remove all water and clean the impingers.
4. Change the filter.

5. Turn on the pump.
6. Perform a leak check on the entire tracer gas train. This is done by placing the SO_2 exhaust line in water. A successful leak check is accomplished when no bubbles are detected.
7. Slowly remove the plug from the end of the probe to prevent any back flushing.
8. Turn off the pump.
9. Bypass the pump.
10. Connect the probe to the zero/span delivery gas line.
11. Connect the zero/span gas delivery line to the zero gas cylinder and turn on the zero gas and adjust the flow until the flow rate through the SO_2 analyzer is 1.5 SCFH.
12. Wait until the zero gas has completely flushed the train.
13. Record the zero gas reading. Record the SO_2 analyzer's DVM output on Data Sheets #15.
14. Turn off zero gas at the cylinder.
15. Disconnect the zero/span gas delivery line from the zero gas cylinder.
16. Connect the zero/span gas delivery line to the span gas cylinder.
17. Turn on the span gas and adjust the flow until the flow rate through the SO_2 analyzer is 1.5 SCFH. Wait until the span gas has completely flushed the train and a stable reading is obtained on the analyzer.
18. Record the span gas reading. Record the analyzer's output and all other pertinent information on Data Sheets #15.
19. Turn off the span gas at the cylinder.
20. Disconnect the zero/span gas delivery line from the probe.
21. Insert the probe in the stack.
22. Close the bypass on the pump.
23. Approximately 15 to 20 minutes before the actual start of the test, turn on the SO_2 injection train and the pump for the tracer gas train.

B. Operation

1. Turn on the tube furnace to insure furnace is at approximately 1425 °F when the test begins.
2. Approximately 15-20 minutes before the actual start of the test, turn on the cylinder of pure SO_2.
3. Using the rotameter's current calibration, adjust the SO_2 flow rate to the calibrated level.
4. Turn on the pump in the tracer gas train. Adjust the flow rate through the SO_2 analyzer so that it remains at 1.5 SCFH.

5. Monitor the SO_2 concentrations in the stack and stack gas flow rates in order to establish a sampling ratio for the test and a correct ΔH at the start of the test.

6. At the start of the test and every 5 minutes thereafter, record the SO_2 analyzer output in volts and the stack gas SO_2 concentration in order to calculate the stack gas flow rate and determine the correct ΔH for the meter box.

   Also monitor and record the temperature at the Rotameter (Tr), pressure at the Rotameter (Pr), barometric pressure (BP) SO_2 injection rate (cc/min) and static pressure on Data Sheets #2 and #12.

C. Post Test Checks and Audit (Zero/Span) Procedures

1. Remove the probe from the stack. (Be careful when removing the probe from the stack as it can be quite hot.)
2. Plug the end of the probe.
3. Perform a leak check.
4. Slowly remove the plug from the end of the probe to prevent any back flushing.
5. Turn off the pump.
6. Bypass the pump.
7. Connect the probe to the zero/span gas delivery line.
8. Connect the zero/span gas delivery line to the zero gas cylinder. Turn on and adjust until the flow rate through the SO_2 analyzer is 1.5 SCFH.
9. Wait until the zero gas has completely flushed the train.
10. Record the zero gas reading. Record the SO_2 analyzer's DVM output on Data Sheet #15.
11. Turn off zero gas at the cylinder.
12. Disconnect the zero/span gas delivery line from the zero gas cylinder.
13. Connect the zero/span gas delivery line to the span gas cylinder.
14. Turn on the span gas and adjust the flow until the flow rate through the SO_2 analyzer is 1.5 SCFH. Wait until the span gas has completely flushed the train and a stable reading is obtained.
15. Record the span gas reading. Record the analyzer's output and all other pertinent information on Data Sheet #15.
16. Turn off the span gas at the cylinder.
17. Disconnect the zero/span gas delivery line from the probe.

D. Determination of Tracer Gas Train's Response Time

1. Zero and calibrate the SO_2 analyzer.
2. Prepare and leak check the tracer gas train as per A above.
3. Insert the probe in the stack which contains flue gas and SO_2 concentrations in the ranges normally encountered during wood stove testing.

4. Sample flue gas with SO_2 concentrations until a stable reading is obtained. It is best to determine the tracer gas train's response time during the "charcoal phase" of a test burn so that the SO_2 concentrations are as stable as possible.
5. Remove the probe from the stack, noting the exact SO_2 concentration as measured by the DVM and starting a stop watch at the exact time of removal.
6. Observe the stop watch and DVM. Record the length of time to the initial response, i.e., when the SO_2 levels begin to decline.
7. Continue observing the stop watch and DVM. Record the time when the SO_2 analyzer's output equals zero (0.000 v.).
8. Repeat steps 3-7 two or three times to verify results.

E. Calibration and Audit Procedures for the Tracer Gas (SO_2) Analyzer

1. Calibrate by presenting zero and span gases to the analyzer at the probe and through the entire sampling train. Record the responses on the appropriate calibration form.
2. Immediately prior to and after each test run, present the zero and span gases to the analyzer through the entire sampling train as is discussed in Sections A and C. Record the analyzer's response on Data Sheet #15.
3. Calculate the ± concentration differences and actual percent difference as follows using values obtained in #2 above as the expected response. All calculations are to be based upon the actual gas concentration involved.

$$\pm \text{ Concentration Difference} = \text{Actual Conc (\%)} - \text{Std Conc (\%)}$$

$$\text{Zero \% Difference} = \frac{\text{Act Conc (\% or ppm)} - \text{Std Conc (\% or ppm)}}{\text{Full Scale Value (\% or ppm)}} * 100$$

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

Then refer to Section 4.2 and 4.3 (M5H) to determine whether the audits are acceptable or not.

TEMPERATURE SENSING OPERATING INSTRUCTIONS

A. Operate the thermocouple readout selector switch and record the temperature for each thermocouple. All the temperature in the test facility should be approximately the same. Repair as necessary.

B. Check the operation and output of the thermocouple readout using the Omega NBS Traceable Thermocouple Simulator. The simulator is hooked up to thermocouple readout #23. Check the readout over its full range at 200 °F intervals. Record the data on Data Sheet #16.

C. One hour before the actual test start record stove temperatures (thermocouple readout #'s 4, 5, 6, 7 and 8), firebox (readout #9), post catalytic combustor or secondary burn chamber (readout #10), and room temperature (readout #11). Record the temperatures every 5 minutes until the start of the test on Data Sheet #13 (Preburn).

D. During the test record the temperatures every 5 minutes for each of the thermocouples on Data Sheets #12 and 14.

FUEL PREPARATION

A. No more than 4 hours prior to use, obtain 3 moisture readings from each piece of wood. Record all moisture readings on Data Sheet #10.

B. Obtain kindling by finely splitting pieces that otherwise cannot be used as test fuel. Weigh the kindling and record the weight on Data Sheet #8.

C. Obtain the pretest fuel by using 2 x 4's. The length of the pretest fuel can be no less than 1/3 the length of the test fuel. Weigh the pretest fuel prior to its being loaded in the stove. Record weights on Data Sheets #8 and #9.

D. Obtain the test fuel by cutting dimensional lumber (either 2 x 4's or 4 x 4's) so that the length is 5/6's the length of the longest usable dimension of the firebox. Use the mix of 2 x 4's and 4 x 4's specified in Section 4.3 M28. The test fuel shall be essentially free of knots, sap seams or rotten areas.

E. The spacers shall measure 1 x 5 x 1" (nominally). The spacers shall be free of knots, sap seams or rotten areas. Nail the spacers to the 2 x 4's and 4 x 4's as described in the regulations.

F. Take a photograph of the assembled fuel charge at a 90° angle from the photograph that will be taken when the fuel charge is loaded in the stove.

WOOD DENSITY DETERMINATION

A. When cutting the test fuel, cut a representative piece of 2 x 4 or 4 x 4 that is approximately 3 to 5-inches in length.

B. Take a moisture reading from the top, bottom and side of the piece. Record readings on Data Sheet #11. Determine the % moisture on a wet and dry basis.

C. Weight the piece on a balance.

D. Take measurements of width, depth and length at the four corners with a micrometer. Determine the volume of the piece. (Length x width x depth = Volume in cubic centimeters)

E. Dry the piece in an oven at 95-100 °C for a minimum of 24 hours.

F. Reweigh the piece on the balance.

G. Calculate % moisture on a dried basis.

$$\% \text{ moisture (dry basis)} = 1 - \frac{\text{dried weight}}{\text{wet weight}} * 100$$

H. Calculate the density.

$$\text{Density (g / cc)} = \frac{\text{dried weight (g)}}{\text{volume (cc)}}$$

BTU'S/LB DETERMINATION

A. When cutting the test fuel (only the test fuel, not the kindling, pretest fuel or spacers), collect a sawdust sample. Place in a clearly marked plastic bag.

B. Forward sample to a commercial laboratory for BTU contents analysis.

STOVE PREPARATION

A. Clean the stove.

B. Weigh the stove, record the weight on Data Sheet #8.

C. Add approximately 0.3 lb. of wadded newspaper to the stove. Record weight of newspaper on Data Sheet #8. Add 4-8 lb. of kindling to the stove, and record the weight of the kindling on Data Sheet #8.

D. Light the paper and kindling, leaving the stove's air draft control(s) wide open and the door cracked until well ignited.

E. Close door.

F. When between 50% - 75% of the weight of the kindling has been burned add the first pretest fuel charge.

G. Continue to add pretest fuel until the stove has thoroughly warmed up. As necessary, rake the coal bed prior to adding additional pretest fuel charges.

H. Remove all material from the firebox after two or more hours of burning on high. Obtain the dry empty stove weight and record on Data Sheet #8.

I. Set the stove's air draft control(s) at the desired setting a minimum of 1 hour before the test run is to begin.

J. As necessary set the heat exchange blower(s) at the specified setting a minimum of one hour before the test is to begin.

K. Record the stove surface temperatures, firebox and post catalytic or secondary burn temperatures and scale weigh for a minimum of one hour before the test run begins. As necessary add fuel, rake the coal bed, level the coal bed and/or remove coals during the first 45 minutes of the hour immediately preceding the start of the test. Record all information concerning raking, fuel additions, etc. on Data Sheet #13.

L. If necessary, sometime during the last 15 minutes before the start of the test, open the door and brake up all large pieces and then rake and level the pretest fuel in the stove. At this time, level the coal bed as necessary to accommodate loading the fuel charge into the stove. Close the door. Total time door can be open during the last 15 minutes is 1 minute. No further manipulation of the stove is allowed during the 15 minutes immediately preceding the start of the test.

M. When the weight of the coal bed equals 20-25% of the weight of the test fuel charge, load the test fuel. Take a photograph of the fuel load in the stove immediately after loading the fuel. Leave the door open as per the manufacturer's instruction, but no longer than 5 minutes.

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


Jotul
F500
Run 1
5-15-2002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F500
Run 1
5-15-2002


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F500
Run 2
5-16-2002


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Run 2
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Run 3
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